INTRODUCTION

This new secondary syllabus replaces the original 8-4-4 education syllabus which was first introduced in 1986 and revised in 1992. It is available in four volumes. **Volume one** contains English, Kiswahili, Arabic, French, German and Physical Education. **Volume two** contains Mathematics, Physics, Chemistry, Biology, Agriculture and Homescience. **Volume three** contains History and Government, Geography, Business Studies, Christian Religious Education, Islamic Religious Education and Hindu Religious Education. **Volume four** contains Art and Design, Computer Studies and Music.

In each syllabus the objectives have been more clearly defined and the content spelt out more specifically to give better guidance to the users.

The issue of overload in the secondary curriculum has been addressed by a reduction in the number of subjects and content in the different subject areas. The reorganization of the syllabuses has been done in such a way that better mastery of the knowledge, skills and attitudes required at the end of the secondary cycle is ensured.

The reorganisation has also tried to ensure that the cost of education on the part of both the government and households will be significantly reduced. Careful consideration has been given to the resources required to implement this curriculum in order to make the cost manageable. Most of the resources can either be improvised, obtained locally or acquired at fairly low costs.

A special feature of the revised curriculum is the deliberate attempt to respond to the contemporary needs of society. This has been done by the inclusion of such emerging issues as health, environmental and civic education, gender and the anticipated industrial transformation of the nation.

In this rationalization most of the Technical and Industrial subjects have been moved to training institutions. Essential competencies earlier acquired through the Business Education subjects will be taught in the new integrated Business Studies subject.

The teaching of English and Kiswahili will remain integrated. The revised syllabuses have clearly defined the integrated approach to make the teaching of the languages more effective.

NAOMY W. WANGAI
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NATIONAL GOALS OF EDUCATION

Education in Kenya should:

1. foster nationalism, patriotism and promote national unity

Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. It is a paramount duty of education to help the youth acquire this sense of nationhood by removing conflicts and by promoting positive attitudes of mutual respect which enable them to live together in harmony, and foster patriotism in order to make a positive contribution to the life of the nation.

2. promote the social economic, technological and industrial needs for national development

Education should prepare the youth of the country to play an effective and productive role in the life of the nation.

a) Social Needs

Education in Kenya must prepare children for the changes in attitudes and relationships which are necessary for the smooth process of a rapidly developing modern economy. There is bound to be a silent social revolution following in the wake of rapid modernization. Education should assist our youth to adapt to this change.

b) Economic Needs

Education in Kenya should produce citizens with skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a modern and independent economy which is in need of adequate domestic manpower.

c) Technological and Industrial Needs

Education in Kenya should provide the learners with the necessary skills and attitudes for Industrial development. Kenya recognizes the rapid industrial and technological changes taking place especially in the developed world.

We can only be part of this development if our education system deliberately focused on knowledge, skills and attitudes that will prepare the youth for these changing global trends.

3. promote individual development and self –fulfillment

Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential interests and abilities. A vital aspect of individual development is character building.

4. promote sound moral and religious values

Education should provide for the development of knowledge, skills and attitudes that will enhance acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

5. promote social equality and responsibility

Education should promote social equality and foster a sense of social responsibility within an education system which provides equal educational opportunities for all. It should give all children varied and challenging opportunities for collective activities ad corporate social service irrespective of gender, ability or geographical environment.

6. promote respect for and development of Kenya's rich and varied cultures

Education should instill in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. The children should be able to blend the best of traditional values with the changed requirements that must follow rapid development in order to build a stable and modern society.

7. promote international consciousness and foster positive attitudes towards other nations

Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should therefore lead the youth of the country to accept membership in this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

8. promote positive attitudes towards good health and environmental protection

Education should inculcate in the youth the value of good health in order to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth to appreciate the need for a healthy environment.

OBJECTIVES OF SECONDARY EDUCATION

Secondary Education should provide the learner with opportunities to:

1. acquire necessary knowledge, skills and attitudes for the development of the self and the nation
2. promote love for and loyalty to the nation
3. promote harmonious co-existence among the peoples of Kenya
4. develop mentally, socially morally, physically and spiritually
5. enhance understanding and respect for own and other people's cultures and their place in contemporary society
6. enhance understanding and appreciation of inter-relationships among nations
7. promote positive environmental and health practices
8. build a firm foundation for further education and training
9. develop ability for enquiry, critical thinking and rational judgment
10. develop into a responsible and socially well adjusted person
11. promote acceptance of and respect for all persons
12. enhance enjoyment in learning
13. identify individual talents and develop them
14. build a foundation for technological and industrial development
15. develop into a self-disciplined individual who appreciates work and manages time properly.

MATHEMATICS

INTRODUCTION

Secondary Mathematics aims at producing a person who will be numerate, orderly, logical, accurate and precise in thought. The person should also be competent in appraising and utilizing mathematical skills in playing a positive role in the development of a modern society.

In preparing this course care has been taken to ensure not only continuity, but also the reinforcement and broadening of the basic skills already established in the eight years of primary education. While greater emphasis has been placed in the needs of learners who will leave the normal education at the end of the four year secondary cycle, the course will also prepare learners who will pursue further studies in the subject and other related courses.

This syllabus has been reorganized and streamlined to remove overloads in the content and overlaps of certain content evident in the previous Mathematics syllabus. Effort has been made to bridge the gap between Primary and Secondary Mathematics.

The syllabus has emphasized application of Mathematics to real life experiences and practical approaches to teaching and learning in an effort to address such contemporary issues as information technology, health, gender and integrity. However, apart from the use of calculators which has been introduced in the course, as a technological device most of the other issues will be addressed by way of examples and exercises in support materials.

The objectives of teaching Mathematics have been expanded to enhance clarity. In addition notes have been included with the aim of not only assisting in the interpretation of the syllabus, but also to alert the teacher on some precautions required in handling the different topics. Also included in the notes are suggested resources and further assessment. Time for each topic have been suggested.

The course has been designed to enable the learner to acquire attitudes, knowledge and skills which will be relevant to his/her life after school. It is also expected to enable the learner to foster a positive attitude towards Mathematics appreciating its usefulness and relevance to a modern society.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1. develop a positive attitude towards learning Mathematics
2. perform mathematical operations and manipulations with confidence, speed and accuracy
3. think and reason precisely, logically and critically in any given situation
4. develop investigative skills in Mathematics
5. identify, concretise, symbolise and use Mathematical relationships in everyday life
6. comprehend, analyse, synthesise evaluate and make generalizations so as to solve mathematical problems
7. collect, organise, represent, analyse, interprete data and make conclusions and predictions from its results
8. apply mathematical knowledge and skills to familiar and unfamiliar situations
9. appreciate the role, value and use of Mathematics in society
10. develop a willingness to work collaboratively
11. acquire knowledge and skills for further education and training
12. communicate mathematical ideas

Symbols:

The use of SI units will be applied throughout the syllabus. Besides the usual operational symbols +,-,x,÷, the combined ± will also be used.

Rational symbols

=	is equal to.
≠	is not equal to.
>	is greater than.
≥	is greater than or equal to
<	is less than.
≤	is less than or equal to.
a: b	ratio of a to b.
α	Varies as.
≡	is congruent to or is identical to.
≈	is approximately equal to.

FORM ONE

1.0.0 NATURAL NUMBERS
(4 Lessons)

1.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
a) identify, read and write natural numbers in symbols and words
b) round off numbers to the nearest tens, hundreds, thousands, millions and billions
c) classify natural numbers as even, odd or prime
d) solve word problems involving natural numbers.

1.2.0 Content
1.2.1 Place values of numbers
1..2.2 Round off numbers to the nearest tens, hundreds, thousands, millions and billions
1.2.3 Odd numbers
1.2.4 Even numbers
1.2.5 Prime numbers
1.2.6 Word problems involving natural numbers

Notes
- Include reading and writing large numbers - millions and billions
- Use word problems to involve the four basic operations
- Reinforce the idea of place value and total value of natural numbers.
- **Suggested Resources**
  - Place value charts
  - The abacus
  - Bank cheques and Statements
- **Suggested Further Assessment**
  - puzzles and games

2.0.0 FACTORS (4 lessons)

2.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
a) express composite numbers in factor form
b) express numbers as product of prime factors
c) express factors in power form.

2.2.0 Content
2.2.1 Factors of composite numbers
2.2.2 Prime factors
2.2.3 Factors in power form

Notes
- Use of "index" for "power" is discouraged at this stage.
- **Suggested Resources**
  Charts to illustrate factorisation e.g. factor tree diagrams.
- **Suggested Further Assessment**
  - puzzles and games

3.0.0 DIVISIBILITY TESTS

3.1.0 Specific Objectives
By the end of the topic, the learner should be able to test the divisibility of numbers by 2, 3, 4, 5, 6, 8, 9, 10 and 11

3.2.0 Content
3.2.1 Divisibility test of numbers by 2, 3,4,5,6,8,9,10, and 11

Notes
- **Suggested Resources**
  - Multiplication table
  - Charts to illustrate divisibility test
- **Suggested Further Assessment**
  - Puzzles and games

4.0.0 GREATEST COMMON DIVISOR(GCD) / HIGHEST COMMON FACTOR (HCF)
(4 lessons)

4.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
a) find the GCD/HCF of a set of numbers
b) apply GCD to real life situations.

4.2.0 **Content**
4.2.1 Greatest common divisor of a set of numbers
4.2.2 Application of GCD/HCF to real life situations

Notes
- **Suggested Resources**
  - Containers of different capacities
- **Suggested Further Assessment**
  - Quiz
  - Practical exercises

5.0.0 LEAST COMMON MULTIPLE (L.C.M.) (5 Lessons)

5.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) list multiples of numbers
b) find the least common multiple of a set of numbers
c) apply knowledge of LCM in real life situations.

5.2.0 Content

5.2.1 Multiples of a number
5.2.2 LCM of a set of numbers
5.2.3 Application of LCM in real life situations

Notes

- **Suggested Resources**
  - Bells, flickering light, alarms, containers of different capacities etc.
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 1.00 to 5.00 can be given at this stage

6.0.0 INTEGERS (12 Lessons)

6.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define integers
b) identify integers on a number line
c) perform the four basic operations on integers using the number line
d) work out combined operations on integers in the correct order
e) apply knowledge of integers to real life situations.

6.2.0 Content

6.2.1 Integers
6.2.2 The number line
6.2.3 Operation on integers
6.2.4 Order of operations
6.2.5 Application to real life situations

Notes

- Practical exercises are encouraged
- More practice required on directed numbers especially when subtracting negative integers
- Explain the term directed numbers.
- **Suggested Resources**
  - the number line
  - stairways
  - ladder
  - thermometer
  - real life situations
- **Suggested Further Assessment**
  - Short test on 6.00
  - Puzzles and games

7.0.0 FRACTIONS (12 lessons)

7.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify proper and improper fractions and mixed numbers
b) convert mixed numbers to improper fractions and vise versa
c) compare fractions
d) perform the four basic operations on fractions
e) carry out combined operations on fractions in the correct order
f) apply the knowledge of fractions to real life situations.

7.2.0 Content

7.2.1 Fractions
7.2.2 Proper, improper fractions and mixed numbers
7.2.3 Conversion of improper fractions to mixed numbers and vice versa
7.2.4 Comparing fractions
7.2.5 Operations on fractions
7.2.6 Order of operations on fractions
7.2.7 Word problems involving fractions in real life situations

Notes

- Treat fractions with positive and negative cases in the same way as integers or as directed numbers.
- Give emphasis and time to the correct order of operations.
- Use of real objects is encouraged
- Include equivalent fractions

- **Suggested Resources**
  - Chart illustrating operations on fractions and equivalent fractions
  - Real life situations
- **Suggested Further Assessment**
  - Puzzles and games
  - Short test on fractions

8.0.0 DECIMALS (12 Lessons)

8.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) convert fractions into decimals and vice versa
b) identify recurring decimals
c) convert recurring decimals into fractions
d) round off a decimal number to the required number of decimal places
e) write numbers in standard form
f) perform the four basic operations on decimals
g) carry out operations in the correct order
h) apply the knowledge of decimals to real life situations.

8.2.0 Content

8.2.1 Fractions and decimals
8.2.2 Recurring decimals
8.2.3 Recurring decimals and fractions
8.2.4 Decimal places
8.2.5 Standard form
8.2.6 Operations on decimals
8.2.7 Order of operations
8.2.8 Real life problems involving decimals

Notes

- Explain the recurring decimal notation of the form;

  $6.3 = (6.33 \ldots\ldots)$

  $6.34 = (6.3434\ldots\ldots..)$

  $6.34 = (6.3444\ldots\ldots)$

  $6.345 = (6.345345 \ldots\ldots)$

  $6.345 = (6.34545 \ldots\ldots.)$

  $6.345 = (6.34555\ldots\ldots.)$

- Explain numbers in standard form i.e. $A \times 10^n$ where $1 \leq A < 10^n$ and n is an integer
- Mention the use of statements such as 5.6million, 3.9 million, 2.1 billion
- Emphasize on the cancellation process on problems of the type;

  $\frac{0.036 \times 0.0049}{0.07 \times 0.048}$

- **Suggested Resources**
  - real life situations
- **Suggested Further Assessment**
  - Test on topics 6.00 - 8.00 can be given at this stage.
  - puzzles and games.

9.0.0 SQUARES AND SQUARE ROOTS (12 Lessons)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find squares of numbers by multiplication
b) find squares from tables
c) find square root by factor method
d) find square root from tables.

9.2.0 Content

9.2.1 Squares by multiplication
9.2.2 Squares from tables
9.2.3 Square roots by factorization
9.2.4 Square roots from tables

Notes

- Use four figure mathematical tables.
- When finding the square roots of a number, the number should be written in the form $A \times 10^n$ where $1 \leq A < 100$ and n is an even integer.
- **Suggested Resources**
  - Mathematical tables
  - Real life experiences
- **Suggested Further Assessment**
  - Puzzles and games
  - Short test on 9.00

10.0.0 ALGEBRAIC EXPRESSIONS (14 Lessons)

10.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) use letters to represent numbers
b) write statements in algebraic form
c) simplify algebraic expressions
d) factorise an algebraic expression by grouping
e) remove brackets from algebraic expressions
f) evaluate algebraic expressions by substituting numerical values
g) apply algebra in real life situations.

10.2.0 **Content**

10.2.1 Letters for numbers
10.2.2 Algebraic expressions including algebraic fractions
10.2.3 Simplification of algebraic expressions
10.2.4 Factorisation by grouping
10.2.5 Removal of brackets
10.2.6 Substitution and evaluation
10.2.7 Problem solving in real life situation

Notes

- Use the idea of like and unlike terms in simplification and factorisation of algebraic expressions
- Use the term expansion when removing brackets
- Apply brackets in simplifying expressions

Suggested Resources

- Real life experiences

Suggested Further Assessment

- Short test on algebra
- Puzzles and games

11.0.0 RATES, RATIO, PERCENTAGES AND PROPORTION (18 Lessons)

11.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define rates
b) solve problems involving rates
c) define ratio
d) compare two or more quantities using ratios
e) change quantities in a given ratio
f) compare two or more ratios
g) represent and interpret proportional parts
h) recognise direct and inverse proportions
i) solve problems involving direct and inverse proportions
j) convert fractions and decimals to percentages and vice-versa
k) calculate percentage change in a given quantity
l) apply rates, ratio, percentage to real life situations.

11.2.0 **Content**

11.2.1 Rates
11.2.2 Solving problems involving rates
11.2.3 Ratio
11.2.4 Comparing quantities using ratio
11.2.5 Increase and decrease in a given ratio
11.2.6 Comparing ratios
11.2.7 Proportion: direct and inverse.
11.2.8 Solve problems direct and inverse proportions.
11.2.9 Fractions and decimals as percentages
11.3.10 Percentage increase and decrease
11.3.11 Application of rates, ratios, percentages and proportion to real life situations

Notes

- Exclude graphs on rates at this stage
- Include speed, velocity and acceleration

- **Suggested resources**
  - Real life situations involving quantities, shares, sharing etc.
- **Suggested further assessment**
  - Test on topics 9.00 and 10.00 can be given here

12.0.0 LENGTH (6 Lessons)

12.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state the units of measuring length
b) convert units of length from one form to another
c) express numbers to required number of significant figures
d) find the perimeter of a plane figure and circumference of a circle(include length of arcs).

12.2.0 Content

12.2.1 Units of length
12.2.2 Conversion of units of length from one form to another
12.2.3 Significant figures
12.2.4 Perimeter
12.2.5 Circumference(include length of arcs)

Notes

- Encourage practical approach to establish the value of π and the relationship $C = \pi D$ or $C = 2\pi r$
- Include lengths of arcs taken as fractions of circumference
- **Suggested Resources**
  - Measuring instrument eg. Metre rule, vernier callipers, micrometre screw gauge, tape measure etc
  - Environment
- **Suggested Further Assessment**
  - Practical exercises in measuring
  - Short test on 12.00

13.0.0 AREA (6 Lessons)

13.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state units of area
b) convert units of area from one form to another
c) calculate the area of a regular plane figure including circles
d) estimate the area of irregular plane figures by counting squares
e) calculate the surface area of cubes, cuboids and cylinders.

13.2.0 Content

13.2.1 Units of area
13.2.2 Conversion of units of area
13.2.3 Area of regular plane figures
13.2.4 Area of irregular plane shapes
13.2.5 Surface area of cube, cuboid and cylinder

Notes

- Deriving area of circle practically using very small sectors is required.
- Include "acres" and "hectares"
- Derive surface area of cylinders.
- Include combined areas of shapes
- Include conversion of cm^2 to m^2 etc.

- **Suggested Resources**
  - Model of cube, cuboid and cylinder
  - Charts illustrating regular plane figures
  - Plane figures
  - Environment
- **Suggested Further Assessment**
  - Practical exercises in the process of deriving formulae for areas.

14.0.0 VOLUME AND CAPACITY (6 Lessons)

14.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) state units of volume
b) convert units of volume from one form to another
c) calculate volume of cubes, cuboids and cylinders
d) state units of capacity
e) convert units of capacity from one form to another
f) relate volume to capacity
g) solve problems involving volume and capacity.

14.2.0 Content

14.2.1 Units of volume
14.2.2 Conversion of units of volume
14.2.3 Volume of cube, cuboid and cylinders
14.2.4 Units of capacity
14.2.5 Conversion of units of capacity
14.2.6 Relationship between volume and capacity
14.2.7 Solving problems involving volume and capacity

Notes

- deriving the formula for finding volume of a cylinder is not required.
- Involve conversion of cm^3 to m^3 etc
- **Suggested Resources**
  - Containers
  - Measuring cylinders
  - Burrettes
- **Suggested Further Assessment**
  - Practical exercises.
  - Short test on volume

15.0.0 MASS, DENSITY AND WEIGHT (4 LESSONS)

15.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define mass
b) state units of mass
c) convert units of mass from one form to another
d) define weight
e) state units of weight
f) distinguish mass and weight
g) relate volume, mass and density.

15.2.0 Content

15.2.1 Mass and units of mass
15.2.2 Density
15.2.3 Problem solving involving real life experiences on mass, volume and density and weight
15.2.4 Weight and units of weight
15.2.5 Mass and weight

Notes

- Explain the difference between mass and weight
- Explain the relationship $\frac{\text{mass}}{\text{volume}} = \text{density}$ and units of density
- **Suggested Resources**
  - Beam balance
  - Lactometer

- **Suggested Further Assessment**
  - Practical exercises in finding density of solids
  - Short test on 15.00

16.0.0 TIME (4 Lessons)

16.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) convert units of time from one form to another
b) relate the 12 hour and 24 hour clock systems
c) read and interpret travel time-tables
d) solve problems involving travel time tables

16.2.0 **Content**
16.2.1 Units of time
16.2.2 12 hour and 24 hour systems
16.2.3 travel time-tables
16.2.4 problem solving involving travel time tables

Notes

- Actual travel time-tables should be used
- Include speed and distance
- Mention distance and fare tables
- **Suggested Resources**
  - Charts illustrating conversion of time from one system to another
  - Clocks and watches
  - Travel time table charts for buses, trains, ships and aeroplanes
- **Suggested Further Assessments**
  - Test on topics 11.00 - 15.00 can be given at this stage

17.0.0 LINEAR EQUATIONS (12 Lessons)

17.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) solve linear equations in one unknown
b) solve simultaneous linear equations by substitution and elimination
c) form and solve linear equations in one and two unknown.

17.2.0 **Content**
17.2.1 Linear equations in one unknown
17.2.2 Simultaneous linear equations
17.2.3 Formation and solution of linear equations in one and two unknowns from given real life situations

Notes

- **Suggested Resources**
  - Beam balances
  - Real life situations and experiences

- **Suggested Further Assessment**
  - puzzles and games
  - Test on topics 16.00 and 17.00 can be given here

18.0.0 COMMERCIAL ARITHMETIC 1 (6 Lessons)

18.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state the currencies of different countries
b) convert currency from one form into another given the exchange rates
c) calculate profit and loss
d) express profit and loss as percentages
e) calculate discount and commission
f) express discount and commission as percentage.

18.2.0 **Content**
18.2.1 Currency
18.2.2 Current currency exchange rates
18.2.3 Currency conversion
18.2.4 Profit and loss
18.2.5 Percentage profit and loss
18.2.6 Discounts and commissions
18.2.7 Percentage discounts and commissions

Notes

- Include currency exchange and buying and selling tables.
- Knowledge of change and balances in purchases is assumed. However, problems involving change and balances should be given.

- **Suggested Resources**
  - Actual current exchange rate table from newspapers etc
  - Prevailing real life situations
- **Suggested Further Assessment**
  - Short test on 18.00

19.0.0 CO-ORDINATES AND GRAPHS(14 Lessons)

19.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) draw and label the complete cartesian plane

b) locate and plot points on the cartesian plane
c) choose and use appropriate scale for a given data
d) make a table of values for a given linear relation
e) use values to draw a linear graph
f) solve simultaneous linear equations graphically
g) draw, read and interprete graphs.

19.2.0 **Content**
19.2.1 Cartesian plane
19.2.2 Cartesian co-ordinates
19.2.3 Points on the cartesian plane
19.2.4 Choice of appropriate scale
19.2.5 Table of values for a given linear relation
19.2.6 Linear graphs
19.2.7 Graphical solutions of simultaneous linear equations
19.2.8 Interpretation of graphs

Notes
- Co-ordinates should include both positive and negative values

▪ **Suggested Resources**
- Cartesian plane
- Square board
- Pegboards/geoboards
- Graph papers
- Topographical maps

▪ **Suggested Further Assessment**
- Test on Topics 18.00 and 19.00 can be given here

20.0.0 ANGLES AND PLANE FIGURES
(6 Lessons)

20.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
a) name and identify types of angles
b) solve problems involving angles on a straight line
c) solve problems involving angles at a point
d) solve problems involving angles on a transversal
e) solve problems involving corresponding angles
f) state angle properties of polygons
g) solve problems involving angle properties of polygons
h) apply the knowledge of angle properties to real life situations.

20.2.0 **Content**
20.2.1 types of angles
20.2.2 angles on a straight line
20.2.3 angles at a point
20.2.4 angles on a transversal
20.2.5 corresponding angles
20.2.6 angle properties of polygons
20.2.7 application to real life situations

Notes
▪ Include exterior angles of a polygon
▪ Include the formula for finding the sum of interior angles of a polygon i.e sum = 2(n-2) right angles or 180(n-2), where n is the number of sides. This formula should be derived.
▪ **Suggested Resources**
- Geometrical instruments
- Polygonal shapes

▪ **Suggested Further Assessment**
- Practical exercises
- Short test on 20.00

21.0.0 GEOMETRICAL CONSTRUCTIONS
(18 lessons)

21.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
a) use a ruler and compasses only to construct
i) a perpendicular bisector of a line
ii) an angle bisector
iii) a perpendicular to a line from a given point
iv) a perpendicular to a line through a given point on the line
v) angles whose values are multiples of 7½°
vi) parallel lines
b) use a ruler and a set square to;
i) construct parallel lines
ii) divide a line proportionally
iii) construct perpendicular lines
c) construct a regular polygon using
i) ruler and compasses only
ii) ruler, compasses and protractor
d) construct irregular polygons using a ruler, compasses and protractor

21.2.0 **Content**
21.2.1 Construction of lines and angles using a ruler and compasses only
21.2.2 Construction of perpendicular and parallel lines using a ruler and a set square only
21.2.3 Proportional division of a line
21.2.4 Construction of regular polygons (upto a hexagon)

21.2.5 Construction of irregular polygons (upto a hexagon)

Notes

- The polygons should include triangles, quadrilaterals, pentagons, trapezia, parallelograms, hexagons, octagons etc.
- **Suggested Resources**
  - Geometrical instruments,
  - Polygonal shapes
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 20.00 and 21.00 can be given here

22.0.0 SCALE DRAWING
(18 Lessons)

22.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) interpret a given scale;
b) choose and use an appropriate scale
c) draw suitable sketches from given information
d) state the bearing of one point from another
e) locate a point using bearing and distance
f) determine angles of elevation and depression
g) solve problems involving bearings, elevations and scale drawing
h) apply scale drawing in simple surveying.

22.2.0 **Content**
22.2.1 Types of scales
22.2.2 Choice of scales
22.2.3 Sketches from given information and scale drawing.
22.2.4 Bearings
22.2.5 Bearings, distance and locating points
22.2.6 Angles of elevation and depression
22.2.7 Solving problems involving bearings, scale drawing, angles of elevation and depression

22.2.8 Simple surveying techniques

Notes

- Accuracy to be emphasised
- Should include true and compass bearings
- Include problems involving a combination of bearings, angles of elevation and depression and scale drawing
- **Suggested Resources**
  - geometrical instruments
  - clinometer
  - magnetic compass
  - metre rule
  - tape measure

- **Suggested Further Assessment**
  - practical exercises
  - short test on 22.00

23.0.0 COMMON SOLIDS
(18 Lessons)

23.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify and sketch common solids
b) sketch and accurately draw nets of solids
c) make models of solids from nets
d) calculate surface area of solids from nets
e) find distance between two points on a solid.

23.2.0 **Content**

23.2.1 Common solids, eg cubes, cuboids pyramdis, prisms, cones, spheres, cylinders etc.

23.2.2 Sketches of solids

23.2.3 Nets of solids

23.2.4 Models of solids from nets

23.2.5 Surface area of solids from nets (include cubes, cuboids, cones, pyramids, prisms)

23.2.6 Distance between two points on the surface of a solid

Notes

- Use and making of models is recommended.
- **Suggested Resources**
  - Geometrical instruments
  - Manila papers
  - Models of solids
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 20.00 to 23.00 may be given here

FORM TWO

24.0.0 CUBES AND CUBE ROOTS (4 Lessons)

24.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find the cube of a number by multiplication
b) find the cube root of a number by factor method
c) find cubes of numbers from mathematical tables
d) evaluate expressions involving cubes and cube roots
e) apply the knowledge of cubes and cube roots in real life situations.

24.2.0 Content

24.2.1 Cubes of numbers by multiplication
24.2.2 Cubes from tables
24.2.3 Cuberoots of numbers by factor method
24.2.4 Evaluation of cube and cuberoot expressions
24.2.3 Application of cubes and cuberoots to real life situations

Notes

- Cube roots should be found by using factor method first before using tables
- **Suggested Resources**
  - Mathematical tables
  - Real life situations
- **Suggested Further Assessment**
  - Short test on 24.20

25.0.0 RECIPROCALS (7 Lessons)

25.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find reciprocals of numbers by division
b) find reciprocals of numbers from tables
c) use reciprocals of numbers in computation.

25.2.0 Content

25.2.1 Reciprocals of numbers by division
25.2.2 Reciprocals of numbers from tables
25.2.3 Computation using reciprocals

Notes

- Decimal numbers should be converted to standard form before finding their reciprocals using tables.
- **Suggested Resources**
  Mathematical tables
- **Suggested Further Assessment**
  - short test on 25.00

26.0.0 INDICES AND LOGARITHMS (18 Lessons)

26.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define indices (powers);
b) state the laws of indices;
c) apply the laws of indices in calculations;
d) relate the powers of 10 to common logarithms;
e) use the tables of common logarithms and anti-logarithms in computation.

26.2.0 **Content**

26.2.1 Indices (powers) and base
26.2.2 Laws of indices (including positive integers, negative integers and fractional indices)
26.2.3 Powers of 10 and common logarithms
26.2.4 Common logarithms;
  - characteristics
  - mantissa
26.2.5 Logarithm tables
26.2.6 Application of common logarithms in multiplication, division and finding roots

Notes

- Introduce laws using integral indices.
- Laws of indices should include
  - $a^m \times a^n = a^{m+n}$
  - $a^m \div a^n = a^{m-n}$
  - $(a^m)^n = a^{mn}$
  - $a^\circ = 1$

$\frac{1}{a^m} = a^{-m}$

- $\frac{1}{a^{-m}} = a^m$
- $a^{m/n} = \sqrt[n]{a^m}$

- **Suggested Resources**
  Logarithm tables.
  Charts illustrating laws of indices
- **Suggested Further Assessment**
  - Test on 24.00, 25.00, 26.00

27.0.0 EQUATIONS OF STRAIGHT LINES (12 Lessons)

27.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define gradient of a straight line
b) determine the gradient of a straight line through known points
c) determine the equation of a straight line using gradient and one known point
d) express a straight line equation in the form $y = mx + c$
e) interpret the equation $y = mx + c$
f) find the x- and y- intercepts from an equation of a line
g) draw the graph of a straight line using gradient and x and y intercept
h) state the relationship of gradients of perpendicular lines
i) state the relationship of gradients of parallel lines
j) apply the relationship of gradients of perpendicular and parallel lines to get equations of straight lines.

27.2.0 Content

27.2.1 Gradient of a straight line
27.2.2 Equation of a straight line
27.2.3 The equation of a straight line of the form $y = mx + c$
27.2.4 The x and y intercepts of a line
27.2.5 The graph of a straight line
27.2.6 Perpendicular lines and their gradients
27.2.7 Parallel lines and their gradients
27.2.7 Equations of parallel and perpendicular lines.

Notes

- **Suggested Resources**
  - Square boards, graph books, straight edges/rulers, real life situations
- **Suggested Further Assessment**
  Short test on 27.00

28.0.0 REFLECTION AND CONGRUENCE (12 Lessons)

28.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state the properties of reflection as a transformation
b) use the properties of reflection in construction and identification of images and objects
c) make geometrical deductions using reflection
d) apply reflection in the cartesian plane
e) distinguish between direct and opposite congruence
f) identify congruent triangles.

28.2.0 Content

28.2.1 lines and planes of symmetry
28.2.2 mirror lines and construction of objects and images.
28.2.3 reflection as a transformation.
28.2.4 reflection in the cartesian plane.
28.2.5 direct and opposite congruency.
28.2.6 Congruency tests (SSS, SAS, AAS, ASA and RHS)

Notes

- Practical aspects should be used as much as possible
- ASS does not prove triangles congruent except when the triangles are right angled
- Images are oppositely congruent to their objects under reflection
- **Suggested Resources**
  Mirrors, cartesian plane, various Symmetrical objects, tracing and graph papers, real life experiences
- **Suggested Further Assessment**
  - Practical exercises using mirrors and constructions
  - Short test on 28.00

29.0.0 ROTATION (12 Lessons)

29.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state properties of rotation as a transformation

b) determine centre and angle of rotation
c) apply properties of rotation in the cartesian plane
d) identify point of rotational symmetry
e) state order of rotational symmetry of plane figure
f) identify axis of rotational symmetry of solids
g) state order of rotational symmetry of solids
h) deduce congruence from rotation.

29.2.0 Content

29.2.1 Properties of rotation
29.2.2 Centre and angle of rotation
29.2.3 Rotation in the cartesian plane
29.2.4 Rotational symmetry of plane figures and solids (point axis and order)
29.2.5 Congruence and rotation

Notes

- Encourage practicals
- Emphasise that images are directly congruent to their objects under rotation
- **Suggested Resources**
  Square boards, graph papers geometrical instruments, tracing paper and real life situations
- **Suggested Further Assessment**
  - Practical exercises,
  - Short test on 29.12

30.0.0 SIMILARITY AND ENLARGEMENT (19 Lessons)

30.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify similar figures
b) construct similar figures
c) state properties of enlargement as a transformation
d) apply the properties of enlargement to construct objects and images
e) apply enlargement in cartesian planes
f) state the relationship between linear, area and volume scale factors
g) apply the scale factors to real life situations.

30.2.0 Content

30.2.1 Similar figures and their properties
30.2.2 Construction of similar figures
30.2.3 Properties of enlargement
30.2.4 Construction of objects and images under enlargement.
30.2,5 Enlargement in the Cartesian plane.
30.2.6 Linear, area and volume scale factors
30.2.7 Real life situations

Notes

- Enlargement should include fractional and negative scale factors
- Apply enlargement in the cartesian coordinate system
- **Suggested Resources**
  Geometrical instruments, models maps photographs, charts illustrating similarity and enlargement.
- **Suggested Further Assessment**
  - Practical exercises.
  - Test on 27.00, 29.00, and 30.00

31.1.0 PYTHAGORAS THEOREM (4 Lessons)

31.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) derive Pythagoras Theorem
b) solve problems using Pythagoras Theorem
c) apply Pythagoras Theorem to real life situations.

31.2.0 Content

31.2.1 Pythagoras Theorem
31.2.2 Solution of problems using Pythagoras Theorem
31.2.3 Application to real life situations

Notes

- Use square cuttings to verify Pythagoras Theorem.
- **Suggested Resources**
  Square boards, tape measures and metre rules
- **Suggested Further Assessment**
  - Practical exercises
  - Quiz

32.0.0 TRIGONOMETRY (19 Lessons)

32.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define tangent, sine and cosine ratios from a right angled triangle

b) read and use tables of trigonometric ratios
c) use sine, cosine and tangent in calculating lengths and angles
d) establish and use the relationship of sine and cosine of complimentary angles
e) relate the three trigonometric ratios
f) determine the trigonometric ratios of special angles 30°, 45°, 60° and 90° without using tables
g) read and use tables of logarithms of sine, cosine and tangent
h) apply the knowledge of trigonometry to real life situations.

32.2.0 Content

32.2.1 Tangent, sine and cosine of angles
32.2.2 Trigonometric tables
32.2.3 Angles and sides of a right angled triangle
32.2.4 Sine and cosine of complimentary angles
32.2.4 Relationship between tangent, sine and cosine
32.2.5 Trigonometric ratios of special angles 30°, 45°, 60° and 90°
32.2.6 Logarithms of sines, cosines and tangents
32.2.7 Application of trigonometry to real life situations

Notes

- Use a general right angled triangle to define the ratios
- Apply trigonometry to bearings, angles of elevation and depression
- **Suggested Resources**
  - Right angled triangles,
  - Mathematical tables
  - Real life situations
- **Suggested Further Assessment**
  Test on 31.00, 32.00

33.0.0 AREA OF A TRIANGLE
(7 Lessons)

33.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) Derive the formula;
Area = ½ ab sin C
b) Solve problems involving area of triangles using the formula
Area = ½ ab sin C
c) Solve problems on area of a triangle using the formula
area = $\sqrt{\{s(s - a)(s - b)(s - c)\}}$.

33.2.0 Content

33.2.1 Area of triangle
A = ½ ab sin C.
33.2.2 Area of a triangle
A = $\sqrt{\{s(s - a)(s - b)(s – c)\}}$
33.2.3 Application to Real life situations

Notes

- $s = \frac{a + b + c}{2}$
  where a, b and c are the sides of triangle ABC
- **Suggested Resources**
  charts illustrating different ways of showing area of a triangle.
- **Suggested Further Assessment**
  - practical exercises
  - Short test on 33.00

34.0.0 AREA OF QUADRILATERALS AND OTHER POLYGONS
(4 Lessons)

34.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find the area of a quadrilateral
b) find the area of other polygons (regular and irregular).

34.2.0 Content

34.2.1 Area of quadrilaterals
34.2.2 Area of other polygons (regular and irregular)

Notes

- Other polygons include pentagon, hexagon, heptagon and octagon.
- Use trigonometry.
- **Suggested Resources**
  - Charts illustrating various polygons
  - Polygonal shapes
- **Suggested Further Assessment**
  - practical exercises
  - short test on 34.00

35.0.0 AREA OF PART OF A CIRCLE
(9 Lessons)

35.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find area of a sector
b) find area of a segment
c) find area of common region between two circles

35.2.0 Content

35.2.1 Area of a sector

32.2.2 Area of a segment

32.2.3 Area of a common regions between two circles

Notes

- **Suggested Resources**
  Circular cutouts, charts illustrating sectors, segments and common region between two circles.
- **Suggested Further Assessment**
  Short test on 35.00

36.0.0 SURFACE AREA OF SOLIDS (10 Lessons)

36.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) find the surface area of a prism
b) find the surface area of a pyramid
c) find the surface area of a cone
d) find the surface area of a frustum
e) find the surface area of a sphere.

36.2.0 Content

36.2.1 Surface area of prisms, pyramids, cones, frustums and spheres

Notes

- **Suggested Resources**
  Models of pyramids, frustums, prisms, cones and spheres
- **Suggested Further Assessment**
  - Practical exercises
  - short test on 36.00

37.0.0 VOLUME OF SOLIDS (12 Lessons)

37.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find the volume of a prism
b) find the volume of a pyramid
c) find the volume of a cone
d) find the volume of a frustum
e) find the volume of a sphere.

37.2.0 Content

37.2.1 Volumes of prisms, pyramids, cones, frustums and spheres

Notes

- Linear scale factor and volume scale factor are useful in finding the volume of a frustum.
- **Suggested Resources**
  Models of solids (prism, pyramid cone, frustum and sphere)
- **Suggested Further Assessment**
  Test on 33.00, 34.00, 35.00, 36.00

38.0.0 QUADRATIC EXPRESSIONS AND EQUATIONS (12 Lessons)

38.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) expand algebraic expressions that form quadratic equations
b) derive the three quadratic identities
c) identify and use the three quadratic identities
d) factorise quadratic expressions including the identities
e) solve quadratic equations by factorization
f) form and solve quadratic equations.

38.2.0 Content

38.2.1 Expansion of algebraic expressions

38.2.2 The three quadratic identities

38.2.3 Using the three quadratic identities

38.2.4 Factorisation of quadratic expressions

38.2.5 Solutions of quadratic equations by factor method

38.2.6 Formation and solution of quadratic equations

Notes

- Use the idea of area to derive the quadratic identities
- Use quadratic identities to evaluate numerical cases
- Include real life situations
- **Suggested Resources**
  - Charts illustrating quadratic identities
  - Situations that lead to Formation of quadratic equations
- **Suggested Further Assessment**
  - Practical exercises
  - Short test on 38.00
  - Puzzles and games

39.0.0 LINEAR INEQUALITIES (12 Lessons)

39.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify and use inequality symbols
b) illustrate inequalities on the number line
c) solve linear inequalities in one unknown
d) represent the linear inequalities graphically
e) solve the linear inequalities in two unknowns graphically

f) form simple linear inequalities from inequality graphs.

39.2.0 Content

39.2.1 Inequalities on a number line.
39.2.2 Simple and compound inequality statements.
39.2.3 Linear inequality in one unknown.
39.2.4 Graphical representation of linear inequalities.
39.2.5 Graphical solutions of simultaneous linear inequalities.
39.2.6 Simple linear inequalities from inequality graphs.
39.2.7 Inequalities from inequality graphs.

Notes

- Use the symbols $<, >, \leq, \geq$ correctly.
- Shade the unwanted regions
- Explain the term integral value(s)
- **Suggested Resources**
  Square boards, graph papers
- **Suggested Further Assessment**
  Short test on 39.00

40.0.0 LINEAR MOTION (10 Lessons)

40.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define displacement, speed, velocity and acceleration
b) distinguish between
   i) distance and displacement
   ii) speed and velocity
c) determine velocity and acceleration
d) plot and draw graphs of linear motion(distance and velocity time graphs)
e) interpret graphs of linear motion
f) define relative speed
g) solve problems involving relative speed.

40.2.0 Content

40.2.1 Displacement, velocity, speed and acceleration
40.2.2 Determining velocity and acceleration
40.2.3 Solve problems involving relative speed
40.2.4 Distance - time graph
40.2.5 Velocity time graph
40.2.6 Interpretation of graphs of linear motion
40.2.7 Relative speed

Notes

- The terms vector and scalar should not be used at this stage
- Include approaching and overtaking bodies.
- **Suggested Resources**
  Linear motion tables, graph papers and drawn graphs.
- **Suggested Further Assessment**
  - Test on 37.00, 38.00, 39.00, and 40.00

41.0.0 STATISTICS (20 Lessons)

41.2.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define statistics
b) collect and organise data
c) draw a frequency distribution table
d) group data into reasonable classes
e) calculate measures of central tendency.
   i) mean
   ii) mode
   iii) median for ungrouped and grouped data.
f) represent data in form of linegraph, bargraphs, pie-charts, pictogram, histogram and frequency polygons
g) interpret data from real life situations

41.2.0 **Content**

41.2.1 Definition of statistics
41.2.2 Collection and organization of data
41.2.3 Frequency distribution tables (for grouped and ungrouped data)
41.2.4 Grouping data
41.2.5 Mean, mode and median
41.2.6 Representation of data
- Line graph
- Bar graph
- Pie chart
- Pictogram
- Histogram
- Frequency polygon

41.2.7 Interpretation of data

Notes

- Data from the learners experiences should be used.
- Class limits and class boundaries should be distinguished.
- Equal and unequal class intervals should be used in drawing and interpreting histograms.

- **Suggested Resources**
  - Data from the environment, charts illustrating various presentation of data.
- **Suggested Further Assessment**
  - Practical exercises
  - Test on 41.00

42.0.0 ANGLE PROPERTIES OF A CIRCLE (19 Lessons)

42.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify an arc, chord and segment
b) relate and compute angle subtended by an arc at the circumference
c) relate and compute angle subtended by an arc at the centre and at the circumference
d) state the angle in the semi- circle
e) state the angle properties of a cyclic quadrilateral
f) find and compute angles of a cyclic cyclic quadrilateral.

42.2.0 Content

42.2.1 Arc, chord and segment
42.2.2 Angle subtended by the same arc at the circumference
42.2.3 Relationship between angle subtended at the centre and angle subtended on the circumference by the same arc
42.2.4 Angle in a semi-circle
42.2.5 Angle properties of a cyclic quadrilateral.
42.2.6 Finding angles of a cyclic quadrilateral

Notes

- Distinguish between angle subtended by an arc and angle subtended by a chord
- Reasons in the process of solving for angles should be emphasized
- **Suggested Resources**
  - Mathematical instruments
  - Charts illustrating angle properties of a circle.
- **Suggested Further Assessment**

  Short test on 42.00

43.0.0 VECTORS(1) (20 Lessons)

43.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define vector and scalar
b) use vector notation
c) represent vectors both single and combined geometrically
d) identify equivalent vectors
e) add vectors
f) multiply vectors by scalars
g) define position vector and column vector
h) find magnitude of a vector
i) find mid-point of a vector
j) define translation as a transformation.

43.2.0 Content

43.2.1 Vector and scalar quantities
43.2.2 Vector notation
43.2.3 Representation of vectors
43.2.4 Equivalent vectors
43.2.5 Addition of vectors
43.2.6 Multiplication of a vector by a scalar
43.2.7 Column vectors
43.2.8 Position vectors
43.2.9 Magnitude of a vector
43.2.10 Midpoint of a vector
43.2.11 Translation vector

Notes

- Students should be exposed to various vector notations. One of the notations should be adopted.
- Use practical situations to introduce translation

- **Suggested Resources**

  Square boards, graph papers, geometrical instruments.
- **Suggested Further Assessment**

  Quiz, test on 42.00 and 43.00

FORM THREE

44.0.0 QUADRATIC EXPRESSIONS AND EQUATIONS (2)
(22 Lessons)

44.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) factorise quadratic expressions
b) identify perfect squares
c) complete the square
d) solving quadratic equations by completing the square
e) derive the quadratic formula
f) solve quadratic equations using the formula
g) form and solve quadratic equations from roots and given situations
h) make tables of values from a quadratic relation
i) draw the graph of a quadratic relation
j) solve quadratic equations using graphs
k) solve simultaneous equations (one linear and one quadratic) analytically and graphically
l) apply the knowledge of quadratic equations to real life situations.

44.2.0 **Content**

44.2.1 Factorisation of quadratic expressions
44.2.3 Perfect squares
44.2.4 Completion of the square
44.2.5 Solution of quadratic equations by completing the square

44.2.6 Quadratic formula

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

44.2.7 Solution of quadratic equations using the formula.
44.2.8 Formation of quadratic equations and solving them
44.2.9 Tables of values for a given quadratic relation
44.2.10 Graphs of quadratic equations
44.2.11 Simultaneous equations - one linear and one quadratic
44.2.12 Application to real life situation

Notes

- Use quadratic equation to solve other related quadratic equations graphically
- Interpret the discriminant i.e. (b^2-4ac).
- **Suggested Resources**
  - Square boards
  - Graph papers
- **Suggested Assessment**
  Test on 44.00

45.0.0 APPROXIMATIONS AND ERRORS (16 Lessons)

45.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) use calculators in various computations
b) make reasonable approximations and estimations of quantities in computations and measurements
c) express values to a given number of significant figures
d) define absolute, relative, percentage, round-off and truncation errors
e) determine possible errors made from computations
f) find maximum and minimum errors from operations.

45.2.0 **Content**

45.2.1 Computing using calculators
45.2.2 Estimations and approximations
45.2.3 Significant figures
45.2.4 Absolute, relative, percentage, round-off and truncation errors
45.2.5 Propagation of errors from simple calculations
45.2.6 Maximum and minimum errors

Notes

- Use calculators in various computations involving the four basic operations, squares, squareroots, cubes and cuberoots.
- Confine to errors propagated in addition, subtraction, multiplication and division.
- Include maximum and minimum errors from operations.

▪ **Suggested Resources**
  - Measuring instruments
  - Calculators
  - Real life experiences

- **Suggested Further Assessment**
  - Practical Exercises
  - Quiz

46.0.0 TRIGONOMETRY (2)
(22 Lessons)

46.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define and draw the unit circle
b) use the unit circle to find trigonometric ratios in terms of co-ordinates of points for $0 \leq \theta \leq 360°$
c) find trigonometric ratios of negative angles
d) find trigonometric ratios of angles greater than 360° using the unit circle
e) use mathematical tables and calculators to find trigonometric ratios of angles in the range $0 \leq \theta \leq 360°$
f) define radian measure
g) draw graphs of trigonometric functions; $y = \sin x$, $y = \cos x$ and $y = \tan x$ using degrees and radians
h) derive the sine rule
i) derive the cosine rule
j) apply the sine and cosine rule to solve triangles (sides, angles and area)
k) apply the knowledge of sine and cosine rules in real life situations.

46.2.0 **Content**
46.2.1 The unit circle
46.2.2 Trigonometric ratios from the unit circle
46.2.3 Trigonometric ratios of angles greater than 360° and negative angles
46.2.4 Use of trigonometric tables
46.2.5 Radian measure
46.2.6 Simple trigonometric graphs
46.2.7 Derivation of sine and cosine rule
46.2.8 Solution of triangles
46.2.9 Application of sine and cosine rule to real situation.

Notes

- Conversion of radians to degrees and vice versa is necessary
- Sine rule:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

and Cosine rule:

$a^2 = b^2 + c^2 - 2bc \cos A$

- Use calculators to verify values of trigonometric ratios
- Apply trigonometry to problems involving bearings and angles of elevation and depression and surveying.
- **Suggested Resources**
  - Unit circle
  - Graph paper
  - Square boards
  - Mathematical tables
  - Calculators
  - Real life experiences
- **Suggested Further Assessment**
  - Test on 45.00 and 46.00

47.0.0 SURDS (9 Lessons)

47.1.0 Special Objectives

By the end of the topic, the learner should be able to:

a) define rational and irrational numbers
b) simplify expressions with surds
c) rationalise denominators with surds

47.2.0 **Content**
47.2.1 Rational and irrational numbers
47.2.2 Simplification of surds
47.2.3 Rationalisation of denominators

Notes

- Determination of conjugates is necessary
- Simplifications be left in surd form unless instructed otherwise
- Where evaluation is required, a calculator may be used but the process of working out the sum must be shown
- **Suggested Resources**
  Charts illustrating process of rationalisation.
- **Suggested Further Assessment**
  Short test on 47.00

48.0.0 FURTHER LOGARITHMS (11 Lessons)

48.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) derive logarithmic relation from index form and vice-versa
b) state the laws of logarithms
c) use logarithmic laws to simplify logarithmic expressions and solve logarithmic equations
d) apply laws of logarithms for further computations.

48.2.0 Content

48.2.1 Logarithmic notation
48.2.2 The laws of logarithms
48.2.3 Simplification of logarithmic expressions
48.2.4 Solution of logarithmic equations
48.2.5 Further computations using logarithmic laws.

Notes

- Logarithmic equations will also include indices.

Logarithmic Laws:

$\log ab = \log a + \log b$

$\log \frac{a}{b} = \log a - \log b$

$\log a^n = n \log a$

- **Suggested Resources**
  - Chart illustrating logarithmic laws
  - Logarithm tables
  - Calculators

- **Suggested Further Assessment**
  - Short test on 48.00

49.0.0 COMMERCIAL ARITHMETIC (2) (22 Lessons)

49.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define principal, rate and time in relation to interest
b) calculate simple interest using simple interest formula
c) calculate compound interest using step by step method
d) derive the compound interest formula
e) apply the compound interest formula for calculating interest
f) define appreciation and depreciation
g) use compound interest formula to calculate appreciation and depreciation
h) calculate hire purchase
i) calculate income tax given the income tax bands.

49.2.0 **Content**

49.2.1 Principal rate and time
49.2.2 Simple interest
49.2.3 Compound interest using step by step method
49.2 4 Derivation of compound interest formula
49.2.5 Calculations using the compound interest formula
49.2.6 Appreciation and depreciation
49.2.7 Calculation of appreciation and depreciation using the compound interest formula
49.2.8 Hire purchase
49.2.9 Income tax

Notes

- Current income tax schedules to be used.
- Consider cases where compounding is done monthly, quarterly, and semi annually.

Suggested Resources

- Income tax schedule/bands
- Real life experiences
- Ready reckoner tables
- calculators

Suggested Further Assessment

Tests on 47.00, 48.00 and 49.00

50.0.0 CIRCLES CHORDS AND TANGENTS (21 Lessons)

50.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) calculate length of an arc and a chord
b) calculate lengths of tangents and intersecting chords
c) state and use properties of chords
d) construct tangent to a circle
e) construct direct and transverse common tangents to two circles
f) relate angles in alternate segment
g) construct circumscribed, inscribed and escribed circles
h) locate centroid and orthocentre of a triangle
i) apply knowledge of circles, tangents and chords to real life situations.

50.2.0 Content

50.2.1 Arcs, chords and tangents
50.2.2 Lengths of tangents and intersecting chords
50.2.3 Properties of chords
50.2.4 Construction of tangents to a circle
50.2.5 Direct and transverse common tangents to two circles
50.2.6 Angles in alternate segment
50.2.7 Circumscribed, inscribed and escribed circles
50.2.8 Centroid and orthocentre
50.2.9 Apply knowledge of tangents and chords to real life situations

NOTES

- Mention circumcircle, circumcentre, incentre and incircle and excentre

Suggested Resources

- Charts to illustrate the various properties
- Pulleys and wheels

Suggested Further Assessment

- Short on 50.00

51.0.0 MATRICES (21 Lessons)

51.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define a matrix
b) state the order of a matrix
c) define a square matrix
d) determine compatibility in addition and multiplication of matrices
e) add matrices
f) multiply matrices
g) identify identity matrix
h) find determinant of a 2 x 2 matrix
i) find the inverse of a 2 x 2 matrix
j) use matrices to solve simultaneous equations.

51.2.0 Content

51.2.1 Matrix
51.2.2 Order of a matrix
51.2.3 Square matrix
51.2.4 Compatibility in addition and multiplication of matrices
51.2.5 Multiplication of a matrix by a scalar
51.2.6 Matrix multiplication
51.2.7 Identity matrix
51.2.8 Determinant of a 2 x 2 matrix
51.2.9 Inverse of a 2 x 2 matrix and
51.2.10 Singular matrix
51.2.11 Solutions of simultaneous equations in two unknowns

Notes

- Reduction of a 2 x 2 matrix to echelon form is not required

Suggested Resources

- Charts illustrating compatibility of matrices
- Real life situations
- Calculators

Suggested Further Assessment

- Test on 50.00 and 51.00

52.0.0 FORMULAE AND VARIATIONS (21 Lessons)

52.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) rewrite a given formula by changing the subject
b) define direct, inverse, partial and joint variations
c) identify constants of proportionality
d) form and solve equations involving variations
e) draw graphs to illustrate direct and inverse proportions
f) use variations to solve everyday life problems

52.2.0 Content

52.2.1 Change of the subject
52.2.2 Direct, inverse, partial and joint variations
52.2.3 Constant of proportionality
52.2.4 Graphs of direct and inverse proportion
52.2.5 Formation of equation on variation from real life situations

Notes

- Need to clarify the relation connecting "α" and "=" signs.

Suggested Resources

- Square boards
- Graph papers
- Real life situations
- Calculators

Suggested Further Assessment

- Short test

53.0.0 SEQUENCES AND SERIES (21 Lessons)

53.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) identify simple number patterns
b) define a sequence
c) identify the pattern for a given set of numbers and deduce the general rule
d) determine a term in a sequence
e) recognise arithmetic and geometric sequences
f) define a series
g) recognise arithmetic and geometric series (Progression)
h) derive the formula for partial sum of an arithmetic and geometric series (Progression)
i) apply A.P and G.P formula to solve problems in real life situations.

53.2.0 Content

53.2.1 Simple number patterns
53.2.2 Sequences
53.2.3 Arithmetic sequence
53.2.4 Geometric sequence
53.2.5 Determining a term in a sequence
53.2.6 Arithmetic progression (A.P)
53.2.7 Geometric progression (G.P)
53.2.8 Sum of an A.P
53.2.9 Sum of a G.P
53.2.10 Application of A.P and G.P to real life situations

Notes

- Sum up to infinity is not required
- Deduction of general rule for simple cases only is necessary

Suggested Resources

- Charts illustrating number patterns
- Real life situations
- calculators

Suggested Further Assessment

Test on 52.00 and 53.00

54.0.0 VECTORS (2) (24 Lessons)

54.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) locate a point in two and three dimension co-ordinate systems
b) represent vectors as column and position vectors in three dimensions
c) distinguish between column and position vectors
d) represent vectors in terms of **i, j,** and **k**
e) calculate the magnitude of a vector in three dimensions
f) use the vector method in dividing a line proportionately
g) use vector method to show parallelism
h) use vector method to show collinearity
i) state and use the ratio theorem
j) apply vector methods in geometry.

54.2.0 Content

54.2.1 Coordinates in two and three dimensions
54.2.2 Column and position vectors in three dimensions
54.2.3 Column vectors in terms of unit vectors **i, j** and **k**.
54.2.4 Magnitude of a vector
54.2.5 Parallel vectors
54.2.6 Collinearity
54.2.7 Proportional division of a line
54.2.8 Ratio theorem
54.2.9 Vector methods in geometry

Notes

- Discuss collinearity in two and three dimensional spaces
- Discuss the various vector notations.
- Include column vectors i and j in two dimensions.

Suggested Resources

- Graph papers
- Square board
- Skeleton model of a cuboid

Suggested Further Assessment

- Test on 54.00

55.0.0 BINOMIAL EXPANSIONS
(11 Lessons)

55.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) expand binomial expressions up to the power of four by multiplication
b) build up - Pascal's Triangle up to the eleventh row
c) use Pascal's triangle to determine the coefficient of terms in a binomial expansion up to the power of 10
d) apply binomial expansion in numerical cases.

55.2.0 Content

55.2.1 Binomial expansion up to power four
55.2.2 Pascal's triangle
55.2.3 Coefficent of terms in binomial expansion
55.2.4 Computation using binomial expansion
55.2.5 Evaluation of numerical cases using binomial expansion

Notes

- Binomial expansion by multiplication up to power four only
- Compute numerical cases such as $(1.05)^{10}$ and $(0.99)^{10}$ to specified number of terms and significant figures.
- Use calculators but, process of working out the figures must be shown

Suggested Resources

- Charts illustrating Pascal's triangle
- Calculators

Suggested Further Assessment

- Short test on 55.00

56.0.0 PROBABILITY (22 Lessons)

56.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define probability
b) determine probability from experiments and real life situations
c) construct a probability space
d) determine theoretical probability
e) differentiate between discrete and continuous probability
f) differentiate mutually exclusive and independent events
g) state and apply laws of probability
h) use a tree diagram to determine probabilities.

56.2.0 Content

56.2.1 Probability
56.2.2 Experimental probability
56.2.3 Range of probability measure $O \leq P(x) < 1$
56.2.4 Probability space
56.2.5 Theoretical probability
56.2.6 Discrete and continuous probability (simple cases only)
56.2.7 Combined events (mutually exclusive and independent events)
56.2.8 Laws of probability
56.2.9 The tree diagrams

Notes

- Explain the terms; at least, at most, not more than, not less than, with respect to probability.

Suggested Resources

- Real life situations
- Probability games
- Calculators

Suggested Further Assessment

- Practical exercises
- Test on 55.00 and 56.00

57.00 COMPOUND PROPORTIONS AND RATES OF WORK
(9 Lessons)

57.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) solve problems involving compound proportions using unitary and ratio methods
b) apply ratios and proportions to real life situations
c) solve problems involving rates of work

57.2.0 Content

57.2.1 Proportional parts
57.2.2 Compound proportions
57.2.3 Ratios and rates of work
57.2.4 Proportions applied to mixtures

Notes

- Revise ratios and proportions covered previously
- Use unitary and ratio methods

Suggested Resources

- Real life situations
- Calculators

Suggested Further Assessment

- Short test on 57.00

58.0.0 GRAPHICAL METHODS
(21 Lessons)

58.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) make a table of values from given relations
b) use the table of values to draw the graphs of the relations
c) determine and interpret instantaneous rates of change from a graph
d) interpret information from graphs
e) draw and interpret graphs from empirical data
f) solve cubic equations graphically
g) draw the line of best fit
h) identify the equation of a circle
i) find the equation of a circle given the centre and the radius
j) determine the centre and radius of a circle and draw the circle on a cartesian plane.

58.2.0 Content

58.2.1 Tables and graphs of given relations.
58.2.2 Graphs of cubic equations
58.2 3 Graphical solutions of cubic equations.
58.2.4 Average rate of change
58.2.5 Instantaneous rate of change
58.2.6 Empirical data and their graphs
58.2.7 The line of best fit
58.2.8 Equation of a circle
58.2.9 Finding of the equation of a circle
58.2.10 Determining of the centre and radius of a circle

Notes

- Include linear graphs and curves
- Line of best fit does not always start from the origin
- Include the following equations of a circle;
  $x^2 + y^2 = r^2$
  $(x - a)^2 + (y - b)^2 = r^2$

Suggested Resources

- Graph papers
- Square boards
- Real life situations

Suggested Further Assessment

- Test on 57.00 and 58.00

FORM FOUR

59.0.0 MATRICES AND TRANSFORMATIONS (21 Lessons)

59.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) relate image and object under a given transformation on the cartesian plane
b) determine the matrix of a transformation
c) perform successive transformations
d) determine and identify a single matrix for successive transformation
e) relate identity matrix and transformation
f) determine the inverse of a transformation
g) establish and use the relationship between area scale factor and determinant of a matrix
h) determine shear and stretch transformations
i) define and distinguish isometric and non-isometric transformation
j) apply transformation to real life situations.

59.2.0 Content

59.2.1 transformation on the Cartesian plane
59.2.2 identification of transformation matrix
59.2.3 successive transformations
59.2 4 single matrix of transformation for successive transformations.
59.2.5 identity matrix and transformation
59.2.6 inverse of a transformation
59.2.7 area scale factor and determinant of a matrix
59.2.8 shear and stretch (include their matrices)
59.2.9 isometric and non-isometric transformation
59.2.10 application of transformation to real life situations

Notes

- Revise transformation covered previously

Suggested Resources

- Square boards
- Peg boards and strings
- Rubber bands
- Models
- Calculators

Suggested Further Assessment

- Practical exercises
- Test on 59.00 and related topics

60.1.0 STATISTICS (2) (27 Lessons)

60.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the measures of central tendency
b) calculate the mean using the assumed mean method
c) make cumulative frequency table
d) estimate the median and the quartiles by
   (i) calculation and
   (ii) ogive
e) define and calculate the measures of dispersion: range, quartiles, interquartile range, quartile deviation, variance and standard deviation
f) interpret measures of dispersion.

60.2.0 Content

60.2.1 Mean from assumed mean
60.2.2 Cumulative frequency table
60.2.3 Ogive
60.2.4 Median
60.2.5 Quartiles
60.2.6 Range
60.2.7 Interquartile range
60.2.8 Quartile deviation
60.2.9 Variance
60.2.10 Standard deviation

Notes

- Revise statistics (I)
- For measures of dispersion include both ungrouped and grouped data
- Relate quartiles with percentages.

Suggested Resources

- Square boards
- Graph papers
- Data from real life situations

Suggested Further Assessment

- Practical exercises
- Test on unit 60.00

61.0.0 LOCI (21 Lessons)

61.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define Locus
b) describe common types of Loci
c) construct
   (i) loci involving inequalities
   (ii) loci involving chords
   (iii) loci involving points under given conditions
   (iv) intersecting loci

61.2.0 Content

61.2.1 common types of Loci
61.2.2 Perpendicular bisector loci
61.2.3 Loci of a point at a given distance from a fixed point and a fixed line
61.2.4 Angle bisector loci
61.2.5 Constant angle loci
61.2.6 other loci under given condition including intersecting loci
61.2.7 loci of inequalities
61.2.8 loci involving chords

Notes

- Understanding of the language used in locus is important
- Knowledge of geometric construct is a prerequisite

Suggested Resources

- Geometrical patterns
- Square boards
- Graph papers

Suggested Further Assessment

- Practical exercises
- Test on unit 61.00

62.0.0 TRIGONOMETRY (3) (21 Lessons)

62.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) recall and define trigonometric ratios
b) derive trigonometric identity $\sin^2 x + \cos^2 x = 1$
c) draw graphs of trigonometric ratios of the form
   y= sin x, y = cos x,
   y= tan x y = a sin x,
   y= a cos x, y = a tan x
   y= a sin bx, y= a cos b x,
   y=a tan bx
   y=a sin(bx ± θ),
   y= a cos(bx ± θ)
   y=a tan(bx ± θ)
d) solve simple trigonometric equations analytically and graphically
e) deduce from the graph amplitude, period, wavelength and phase angles.

62.2.0 Content

62.2.1 Trigonometric ratios
62.2.2 deriving the relation $\sin^2 x + \cos^2 x = 1$
62.2.3 graphs of trigonometric functions
y =sinx, y=Cosx, y=tanx
y=a sinx, y=a cosx,
y= a tanx y= a sin bx,
y= a cos bx, y=a tan bx
y= a sin (bx ± θ),
y = a cos (bx ± θ)
y = a tan (bx ± θ)

62.2.4 simple trigonometric equations amplitude, period, wavelength and phase angle of trigonometric functions.

Notes

- Making a correct table of values from a trigonometric function and correct plotting of points are essential.
- Identification of symmetry and its use in drawing waves is important

Suggested Resources

- Square boards
- Graph papers
- Charts to illustrate amplitude period and phase angle

Suggested Further Assessment

Test on 62.00 and related topics

63.0.0 THREE DIMENSIONAL GEOMETRY (24 Lessons)

63.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state the geometric properties of common solids
b) identify projection of a line onto a plane
c) identify skew lines

d) calculate the length between two points in three dimensional geometry
e) identify and calculate the angle between
   (i) two lines
   (ii) a line and a plane
   (iii) two planes

63.2.0 Content

63.2.1 Geometrical properties of common solids
63.2.2 Skew lines and projection of a line onto a plane
63.2.3 length of a line in 3- dimensional geometry
63.2.4 the angle between
(i) a line and a line
(ii) a line and a plane
(iii) a plane and a plane
63.2.5 angles between skewlines

Notes
- Revise sketching common solids
- 3 -dimensional models must be used

Suggested Resources
- 3- dimensional models both skeleton and solid and detacheable models objects used in real life situations

Suggested Further Assessment
- Practical exercises
- Test on 63.00 related topics

64.0.0 LONGITUDES AND LATITUDES (21 Lessons)

64.1.0 Specific Objectives

By the end of the topic, the learner should be able to:
a) define the great and small circles in relation to a sphere (including the earth)
b) establish the relationship between the radii of small and great circles
c) locate a place on the earths surface in terms of latitude and longitude
d) calculate the distance between two points along the great circles and small circles (longitude and latitude) in nautical miles (nm) and kilometers (km)
e) calculate time in relation to longitudes
f) calculate speed in knots and kilometres per hour.

64.2.0 Content

64.2.1 Latitude and longitude(great and small circles)
64.2.2 The Equator and Greenwich Meridian
64.2.3 Radii of small and great circles
64.2.4 Position of a place on the surface of the earth
64.2.5 Distance between two points along the small and great circles in nautical miles and kilometres.
64.2.6 Distance in nautical miles and kilometers along a circle of latitude
64.2.7 Time and longitude
64.2.8 Speed in knots and Kilometres per hour

Notes
- Revise (i) trigonometric ratios
  (ii) Length of an arc
  (iii) Co-ordinates
- Take the Equator and GMT as reference points
- take 1nm = 1.853 km
  radius of the earth = 6370 km
- include problems involving speed, time and distance

Suggested Resources
- Globe
- Calculator
- Ball

Suggested Further Assessment

Test on unit 64.00 and related topics

65.0.0 LINEAR PROGRAMMING (21 Lessons)

65.1.0 Specific Objectives

By the end of the topic, the learner should be able to:
a) form linear inequalities based on real life situations
b) represent the linear inequalities on a graph
c) solve and interpret the optimum solution of the linear inequalities
d) apply linear programming to real life situations.

65.2.0 Content

65.2.1 Formation of linear inequalities
65.2.2 Analytical solutions of linear inequalities
65.2.3 solutions of linear inequalities by graphs
65.2.4 optimisation (include objective function)
65.2.5 application to real life situations

Notes

- Revise on linear inequalities
- Emphasis should be put on key words and their related symbols such as - at least, less than, at most, more than, not less than, not more than and so on.

Suggested Resources

- Square boards
- Graph papers

Suggested Further Assessment

- Test on 65.00 and related topics

66.0.0 DIFFERENTIATION (19 Lessons)

66.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) find average rates of change and instantaneous rates of change
b) find the gradient of a curve at a point using tangent
c) relate the delta notation to rates of change;
d) find the gradient function of a function of the form $y = x^n$ (n is a positive integer)
e) define
   (i) derivative of a function
   (ii) derived function of a polynomial
   (iii) differentiation
f) determine the derivative of a polynomial
g) find equations of tangents and normals to the curves
h) sketch a curve
i) apply differentiation in calculating distance, velocity and acceleration
j) apply differentiation in finding maxima and minima of a junction.

66.2.0 Content

66.2.1 Average and instantaneous rates of change
66.2.2 Gradient of a curve at a point
66.2.3 Gradient of $y=x^n$ (where n is a positive integer)
66.2.4 Delta notation (Δ)
66.2.5 Derivative of a polynomial
66.2.6 Equations of tangents and normals to the curve
66.2.7 Stationery points
66.2.8 Curve sketching
66.2.9 Application of differentiation in calculation of distance, velocity and acceleration.
66.2.10 Maxima and minima

Notes

- exclude the product and quotient rule in differentiation

Suggested Resources

- square boards
- graph papers

Suggested Further Assessment

- Test on 66.00 and related topics

67.0.0 AREA APPROXIMATION (10 Lessons)

67.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) approximate the area of irregular shapes by counting techniques
b) derive the trapezium rule
c) apply trapezium rule to approximate areas of irregular shapes
d) apply trapezium rule to estimate areas under curves
e) derive the mid-ordinate rule
f) apply mid-ordinate rule to approximate area under a curve.

67.2.0 Content

67.2.1 Area by counting techniques
67.2.2 Trapezium rule
67.2.3 Area using trapezium rule
67.2.4 Mid–ordinate
67.2.5 Area by the mid-ordinate rule

Notes

- Revise area of irregular shapes and area of a trapezium

Suggested Resources

- Square boards
- Graph papers
- Tracing papers for tracing irregular shapes from maps
- Worksheet containing practical work on trapezium and mid-ordinate rules

Suggested Further Assessment

- Practical exercises
- Test on 67.00 and related topics

68.0.0 INTEGRATION (19 Lessons)

68.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) carry out the process of differentiation
b) interpret integration as a reverse process of differentiation
c) relate integration notation to sum of areas of trapezia under a curve
d) integrate a polynomial
e) apply integration in finding the area under a curve
f) apply integration in kinematics.

68.2.0 Content

68.2.1 Differentiation
68.2.2 Reverse differentiation
68.2.3 Integration notation and sum of areas of trapezia
68.2.4 Indefinite and definite integrals
68.2.5 Area under a curve by integration
68.2.6 Application in kinematics

Notes

- Revise differentiation
- Consider area of curves above and below the x - axis
- Curve - sketching is important in identifying the required region
- Avoid substitution methods of integration.
- Compare approximation of area by; trapezoidal rule, mid-ordinate rule and by integration.
- If a curve is to be drawn **either** it should not exceed the 3^{rd} degree **or** a table of values is given for students to plot and draw.

Suggested Resources

- Square boards
- Graph papers
- Real life situations

Suggested Assessment

Oral and written exercises
Test on 66.00, 67.00, and 68.00

PHYSICS

INTRODUCTION

The Physics Syllabus is designed to offer varied experiences to the learner. The experiences are meant to lead to an all round mental, social and moral development of the learner.

This syllabus presents Physics as a body of knowledge about the physical environment. It employs a systematic scientific methodology of study to arouse learners way of reasoning and create positive attitude. To this end the use of teacher/learner discussion, teacher demonstration and group/class experiments as methods of instruction is encouraged. It emphasizes not only the understanding of the fundamental scientific concept and principles, but also the experimental approach of investigation. The experimental approach should prepare the learner to present scientific concepts and ideas in the modern technology. Teachers are encouraged to expand upon suggested projects and teaching methodologies for effective implementation of this syllabus. These projects are designed to enrich the experiments carried out in the laboratory and enhance creativity. The project work approach provides a learner with opportunities in undertaking investigations for purposes of finding solutions to problems. It also helps in the transfer and application of the required scientific knowledge to solving problems encountered in day-to-day experiences. Field visits to resource centre/institutions of higher learning and industries are encouraged to enrich and modernize the teaching/learning process.

The general and specific objectives have been carefully articulated to ensure clarity of the intended learning outcomes. The time allocated for each topic is adequate and will enable the average learner not only acquire knowledge but also discover more about the world around him/her and as such develop interest in the subject.

The syllabus also aims at inculcating in the learner virtues such as diligence and high integrity. Care has also been taken to sensitize the learner on aspects of health and environmental concerns. The syllabus ensures appropriate balance in the development of cognitive, psychomotor and affective skills

The teacher of Physics is therefore challenged to make the subject more appealing through experimental approach and proper planning.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1. select and use appropriate instruments to carry out measurements in the physical environment
2. use the knowledge acquired to discover and explain the order of the physical environment
3. use the acquired knowledge in the conservation and management of the environment
4. apply the principles of Physics and acquired skills to construct appropriate scientific devices from the available resources
5. develop capacity for critical thinking in solving problems in any situation
6. contribute to the technological and industrial development of the nation
7. appreciate and explain the role of Physics in promoting health in society
8. observe general safety precautions in all aspects of life
9. acquire and demonstrate a sense of honesty and high integrity in all aspects of Physics and life in general
10. acquire positive attitude towards Physics
11. acquire adequate knowledge in Physics for further education and/or training.

FORM ONE

1.0.0 INTRODUCTION TO PHYSICS (4 Lessons)

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

(a) explain what the study of physics involves
(b) relate physics to other subjects and to technology
(c) identify career opportunities related to physics
(d) state and explain basic laboratory safety rules.

1.2.0 Content

1.2.1 Physics as a Science(reference to Primary Science Syllabus)
1.2.2 Meaning of Physics
1.2.3 Branches of Physics
1.2.4 Relation between Physics, other subjects and technology
1.2.5 Career opportunities in Physics
1.2.6 Basic laboratory safety rules

2.0.0 MEASUREMENTS 1 (12 Lessons)

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define length, area, volume, mass, density, time and state the corresponding symbols and SI units
b) convert other metric units to SI units
c) estimate length, mass and time
d) use accurately the following measuring instruments; metre rule, tape measure, beam balance, stop clock/watch, measuring cylinder, pipette and burette
e) determine experimentally the densities of substances
f) solve numerical problems on density.

2.2.0 Content

2.2.1 Definition of length, area, volume, mass, density and time
2.2.2 SI units and symbols
2.2.3 Estimation of quantities
2.2.4 Conversion of units
2.2.5 Measuring instruments
2.2.6 Experiments on density
2.2.7 Problems on density

3.0.0 FORCE (16 Lessons)

3.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define force and state its SI unit
b) describe types of forces
c) describe experiments to illustrate cohesion, adhesion and surface tension
d) state the effects of force
e) state the difference between mass and weight
f) state the relation between mass and weight, W = mg
g) define scalar and vector quantities
h) solve numerical problems involving W = mg.

3.2.0 Content

3.2.1 Definition of force and state its unit
3.2.2 Types of forces (including cohesive, adhesive and surface tension)
3.2.3 Experiments to demonstrate cohesion, adhesion and surface tension.
3.2.4 Effects of force
3.2.5 Mass, weight and their relationship
3.2.6 Scalar and vector quantities
3.2.7 Problem involving W = mg (take g = 10 N/kg)

4.0.0 PRESSURE (24 Lessons)

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define pressure and state its units
b) determine pressure exerted by solids
c) describe experiments to investigate factors affecting pressure in fluids;
d) derive the formula $P = \rho gh$

e) state the principle of transmission of pressure in fluids (Pascals principle)
f) explain atmospheric pressure and its effect
g) state and explain the applications of pressure
h) solve numerical problems involving pressure.

4.2.0 Content

4.2.1 Definition of pressure
4.2.2 Pressure in solids
4.2.3 Factors affecting pressure in fluid (Experimental treatment required)
4.2.4 Derivation of $P = \rho gh$
4.2.5 Atmospheric pressure
4.2.6 Simple mercury barometer, manometers
4.2.7 Applications of pressure: drinking straw, syringe, siphon, hydraulic press, hydraulic brakes, bicycle pump, force pump, lift pump
4.2.8 Problems on pressure

4.3.0 Project Work

4.3.1 Construct a hydraulic press model.

5.0.0 PARTICULATE NATURE OF MATTER (12 Lessons)

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) show that matter is made up of tiny particles
b) describe experiments to show that particles of matter are at constant random motion
c) explain the states of matter in terms of particles
d) explain diffusion

5.2.0 Content

5.2.1 Experiments to show that matter is made up of tiny particles (e.g. cutting papers into small pieces), dilution experiments
5.2.2 Brownian motion
5.2.3 States of matter
5.2.4 Diffusion (Graham's law not required)

6.0.0 THERMAL EXPANSION (12 Lessons)

6.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define temperature
b) describe the functioning of various thermometers
c) convert Celsius scale to Kelvin scale of temperature
d) describe thermal expansion in solids, liquids and gases
e) explain expansion in terms of particle behaviour
f) describe the unusual expansion of water and its effects
g) explain the effects and applications of thermal expansion.

6.2.0 Content

6.2.1 Temperature
6.2.2 Thermometers:
- liquid - in - glass,
- clinical,
- six's maximum and minimum

6.2.3 Celsius and Kelvin scales
6.2.4 Expansion of solids, liquids and gases
6.2.5 Effects of expansion and contraction
6.2.6 Unusual expansion of water (Anomolous expansion)
6.2.7 Applications of thermal expansion, include Bimetallic strip

7.0.0 HEAT TRANSFER (12 Lessons)

7.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define heat
b) state the difference between temperature and heat
c) state and explain the modes of heat transfer
d) describe experiments to illustrate factors affecting heat transfer
e) explain applications of heat transfer.

7.2.0 Content

7.2.1 Heat and temperature
7.2.2 Modes of heat transfer
7.2.3 Factors affecting heat transfer (Experimental treatment required)
7.2.4 Applications of heat transfer on:
- Vacuum flask,
- Domestic hot - water system,
- Solar concentrators

8.0.0 RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACE (16 Lessons)

8.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe experiments to show that light travels in a straight line
b) describe the formation of shadows and eclipses
c) explain the functioning of a pin-hole camera
d) state the laws of reflection
e) verify experimentally the laws of reflection
f) state the characteristics of images formed by plane mirrors
g) explain the applications of reflection at plane surfaces
h) solve numerical problems involving pin-hole camera and mirrors inclined at an angle.

8.2.0 Content

8.2.1 Rectilinear propagation of light (experimental treatment required)
8.2.2 Formation of shadows and eclipses (umbra and penumbra)
8.2.3 Pin-hole camera image formation and magnification
8.2.4 Laws of reflection
8.2.5 Images formed by plane mirrors, ray diagrams, parallel and inclined mirrors
8.2.6 Devices based on reflection: periscope, kaleidoscope
8.2.7 Problems on pin-hole camera and mirrors inclined at an angle

8.3.0 Project Work

8.3.1 Construct Pin-hole Camera, Periscope and Kaleidoscope.

9.0.0 ELECTROSTATICS I (12 Lessons)

9.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe electrostatic charging of objects by rubbing
b) explain the source of electrostatic charges
c) state the two types of charges
d) state the basic law of charges
e) state the unit of charge
f) construct a simple leaf electroscope
g) explain the charging of a leaf electroscope
h) use a charged leaf electroscope to identify conductors, insulators and types of charges.

9.2.0 Content

9.2.1 Electrostatic charging of objects by rubbing (experimental treatment required)
9.2.2 Types of charges and law of charges
9.2.3 The source of charge
9.2.4 The coulomb
9.2.5 Leaf electroscope: features, charging and discharging
9.2.6 Charging by contact and by induction
9.2.7 Identification of charge
9.2.8 Conductors and insulators

10.0.0 CELLS AND SIMPLE CIRCUITS (12 Lessons)

10.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) draw and set-up simple electric circuits
b) identify circuit symbols
c) define electric current
d) explain the working of primary and secondary cells
e) explain the care and maintenance of secondary cells.

10.2.0 Content

10.2.1 Simple electric circuits: cell, ammeter, voltmeter, variable resistor, connecting wires, bulb and switches
10.2.2 Circuit symbols
10.2.3 Electric current and its units
10.2.4 Primary and secondary cells (simple cell, dry Leclanche' cell, Lead acid cell)
10.2.5 Care and maintenance of secondary cells

10.3.0 Project Work

10.3.1 Making a simple cell from locally available materials.

FORM TWO

11.0.0 MAGNETISM (12 Lessons)

11.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the properties and uses of magnets
b) identify magnetic and non-magnetic materials
c) state the basic law of magnetism
d) describe patterns of magnetic field
e) describe methods of magnetisation and demagnetization
f) explain magnetisation and demagnetisation using the domain theory
g) construct a simple compass.

11.2.0 Content

11.2.1 Magnets: properties and uses
11.2.2 Magnetic and non-magnetic materials
11.2.3 Basic law of magnetism
11.2.4 Magnetic field patterns
11.2.5 Magnetisation and demagnetization
11.2.6 Domain theory of magnetism
11.2.7 Care of magnets
11.2.8 Construction of a simple compass

12.0.0 MEASUREMENT II (16 Lessons)

12.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) measure length using vernier callipers and micrometer screw gauge
b) express quantities in correct number of decimal places and correct number of significant figures
c) express measurements in standard form
d) estimate the diameter of a molecule of oil
e) solve numerical problems in measurement.

12.2.0 Content

12.2.1 Measurement of length using Vernier callipers and micrometer screw gauge
12.2.2 Decimal places, significant figures and standard form
12.2.3 Estimation of the diameter of the molecule of oil (relate to the size of the HIV virus, mention effects of oil spills on health and environment)
12.2.4 Problems in measurements

12.3.0 Project Work

12.3.1 Construct Vernier Calliper.

13.0.0 TURNING EFFECT OF A FORCE (10 Lessons)

13.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define moment of a force about a point and state its SI unit
b) state and verify the principle of moments
c) solve problems involving the principle of moments.

13.2.0 Content

13.2.1 Moment of a force, unit of moment of a force
13.2.2 Principle of moments
13.2.3 Problems on principle of moments (consider single pivot only)

14.0.0 EQUILIBRIUM AND CENTRE OF GRAVITY (12 Lessons)

14.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define centre of gravity
b) determine experimentally the centre of gravity of lamina objects
c) identify and explain the states of equilibrium
d) state and explain factors affecting stability of an object
e) explain the applications of stability
f) solve numerical problems involving centre of gravity and moments of a force.

14.2.0 Content

14.2.1 Centre of gravity
(Experimental treatment required)
14.2.2 States of equilibrium
14.2.3 Factors affecting stability
14.2.4 Applications of stability
14.2.5 Problems on centre of gravity and moments of a force
(consider single pivot only)

15.0.0 REFLECTION AT CURVED SURFACES(16 Lessons)

15.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe concave, convex and parabolic reflectors
b) describe using ray diagram the principal axis, principal focus centre of curvature and related terms
c) locate images formed by curved mirrors by construction
d) determine experimentally the characteristics of images formed by a concave mirror
e) define magnification
f) explain the applications of curved reflecting surfaces.

15.2.0 Content

15.2.1 Concave and convex parabolic reflectors
15.2.2 Principal axis, principal focus, centre of curvature and related terms
15.2.3 Location of Images formed by curved mirrors by construction method
(Experiment on concave mirrors required)
15.2.4 Magnification formula
15.2.5 Applications of curved reflectors

16.0.0 MAGNETIC EFFECT OF ELECTRIC CURRENT (18 Lessons)

16.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe experiments to determine the direction of the magnetic field round a current carrying conductor
b) construct a simple electromagnet
c) state the factors affecting the strength of an electromagnet
d) determine experimentally the direction of a force on a conductor carrying current in a magnetic field (motor effect)
e) state the factors affecting force on a current carrying conductor or in a magnetic field
f) explain the working of simple electric motor and electric bell.

16.2.0 Content

16.2.1 Magnetic field due to a current
16.2.2 Oersted's experiment
16.2.3 Magnetic field patterns on straight conductors and solenoid (right hand grip rule)
16.2.4 Simple electromagnets
16.2.5 Factors affecting strength of an electromagnet
16.2.6 Motor effect (Fleming's left hand rule)
16.2.7 Factors affecting force on a current carrying conductor in a magnetic field (Qualitative treatment only)
16.2.8 Applications:
- electric bell,
- simple electric motor

16.3.0 Project Work

16.3.1 Construct an electromagnet and at least one of the following:
- loudspeaker
- telephone receiver
- electric bell
- electric motor

17.0.0 HOOKE'S LAW (8 Lessons)

17.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state and verify experimentally Hooke's law
b) determine the spring constant
c) construct and calibrate a spring balance
d) solve numerical problems involving Hooke's law.

17.2.0 Content

17.2.1 Hooke's law
17.2.2 Spring constant
17.2.3 Spring balance
17.2.4 Problems on Hooke's Law

18.0.0 WAVES I(14 Lessons)

18.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the formation of pulses and waves
b) describe transverse and longitudinal waves
c) define amplitude(a), wavelength (λ), frequency (f) and periodic time(T) of a wave
d) derive the relation $v = f\lambda$
e) solve numerical problems involving $v = f\lambda$

18.2.0 Content

18.2.1 Pulses and waves
18.2.2 Transverse and longitudinal waves
18.2.3 Amplitude (a), Wavelength (λ), frequency (f), periodic time (T)
18.2.4 $v = f\lambda$
18.2.5 Problems involving $v = f\lambda$

19.0.0 SOUND (12 Lessons)

19.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) perform and describe simple experiments to show that sound is produced by vibrating bodies
b) perform and describe an experiment to show that sound requires a material medium for propagation
c) explain the nature of sound waves
d) determine the speed of sound in air by the echo method
e) state the factors affecting the speed of sound
f) solve numerical problems involving velocity of sound.

19.2.0 Content

19.2.1 Sound: nature and sources (experimental treatment required)
19.2.2 Propagation of sound: compressions and rarefactions
19.2.3 Speed of sound by echo method
19.2.4 Factors affecting speed of sound
19.2.5 Problems on velocity of sound

20.0.0 FLUID FLOW (14 Lessons)

20.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe streamline flow and turbulent flow
b) derive the equation of continuity
c) describe experiments to illustrate Bernoulli's effects
d) explain the Bernoulli's effect
e) describe the applications of Bernoulli's effect
f) solve numerical problems involving the equation of continuity.

20.2.0 Content

20.2.1 Streamline and turbulent flow
20.2.2 Equation of continuity
20.2.3 Bernoulli's effect (Experimental treatment required)
20.2.4 Applications of Bernoulli's effect: Bunsen burner, spray gun, carburator aerofoil, spinning ball
20.2.5 Problems on equation of continuity

FORM THREE

21.0.0 LINEAR MOTION (20 Lessons)

21.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define distance, displacement, speed, velocity and acceleration
b) describe experiments to determine velocity and acceleration
c) determine acceleration due to gravity
d) plot and explain motion - time graphs
e) applying the equations of uniformly accelerated motion
f) solve numerical problems.

21.2.0 Content

2.1.2.1 Distance, displacement, speed, velocity, acceleration (Experimental treatment required)

21.2.2 Acceleration due to gravity:
- free-fall,
- simple pendulum method (experimental treatment required)

21.2.3 Motion-time graphs:
- Displacement - time graphs,
- Velocity - time graphs (Experimental treatment required)

21.2.4 Equations of uniformly accelerated motion

21.2.5 Problems on uniformly accelerated motion

22.0.0 REFRACTION OF LIGHT (20 Lessons)

22.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe simple experiments to illustrate refraction of light
b) state the laws of refraction of light
c) verify Snell's law
d) define refractive index
e) determine experimentally the refractive index
f) describe experiments to illustrate dispersion of white light
g) explain total internal reflection and its effects
h) state the applications of total internal reflection
i) solve numerical problems involving refractive index and critical angle.

22.2.0 Content

22.2.1 Refraction of light - laws of refraction (Experimental treatment required)

22.2.2 Determination of refractive index:
- Snell's law,
- real/apparent depth,
- critical angle

22.2.3 Dispersion of white light Experimental treatment required

22.2.4 Total internal reflection and its effects: critical angle

22.2.5 Applications of total internal reflection:
- Prism periscope,
- Optical fibre

22.2.6 Problems on refractive index and critical angle

23.0.0 NEWTON'S LAWS OF MOTION (15 Lessons)

23.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Newton's laws of motion
b) describe simple experiments to illustrate inertia
c) state the law of conservation of linear momentum
d) define elastic collision, inelastic collision and impulse
e) derive the equation F = ma
f) describe the application of frictional force (static and dynamic friction)
g) define viscosity
h) explain terminal velocity
i) solve numerical problems involving Newton's laws and the law of conservation of linear momentum.

23.2.0 Content

23.2.1 Newton's laws of motion (Experimental treatment on inertia required)

23.2.2 Conservation of linear momentum: elastic collisions, inelastic collisions, recoil velocity, impulse (oblique collisions not required).

23.2.3 F = ma.

23.2.4 Frictional forces:
Static and dynamic friction
- advantages and disadvantages,
- viscosity,
- terminal velocity (qualitative treatment).

23.2.5 Static and dynamic friction

23.2.6 Problems on Newton's Laws and law of conservation of linear momentum (exclude problems on elastic collisions)

24.0.0 WORK, ENERGY, POWER AND MACHINES (20 Lessons)

24.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe energy transformations

c) state the law of conservation of energy

d) define work, energy, power and state their SI units

e) define mechanical advantage, velocity ratio and efficiency of machines

f) solve numerical problems involving work, energy, power and machines.

24.20 Content

24.2.1 Forms of energy and energy transformations

24.2.2 Sources of energy:
- renewable,
- non-renewable

24.2.3 Law of conservation of energy

24.2.4 Work, energy and power (work done by resolved force not required)

24.2.5 Kinetic and potential energy

24.2.6 Simple machines

24.2.7 Problems on work, energy, power and machines

24.3.0 Project Work

24.3.1 Construct an energy saving jiko and a solar heater

25.0.0 CURRENT ELECTRICITY (20 Lessons)

25.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define potential difference and state its units

b) measure potential difference and current in a circuit

c) verify Ohm's law

d) define resistance and state its unit

e) determine resistance

f) determine experimentally the voltage - current relationships for various conductors

g) define emf and explain internal resistance of a cell

h) derive the formulae for effective resistance of resistors in series and in parallel

i) galvanometer to ammeters and voltmeters

j) solve numerical problems involving ohm's law, resistors in series and in parallel.

25.2.0 Content

25.2.1 Scale reading: Ammeter, Voltmeter

25.2.2 Electric circuits: current, potential difference

25.2.3 Ohm's law (experimental treatment required)

25.2.4 Resistance: types of resistors, measurements of resistance and units.

25.2.5 Resistivity and potentiometer

25.2.6 Electromotive force (emf) and internal resistance of a cell ($E = V + ir$)

25.2.7 Resistors in series and in parallel

25.2.8 Galvanometers:
Conversion to ammeters and voltmeters

25.2.9 Problems on Ohm's law, resistors in series and in parallel

26.0.0 WAVES II (10 Lessons)

26.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) describe experiments to illustrate the properties of waves

b) sketch wave fronts to illustrate the properties of waves

c) explain constructive interference and destructive interference

d) describe experiments to illustrate stationary waves.

26.2.0 Content

26.2.1 Properties of waves including sound waves: reflection, refraction, diffraction, interference (Experimental treatment required)

26.2.2 Constructive interference and destructive interference (qualitative treatment only)

26.2.3 Stationary waves (qualitative and experimental treatment required)

27.0.0 ELECTROSTATICS II (15 Lessons)

27.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) sketch electric field patterns around charged bodies
b) describe charge distribution on conductors of various shapes
c) define capacitance and state its SI unit
d) describe charging and discharging of a capacitor (calculation involving curves not required)
e) state the factors affecting the capacitance of a parallel plate capacitor
f) state the applications of capacitors
h) solve numerical problems involving capacitors.

27.2.0 Content

27.2.1 Electric field patterns

27.2.2 Charge distribution on conductors: spherical and pear shaped conductors

27.2.3 Action at points: lightning arrestors

27.2.4 Capacitance, unit of capacitance (farad, microfarad), factors affecting capacitance

27.2.5 Applications of capacitors

27.2.6 Problems on capacitors {using $Q=CV$, $C_T = C_1 + C_2$,

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$$ }

28.0.0 HEATING EFFECT OF AN ELECTRIC CURRENT (10 Lessons)

28.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) Perform and describe experiments to illustrate heating effect of an electric current
b) state the factors affecting heating by electric current
c) derive the equations for electrical energy and electrical power
d) identify devices in which heating effect of an electric current is applied
f) solve numerical problems involving electrical energy and electrical power.

28.2.0 Content

28.2.1 Simple experiments on heating effect

28.2.2 Factors affecting electrical energy, $W = VIt$, $P = VI$

28.2.3 Heating devices:- electric kettle, electric iron, bulb filament, electric heater

28.2.4 Problems on electrical energy and electrical power

29.0.0 QUANTITY OF HEAT (20 Lessons)

29.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define heat capacity and specific heat capacity
b) determine experimentally specific heat capacity of solids and liquids
c) define specific latent heat of fusion and specific latent heat of vaporization
d) determine experimentally the specific latent heat of fusion of ice and the specific latent heat of vaporization of steam
e) state the factors affecting melting point and boiling point
f) explain the functioning of a pressure cooker and a refrigerator
g) solve problems involving quantity of heat.

29.2.0 Content

29.2.1 Heat capacity, specific heat capacity, units (Experimental treatment required)

29.2.2 Latent heat of fusion, latent heat of vaporization, units (Experimental treatment necessary)

29.2.3 Boiling and melting

29.2.4 Pressure cooker, refrigerator

29.2.5 Problem on quantity of heat ($Q = MC\Delta\theta$, $Q = M\ell$)

29.3.0 Project Work

29.3.1 Construct a charcoal refrigerator (cooler)

30.0.0 GAS LAWS (15 Lessons)

30.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the gas laws for an ideal gas
b) verify experimentally the gas laws
c) explain how the absolute zero temperature may be obtained from the pressure - temperature and volume - temperature graphs
d) state the basic assumptions of the kinetic theory of gases
e) explain the gas laws using the kinetic theory of gases
f) solve numerical problems involving gas laws.

30.2.0 Content

30.2.1 Boyle's law, Charles' law, pressure law, absolute zero

30.2.2 Kelvin scale of temperature

30.2.3 Gas laws and kinetic theory of gases ($P = \frac{1}{3}\rho$ not required)

30.2.4 Problems on gas laws [including $\frac{PV}{T}$ = constant]

FORM FOUR

31.0.0 THIN LENSES(20 Lessons)

31.1.0 Specific objectives

By the end of this topic, the learner should be able to:

a) describe converging lenses and diverging lenses
b) describe using ray diagrams the principal focus, the optical centre and the focal length of a thin lens
c) determine experimentally the focal length of a converging lens
d) locate images formed by thin lenses using ray construction method
e) describe the characteristics of images formed by thin lenses
f) explain image formation in the human eye
g) describe the defects of vision in the human eye and how they can be corrected
h) describe the use of lenses in various optical devices
i) solve numerical problems involving the lens formula and the magnification formula.

31.2.0 Content

31.2.1 Types of lenses
31.2.2 Ray diagrams and terms used
31.2.3 Images formed
- ray construction,
- characteristics,
- magnification.

31.2.4 Determination of Focal length:
(Experimental treatment required)
- estimation method,
- lens formula,
- lens-mirror method

31.2.5 Human eye, defects (short sightedness and long sightedness only)
31.2.6 Optical devices:
- simple microscope,
- compound microscope,
- the camera

31.2.7 Problems involving the lens formula and the magnification formula

31.3.0 Project work

31.3.1 Construct a telescope.

32.0.0 UNIFORM CIRCULAR MOTION (10 Lessons)

32.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define angular displacement and angular velocity
b) describe simple experiments to illustrate centripetal force
c) explain the applications of uniform circular motion
d) solve numerical problems involving uniform circular motion.

32.2.0 **Content**

32.2.1 The radian, angular displacement, angular velocity
32.2.2 Centripetal force;
$F = \frac{mv^2}{r}$, $F = mr\omega^2$
(derivation of formulae not required)
(experimental treatment is necessary)
32.2.3 Applications of uniform circular motion
32.2.4 Centrifuge, vertical, horizontal circles banked tracks (calculations on banked tracks and conical pendulum not required)
32.2.5 Problem solving
(Apply $F = \frac{mv^2}{r}$, $F = mr\omega^2$)

33.0.0 FLOATING AND SINKING (15 Lessons)

33.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Archimedes' principle
b) verify Archmimedes' principle
c) state the law of flotation
d) define relative density
e) describe the applications of Archimedes' principle and relative density

f) Solve numerical problems involving Archimedes' principle.

33.2.0 Content

33.2.1 Archimedes' principle, Law of flotation (experimental treatment)
33.2.2 Relative density
33.2.3 Applications of Archimedes' principle and relative density
33.2.4 Problems on Archimedes' principle

33.3.0 Project Work

33.3.1 Construct a hydrometer.

34.0.0 ELECTROMAGNETIC SPECTRUM (15 Lessons)

34.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

a) describe the complete electromagnetic spectrum
b) state the properties of electromagnetic waves
c) describe the methods of detecting electromagnetic radiations
d) describe the applications of electromagnetic radiations
e) solve numerical problems involving $c = f\lambda$.

34.2.0 Content

34.2.1 Electromagnetic spectrum
34.2.2 Properties of electromagnetic waves
34.2.3 Detection of electromagnetic (e.m.) radiations
34.2.4 Applications of e.m radiations (include greenhouse effect)
34.2.5 Problems involving $c = f\lambda$

35.0.0 ELECTROMAGNETIC INDUCTION (20 Lessons)

35.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe simple experiments to illustrate electromagnetic induction
b) state the factors affecting the magnitude and the direction of the induced emf
c) state the laws of electromagnetic induction
d) describe simple experiments to illustrate mutual induction
e) explain the working of an alternating current (a.c.) generator and a direct current (d.c.) generator
f) explain the working of a transformer
g) explain the applications of electromagnetic induction
h) solve numerical problems involving transformers.

35.2.0 **Content**

35.2.1 Simple experiments to illustrate electromagnetic induction
35.2.2 Induced emf:
- Faradays' law,
- Lenz's law

35.2.3 Mutual induction
35.2.4 Alternating current generator, direct current generator
35.2.5 Fleming's right hand-rule
35.2.6 Transformers
35.2.7 Applications of electromagnetic induction:
- induction coil,
- moving coil loudspeaker

35.2.8 Problems on transformers

35.3.0 Project Work

35.3.1 Construct a simple transformer.

36.0.0 MAINS ELECTRICITY (10 Lessons)

36.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the sources of mains electricity
b) describe the transmission of electric power from the generating station
c) explain the domestic wiring system
d) define the Kilowatt hour
e) determine the electrical energy consumption and cost
f) solve numerical problems involving mains electricity.

36.2.0 Content

36.2.1 Sources of mains electricity
36.2.2 Power transmission (include dangers of high voltage transmission)
36.2.3 Domestic wiring system
36.2.4 Kw-hr, consumption and cost of electrical energy
36.2.5 Problems on mains electricity

36.3.0 Excursion

36.3.1 Field trip to a power station is recommended.

37.0.0 CATHODE RAYS AND CATHODE RAY TUBE (10 Lessons)

37.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

a) describe the production of cathode rays
b) state the properties of cathode rays
c) explain the functioning of a Cathode Ray Oscilloscope (C.R.O.) and of a Television tube (T.V. tube)
d) explain the uses of a Cathode Ray Oscilloscope
e) solve problems involving Cathode Ray Oscilloscope.

37.2.0 Content

37.2.1 Production of cathode rays, cathode ray tube
37.2.2 Properties of cathode rays
37.2.3 C.R.O. and T.V. tubes
37.2.4 Uses of C.R.O.
37.2.5 Problems on C.R.O.

Note: Demonstration with a CRO is suggested.

38.0.0 X-RAYS (8 Lessons)

38.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

a) explain the production of X-rays
b) state the properties of X-rays
c) state the dangers of X-rays
d) explain the uses of X-rays
e) solve numerical problems involving X-rays.

38.2.0 Content

38.2.1 Production of X-rays, X-ray tube
38.2.2 Energy changes in an X-ray tube
38.2.3 Properties of X-rays, soft X-rays and hard X-rays
38.2.4 Dangers of X-rays and precautions
38.2.5 Uses of X-rays(Bragg's law not required)
38.2.6 Problems on X-rays

39.0.0 PHOTOELECTRIC EFFECT (15 Lessons)

39.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

a) perform and describe simple experiments to illustrate the photoelectric effect
b) explain the factors affecting photoelectric emission
c) apply the equation $E = hf$ to calculate the energy of photons
d) define threshold frequency, work function and the electron volt
e) explain photoelectric emission using Einstein equation ($hf = hf_0 + \frac{1}{2} mv^2$)
f) explain the applications of photoelectric effect
g) solve numerical problems involving photoelectric emissions.

39.2.0 Content

39.2.1 Photoelectric effect, photons, threshold frequency; work function, Planck's constant, and electron-volt
39.2.2 Factors affecting photoelectric emission
39.2.3 Energy of Photons
39.2.4 Einsteins equation $hf = hf_o + \frac{1}{2}mv^2$
39.2.4 Applications of photoelectric effect:
- photo emissive,
- photo conductive,
- photovoltaic cells

39.2.5 Problems on photoelectric emissions

39.3.0 Project Work

39.3.1 Construct a burglar alarm.

40.0.0 RADIO ACTIVITY
(15 Lessons)

40.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define radioactive decay and half-life
b) describe the three types of radiations emitted in natural radioactivity
c) explain the detection of radioactive emissions
d) define nuclear fission and fusion
e) write balanced nuclear equations
f) explain the dangers of radioactive emissions
g) state the applications of radioactivity
h) solve numerical problems involving half-life.

40.2.0 Content

40.2.1 Radioactive decay
40.2.2 Half-life
40.2.3 Types of radiations, properties of radiations
40.2.4 Detectors of radiation,
40.2.5 Nuclear fission, nuclear fusion
40.2.6 Nuclear equations
40.2.7 Hazards of radioactivity, precautions
40.2.8 Applications
40.2.9 Problems on half-life (integration not required)

41.0.0 ELECTRONICS (10 Lessons)

41.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the differences between conductors and insulators
b) define intrinsic and extrinsic semi-conductors
c) explain doping in semi-conductors
d) explain the working of a p-n junction diode
e) sketch current-voltage characteristics for a diode
f) explain the application of diodes in rectification.

41.2.0 Content

41.2.1 Conductors, semi-conductors, insulators
41.2.2 Intrinsic and extrinsic semi-conductors
41.2.3 Doping
41.2.4 p-n junction diode
41.2.5 Applications of diodes: half wave rectification and full-wave rectification

41.3.0 Project Work

41.3.1 Construct a simple radio receiver

SUGGESTED ASSESSMENT METHODS

1. Practical work.
2. Project work.
3. Field trips.
4. Oral questions.
5. Quizzes.
6. Written tests and examination.

CHEMISTRY

INTRODUCTION

Chemistry as a subject is introduced to the learners for the first time at secondary school level. The knowledge of chemistry is necessary in the understanding of the composition, properties and behaviour changes of matter that form the environment around us.

This syllabus presents chemistry as a practical subject where scientific concepts, principles and skills are developed through experimental investigations. The learning of scientific knowledge by discovery method is encouraged.

The topics and content have been carefully selected and logically organised to facilitate step by step realization of the expected behavioral changes. The specific objectives in every topic will guide the teacher and the learner on the depth of treatment of content. The learning/teaching experiences have been appropriately chosen to ensure proper development of the cognitive, psychomotor and affective skills.
The syllabus emphasises the use of International Units for Physical and Applied Chemistry (IUPAC) system of nomenclature, correct use of chemical terminologies and equations.

There are applications and projects at the end of most of the topics to enable the learners link the subject with the physical environment around them. The learners would use the opportunities to interact with the physical and chemical processes, which take place within the local environment. The projects are meant to enhance creativity, critical thinking and ability to make logical decisions. The projects also make the learners aware of the effect of scientific knowledge in everyday life and thus able to appreciate their responsibility to the society.

The projects given are only examples. Teachers can come up with their own. The learners are also encouraged to initiate their own projects based on the scientific principles so far learnt. This creates interest, curiosity and fun in the learning of the subject.

Most of the apparatus, chemicals and equipment required for carrying out experiments are basic and affordable by most schools. Improvisation and use of local materials is encouraged where necessary to cut down on costs.

The suggested time is only a guide on how long each topic is expected to take.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1 select and handle appropriate apparatus for use in experimental work

2 make accurate measurements, observations and draw logical conclusions from experiments

3 observe and appreciate the need for safety precautions during experimental investigations

4 understand and appreciate the use of chemical symbols and formulae in writing equations

5 use appropriate chemical terms in describing physical and chemical processes

6 identify patterns in the physical and chemical behaviour of substances

7 apply the knowledge acquired to promote positive environmental and health practices

8 use the knowledge and skills acquired to solve problems in everyday life

9 apply principles and skills acquired in technological and industrial development

10 acquire adequate knowledge in chemistry for further education and for training.

FORM ONE

1.0.0 INTRODUCTION TO CHEMISTRY (12 Lessons)

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) recall the topics related to chemistry taught at primary school level
b) explain what the study of chemistry is about
c) name and state the uses of common apparatus in the laboratory
d) describe a Bunsen burner and its flame
e) state laboratory safety rules.

1.2.0 Content

1.2.1 Review the following topics

- properties of matter
- states of matter
- mixtures and their separations
- conductors and non-conductors of electricity
- Mention of drugs (prescription, dosage and abuse)

1.2.2 Chemistry and the Society

- Definition of chemistry and its role in the society

1.2.3 Chemistry laboratory

- heating apparatus (Bunsen burner, spirit lamp, candle, gas or kerosene stove and electric heater)
- parts of a Bunsen burner and its flame
- measuring apparatus (volume, temperature, mass, time)
- other apparatus (glass ware, spatula, deflagrating spoon, crucible, wire gauze etc)
- laboratory safety rules.

2.0.0 SIMPLE CLASSIFICATION OF SUBSTANCES (32 Lessons)

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) carry out simple experiments to obtain pure substances from mixtures
b) state the criteria for identifying a pure substance
c) define and determine the melting point and boiling point of a substance
d) explain the three states of matter (solid, liquid, gas) in terms of a simplified form of the kinetic theory
e) state the effect of heat on a variety of substances
f) distinguish between permanent and non-permanent changes
g) define an element, a compound, an atom and a molecule
h) name and write the chemical symbols of common elements
i) recognize the constituents of matter from given examples
j) distinguish between mixtures and compounds
k) apply separation techniques to extract various substances from natural sources.

2.2.0 Content

2.2.1 Separation of Mixtures

- Filtration, evaporation and condensation
- Distillation (simple and fractional), chromatography, solvent extraction as a method of extracting oil from nut seeds, crystallization, separation by using separating funnel, sublimation and decantation.
- Simple criteria for purity; melting point and boiling point.

2.2.2 Effect of heat on substances

- States of matter (solid, liquid, gases); The Kinetic theory
- Melting and boiling, condensation and evaporation of liquids in terms of kinetic theory
- Permanent and non-permanent changes (illustrate using iodine, wax, copper(II) sulphate crystals, potassium manganate(VII), zinc(II) oxide etc)

2.2.3 Constituents of matter

- Elements, atoms, molecules and compounds
- Names and symbols of common elements
- Simple word equations

2.2.4 Applications

- Fractional distillation of crude oil (e.g. Changamwe oil refinery) and liquid air, salt extraction e.g. Magadi Soda Company and Ngomeni; removal of stains from fabrics (dry cleaning); obtaining cream from milk.

2.3.0 Projects

- extraction of natural dyes, medicines and oils from plants
- construction and use of a fractionating column

3.0.0 ACIDS, BASES AND INDICATORS (16 Lessons)

3.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) prepare and use plant extracts as acid-base indicators
b) use indicators to identify acids and bases
c) state simple properties of acids and bases
d) name uses of acids and bases
e) state effects of acids on substances.

3.2.0 Content

3.2.1 Acid/Base indicators

- Plant - extracts as simple acid -base indicators
- Common acid-base indicators, universal indicator and pH scale
- Acidic, neutral and basic/alkaline solutions illustrated by the use of the following examples; water, aqueous solution/suspension; lemon juice, soap, wood ash, baking powder, anti-acid tablets and powders, toothpaste, sour milk, ammonia, ammonium sulphate, sodium chloride, sodium hydroxide, carbon(IV) oxide, sulphur(IV) oxide, sulphuric acid, hydrochloric acid, nitric acid, calcium hydroxide and magnesium oxide.

3.2.2 Simple properties of acids and bases:

- Reaction of dilute acids with metals, metal oxides, hydroxides, carbonates and hydrogencarbonates
- Effects of acids on substances

3.2.3 Applications

- Uses of acids and bases

3.3.0 Projects

- Investigate various plant extracts and use them as acid/base indicators

4.0.0 AIR AND COMBUSTION (24 Lessons)

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the percentage composition of air by volume
b) carry out simple experiments to show that oxygen is the active part of air
c) determine the percentage of oxygen in air using suitable methods
d) describe the combustion of specified elements in air and oxygen and name the products

e) explain how liquefied air can be separated into its components by fractional distillation
f) carry out experiments to investigate the conditions for rusting, and state the composition of rust
g) state methods of preventing rusting
h) prepare oxygen, investigate its properties and state its uses
i) arrange some elements in order of their reactivity with oxygen using experimental data
j) classify the products of burning elements in oxygen either as acidic or basic
k) state pollution effects due to burning of substances in air
l) state the uses of reactivity series.

4.2.0 Content

4.2.1 Composition of air

- Approximate percentage of nitrogen and oxygen in air by volume (mention of carbon dioxide and noble gases as other constituents of air)
- Quantitative determination of oxygen in air using copper, iron fillings and burning candle.
- Burning of substances in air; carbon, sulphur, phosphorus (CARE), sodium and copper
- Oxygen as an active part of air (mass changes involved)
- Fractional distillation of liquefied air
- Rusting: conditions, composition and prevention

4.2.2 Oxygen

- Laboratory preparation of oxygen using 20 volume by volume (v/v) hydrogen peroxide with manganese(IV) oxide or reaction of sodium peroxide with water (relate methods of collection to the properties of the gas)
- Properties; physical and chemical
- Combustion of elements in oxygen (metals and non-metals)
- competition for combined oxygen illustrated by the reaction of magnesium with carbon(IV) oxide, lead(II) oxide) and copper(II) oxide
- Mention atmospheric pollution due to burning in oxygen

4.2.3 Reactivity Series

- order of reactivity of elements from reaction with oxygen: potassium, sodium, calcium, magnesium, aluminium, carbon, zinc, iron, lead and copper.
  (It is not possible to establish full series practically)
- Uses: oxy -acetylene in welding; life support functions

4.2.4 Application

Extraction of metals (use the concept of reactivity series only)

4.3.0 Projects

Determination of oxygen in water from different sources. Investigate industrial processes of large scale oxygen production (e.g. the British Oxygen Company (BOC) Kenya Limited).

5.0.0 WATER AND HYDROGEN
(20 Lessons)

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state sources of water
b) describe an experiment to show water is a product of burning organic matter
c) describe an experiment to show that water contains hydrogen
d) state the products of reactions of cold water and steam with different metals
e) list the order of reactivity of metals as obtained from metal-water reactions
f) prepare hydrogen, investigate its properties and state its uses.
g) define oxidation as oxygen gain and reduction as removal of oxygen
h) explain metal oxide reactions with hydrogen in terms of reduction and oxidation.

5.2.0 Content

5.2.1 Water

- Sources of water: Burning of organic matter e.g. burning candle in air (test for carbon(IV) oxide and water vapour using calcium hydroxide and cobalt chloride paper or anhydrous copper(II) sulphate respectively)
- Water as an oxide of hydrogen.
- Reaction of sodium, calcium, magnesium with cold water and reaction of magnesium, zinc, iron with steam.

5.2.2 Hydrogen

- Laboratory preparation of hydrogen by reacting a metal with a dilute acid. (relate methods of collection to properties of the gas). Test for hydrogen
- Properties; physical and chemical
- Oxidation and reduction (oxygen gain and removal only) e.g. in metal oxide - hydrogen reaction. (Caution: experiments involving the burning of hydrogen gas are explosive).
- Uses (manufacture of margarine, rocket fuels, ammonia, hydrochloric acid, Oxyhydrogen flame for welding and weather balloons

5.3.0 Project

- Identification of common pollutants of water from local sources and suggesting their control

FORM TWO

6.0.0 STRUCTURE OF THE ATOM AND THE PERIODIC TABLE
(24 Lessons)

6.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) name and write the chemical symbols of the first twenty elements of the periodic table
b) describe the structure of the atom and write the electron arrangement of the first twenty elements of the periodic table
c) explain the electron arrangement of the atom in terms of energy levels
d) define atomic number, mass number, isotopes and relative atomic mass
e) calculate the relative atomic masses from isotopic composition
f) explain the position of an element in the periodic table in terms of the electron arrangement
g) define valency and oxidation number of an element
h) predict the type of ion formed from a given electron arrangement of an atom
i) predict the valencies and oxidation numbers from position of elements in the periodic table
j) derive the formulae of some simple compounds from valencies of elements and radicals
k) write simple balanced chemical equations.

6.2.1 Content

6.2.1 The Structure of the Atom

- Names and symbols of the first twenty elements of the periodic table.
- Simple structure of the atom; protons, electrons and neutrons; electron energy levels in atoms.

6.2.2 Atomic characteristics

- Definitions of atomic number, mass number, isotopes and relative atomic mass (reference C-12); examples of isotopes
- Calculations of relative atomic mass from relative abundance of isotopes of an element

6.2.3 The periodic table

- Build up of the periodic table for the first twenty elements on the basis of energy levels
  - rows (periods)
  - columns (groups)

6.2.4 Ion formation

- Formation of simple ions (cations and anions): qualitative treatment of the ionisation energy and electron affinity.
- Writing of the electron arrangement of ions formed from atoms; lithium, sodium, fluorine, chlorine, aluminium, magnesium and Sulphur; definition of valency and oxidation numbers.
- Derive valency and oxidation number of an element from atoms; its position in the periodic table
- Names and formulae of common radicals
- Use of valencies in determining the chemical formulae of some common compounds
- Writing simple balanced chemical equations

6.3.0 Project

- Atomic model construction

Note: The use of chemical equations with state symbols should be emphasised henceforth

7.0.0 CHEMICAL FAMILIES; PATTERNS IN PROPERTIES
(28 Lessons)

7.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) identify alkali metals, alkaline-earth metals, halogens and noble gases in the periodic table and write their electron arrangement
b) state and explain trends in physical properties of alkali metals, alkaline-earth metals, halogens and noble gases

c) state and explain the trends in reactivity of the alkali metals, alkaline-earth metals and halogens
d) explain the similarities in formulae of compounds formed by alkali metals, alkaline-earth metals and halogens
e) state the uses of alkali metals, alkaline-earth metals, halogens and noble gases
f) explain the unreactive nature of the noble gases in terms of their electron arrangement
g) identify the elements in a given period and write their electron arrangement
h) state and explain the trends in physical properties of elements in a period
i) state and explain the trends in chemical behaviour of elements in a given period.

7.2.0 Content

7.2.1 **Alkali metals (Group 1);**
(lithium, sodium, and potassium).

- Electron arrangement, gradation in size of the atom, ion and trends in ionisation energy.
- Physical properties; appearance, melting point, boiling point, thermal and electrical conductivity
- Reaction with air, water and chlorine.
- Similarity of ions and formulae of hydroxides, oxides and chlorides of alkali metals
- Uses of alkali metals (sodium only).

7.2.2 Alkaline - earth metals (Group 2)
(Beryllium, magnesium, and calcium)

- Electron arrangement, gradation in size of atom, ion and trends of ionisation energy
- Physical properties; appearance, melting point, boiling point, thermal and electrical conductivity
- Reaction with air, water, chlorine and dilute acids.

(Caution: Reaction between calcium and acid is violent. Use very dilute acid)

- Similarity of ions and formulae of oxides, hydroxides and chlorides
- Importance of alkaline-earth metals

7.2.3 **Halogens (Group 7);**
(Fluorine, chlorine, bromine and iodine);

- Electron configuration of fluorine and chlorine, gradation in size of atoms and ions
- Physical properties (appearance, melting point, boiling point, thermal and electrical conductivity)
- Reaction with metals, sodium, zinc, iron and water
- Similarity of ions and formulae of compounds
- Importance of fluorine, chlorine, bromine and iodine

7.2.4 **Noble gases (group 8)**;
(Helium, neon, argon)

- Electron arrangement and gradation in size of atoms
- Electron arrangement - the basis of low reactivity of helium, neon and argon
- Importance of noble gases

7.2.5 Properties and trends across a period

- Period three elements (sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine and argon)
- Electron arrangement of the elements
- Physical properties of period three elements (atomic size, ionisation energy, melting point, boiling point, thermal and electrical conductivity)
- Reaction of period three elements with oxygen, water and dilute acids

(Caution: Reaction of sodium with acids is explosive. Give theoretical treatment only)

7.3.0 Project

- Construction of models of the Periodic table

8.0.0 STRUCTURE AND BONDING (20 Lessons)

8.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the role of the outer electrons in determining chemical bonding
b) explain qualitatively the formation of covalent and ionic bonds
c) illustrate the covalent and ionic bonds using diagrams
d) explain the unique nature of the metallic bonding
e) state the effect of intermolecular forces of attraction on physical properties of substances
f) distinguish between bond types on the basis of physical properties of substances
g) compare and explain the changes in bond type across a period
h) select appropriate materials for use based on bond type.

8.2.0 Content

8.2.1 The role of outer electrons in chemical bonding

- significance of the outer electrons in chemical bonding.
- the noble gas electron arrangement
- electron transfer and ionic bonding
- electron sharing and covalent bonding
- use dot (.) and cross (x) diagrams to illustrate bonding, electrostatic forces of attraction in the following: molecular (iodine), giant covalent (diamond, graphite and silicon (IV) oxide), giant ionic (sodium chloride) and giant metallic (copper)
- other types of bonds: coordinate, hydrogen bond, Van der waals forces of attraction (simple explanation only)
- the influence of hydrogen bonds and Van der waals forces on physical properties (melting point, boiling point, solubility, electrical and thermal conductivity)

8.2.2 Types of bonds across a period (period 3)

- Changes in types of chemical bonds in oxides and chlorides of sodium, magnesium, aluminium, silicon, phosphorous, Sulphur and chlorine.

Note: Use of models to illustrate bonding should be encouraged.

8.2.3 Applications

Selection of materials for various uses; e.g. diamond, graphite and aluminium

8.2.6 Project

Investigation of materials in terms of their structure and bonding.

9.0.0 SALTS (20 Lessons)

9.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) select and use appropriate methods of preparing particular salts
b) explain the terms saturated solution, crystallisation, neutralisation and precipitation
c) write ionic equations for the preparation of salts
d) state types of salts
e) identify soluble and insoluble salts
f) describe and explain from experimental observations the action of heat on various salts
g) state uses of some salts.

9.2.0 Content

9.2.1 Methods of preparing salts

- preparation of soluble salts by reaction of acids with; metals, metal hydroxides, metal oxides, metal carbonates and metal hydrogencarbonates
- preparation of insoluble salts by precipitation (ionic equations required)
- direct combination reaction (e.g. sodium with chlorine, iron with sulphur)
- Types of salts; normal, acid and double salts.

9.2.2 Solubility of salts

- Solubility of sulphates, chlorides, nitrates and carbonates in water
- Relationship between method of preparation and solubility
  Note: The solubility of hydroxides and oxides should be considered along with others

9.2.3 Action of heat on salts

- Effects of heat on the following salts; carbonates, nitrates, sulphates and hydrated salts (include ammonium salts)
- Applications
  - use of lime to change soil pH
  - use of salts as anti - acids
  - use of salts as inorganic fertilizers

9.2.4 Project

Analysing anti-acid drugs.

10.0.0 EFFECT OF AN ELECTRIC CURRENT ON SUBSTANCES (16 Lessons)

10.1.0 Specific objectives

By the end of this topic, the learner should be able to:

a) define the terms conductor and non-conductor; electrolyte and non - electrolyte
b) classify solutions and molten substances as electrolytes and non-electrolytes
c) distinguish between electrolytes and non-electrolytes in terms of the particles they contain
d) explain the process of electrolysis and define the terms anode and cathode
e) state the products of electrolysis of a binary electrolyte
f) state some applications of electrolysis.

10.2.0 Content

10.2.1 Conduction of electricity

- Conductors and non-conductors
- Test for conduction of electricity by;
  - Solids, metals and non metals; (wood, aluminium foil, sodium chloride, sugar and lead(II) bromide)
  - aqueous solutions of: sugar, urea, copper(II) chloride, sodium chloride and mineral acids.
  - melts: Sulphur, lead(II) bromide or lead(II) iodide and sugar
- Electrolytes and non-electrolytes
- Ions as the particles in electrolyte solutions and melts
- Molecules as the particles in non-electrolyte solutions and melts

10.2.2 Electrolysis

- Passage of a direct electric current through an electrolyte (electrolysis of molten lead(II) bromide or lead(II) iodide)
- Anode and cathode
- Applications of electrolysis
  - electroplating
  - production and purification of metals

Note: details of the processes not required at this level

11.0.0 CARBON AND SOME OF ITS COMPOUNDS (20 Lessons)

11.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define allotropy and allotropes
b) explain the physical properties of the carbon allotropes in terms of bonding and how the properties are related to the uses of the allotropes
c) describe some chemical properties of carbon
d) describe laboratory preparation and properties of carbon (IV) Oxide (Carbon(II) oxide)

e) state and explain the physical and chemical properties of carbon(IV) Oxide (Carbon(II) oxide)
f) describe laboratory preparation and some properties of Carbon (II) oxide (Carbon monoxide)
g) describe the chemical reactions of carbonates and hydrogencarbonates
h) describe the manufacture of sodium carbonate
i) explain the advantages and disadvantages of Carbon(IV) Oxide and carbon(II) oxide gases in the atmosphere
j) explain the importance of carbon compounds in the natural environment and industry.

11.2.0 Content

11.2.1 Forms of carbon

- Diamond, graphite and charcoal: structure, physical properties and uses (relate uses to structure and physical properties)

11.2.2 Chemical properties of carbon

- Consider combustion, reaction with acids and reducing action

11.2.3 Preparation and properties of Carbon (IV) oxide (carbon dioxide)

(Relate methods of collection to the properties of the gas)

- Reactions of the gas with water, calcium hydroxide and alkalis.
- Uses of carbon(IV) oxide (carbon dioxide)

11.2.4 Preparation and properties of carbon(II) oxide (carbon monoxide)

- Preparation of carbon(II) oxide (carbon monoxide). Physical properties
- Chemical properties; combustion, reducing action, poisonous nature such as car exhausts fumes and charcoal fire

(Note: only theoretical treatment required because of its poisonous nature)

11.2.5 Carbonates and hydrogen carbonates

- Action of heat and dilute acids on some carbonates and hydrogencarbonates
- Production and manufacture of sodium carbonate (Magadi Soda Company and solvay process)

Note: Use simple schematic diagrams to illustrate solvay process.

11.2.6 Importance of carbon and its oxides

- Carbon cycle
- Soft drinks manufacture
- Fire extinguishers
- The effects of Carbon(IV) oxide (carbon dioxide) and carbon(II) oxide (carbon monoxide) on the environment

11.3.0 Projects

- construction and use of simple fire extinguishers
- construction of carbon cycle chart.

FORM THREE

12.0.0 GAS LAWS (15 lessons)

12.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Boyle's and Charles' laws
b) carry out calculations involving the gas laws
c) use combined gas law in calculations
d) state Graham's law of diffusion
e) explain diffusion in liquids and gases in terms of kinetic theory
f) relate the rate of diffusion to the relative molecular mass of a gas.

12.2.0 Content

12.2.1 Boyle's law and Charles' law

- Boyle's law, Charles' law and combined gas laws
- Explanation of the laws (use graphs to illustrate)
- Calculations involving gas laws

Note: Use of SI units should be emphasised

12.2.2 Grahams' law of diffusion

- Graham's law of diffusion; experiments illustrating diffusion of bromine gas, dissolving of copper(II) sulphate crystals or potassium manganate(VII) crystals in water. Explain diffusion in terms of kinetic theory.
- Relationship between rate of diffusion and density or relative molecular mass of a gas (illustrate with ammonia and hydrogen chloride)
- Calculations on diffusion

13.0.0 THE MOLE: FORMULAE AND CHEMICAL EQUATIONS (40 Lessons)

13.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define the mole
b) relate the mole to the relative atomic mass
c) convert mass into moles and vice versa
d) determine the empirical and molecular formulae of compounds from experimental results and given data
e) explain the terms concentration, molarity and dilution of a solution
f) define and prepare molar solution
g) prepare molar solutions
h) carry out titrations and calculations involving molar solutions
i) write correct full formulae and ionic equations of reactions with state symbols
j) define molar gas volume and atomicity of gases
k) state Avogadro's and Gay - Lussac's laws and carry out related calculations.

13.2.0 Content

13.2.1 The mole as a basic unit

- The mole as a basic unit. Molar mass
- Relative atomic mass (reference to carbon - 12) the mole as a number of particles (illustrated using 'counting by weighing' experiments)
- Conversion of mass in grammes to moles and vice versa (consider atoms, molecules and compounds)

13.2.2 Determination of formulae:

- Empirical and molecular formulae; quantitative determination of composition of magnesium oxide and copper(II) oxide

13.2.3 Molar solutions

- Preparations of molar solutions. Molarity of a solution.
- Concentration and dilution
- Stoichiometry of chemical reactions. (Use of ionic and full formulae equations in calculation of reacting quantities). Reactions that may be considered;

- $Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$ (precipitation)
- $Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$ (precipitation)
- $Cu^{2+}(aq) + Fe(s) \rightarrow Cu(s) + Fe^{2+}(aq)$ (displacement)

- Evolution of gas by action of an acid on solids e.g.
- Na_2CO_3 (s) + 2HCl (aq) → 2NaCl (aq) + CO_2 (g) + H_2O (I)
- Acid/base titrations (use of pippete fillers recommended)
  (Use balanced ionic and full formulae equations in calculation of reacting quantities.)
- Redox titration involving acidified MnO^-_4/Fe^{2+} and $Cr_2O_7^{2-}/Fe^{2+}$
  (writing of redox equations not required)

13.2.4 Molar gas volume

- Molar gas volume and atomicity of gases
- Avogadro's and Gay-Lussac's laws and related calculations

13.3.0 Project

Carrying out Counting by weighing experiments

14.0.0 ORGANIC CHEMISTRY I (HYDROCARBONS) (25 Lessons)

14.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) Define a hydrocarbon
b) name and draw the structures of simple hydrocarbons (alkanes, alkenes and alkynes).
c) state the features of a homologous series
d) draw and name isomers of simple hydrocarbons containing not more than five carbon atoms
e) describe the general methods of preparing alkanes, alkenes and alkynes
f) explain the physical and chemical properties of alkanes, alkenes and alkynes
g) state the uses of alkanes, alkenes and alkynes.

14.2.0 Content

14.2.1 Alkanes

- Definition of a hydrocarbon
- General formula: occurrence, nomenclature (consider straight chain alkanes of up to ten carbon atoms); fractional distillation of crude oil.
- Isomerism (butane and pentane)
- Preparation of methane and ethane
- Trends in physical properties (melting point, boiling point, density and solubility in water and in organic solvents)
- Chemical properties: burning and substitution reactions with chlorine or bromine (details of reaction mechanism not required)
- Uses of alkanes

14.2.2 Alkenes

- General formula, nomenclature (consider straight chain alkenes of up to six carbon atoms)
- Isomerism (butene and pentene)
- Preparation of ethene; trends in physical properties (melting point, boiling point, solubility in water and non-polar solvent)
- chemical properties (combustion, addition of chlorine, bromine, hydrogen, hydrogen halides, and ethene).
  (details of mechanism not required)
- Test for unsaturation (use acidified potassium manganate (VII) or bromine water)
- Uses of alkenes

14.2.3 Alkynes

- General formula, nomenclature (consider straight chain alkynes of up to six carbon atoms)
- Isomerism (butyne)
- Preparation of ethyne; trends in physical properties (melting point, boiling point, density solubility in water and non-polar solvents)
- chemical properties (combustion and addition reactions with chlorine, hydrogen, bromine, hydrogen halides).
- Uses of alkynes

15.0.0 NITROGEN AND ITS COMPOUNDS (30 lessons)

15.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the isolation of nitrogen from air
b) describe the laboratory preparation of nitrogen and state its properties and uses
c) describe the laboratory preparation, and state the properties and uses of the oxides of nitrogen
d) describe the laboratory preparation of ammonia and state its properties and uses
e) explain the difference in chemical reactions of ammonia gas and its aqueous solution
f) describe the industrial manufacture of ammonia
g) calculate the percentage of nitrogen in nitrogen containing fertilizers
h) describe the preparation and manufacture of nitric acid
i) describe and explain the reactions of both dilute and concentrated nitric acid
j) state the uses of nitric acid
k) identify the products formed when different nitrates are heated
l) explain the pollution effects of nitrogen compounds in the environment.

15.2.0 Content

15.2.1 Isolation of nitrogen gas from air

- Isolation of nitrogen gas from air; laboratory and in industry.

15.2.2 Laboratory preparation of nitrogen gas

- Laboratory preparation of nitrogen gas
- Properties
  - inert character
  - burning magnesium and sulphur in nitrogen gas
- uses of nitrogen gas

15.2.3 Oxides of nitrogen (nitrogen (I) oxide, nitrogen(II) oxide, nitrogen(IV) oxide)

- Laboratory preparations
- Properties and uses of the oxides.

15.2.4 Ammonia

- Laboratory preparation and properties of ammonia gas (relate method of collection to the properties of the gas):
- Solubility in water
  - reaction of aqueous ammonia (NH_4OH) with cations.
  - reaction with air/oxygen (catalysed and uncatalysed), copper(II) oxide and hydrogen chloride,
- manufacture of ammonia by Haber process.
  (state optimum conditions only)
- uses of ammonia
- Fertilizers: mention of various nitrogen containing fertilizers, (sulphates, nitrates and phosphate), amount of nitrogen in various fertilizers.

15.2.5 Nitric acid

- Laboratory preparation and manufacture of nitric acid
- Reaction of dilute nitric acid with; metals, carbonates, hydroxides and oxides
- Reaction of concentrated nitric acid as an oxidizing agent; iron(II) solution, Sulphur and copper metal
- Uses of nitric acid

15.2.6 Action of heat on nitrates

- Effects of heat on nitrates of sodium, potassium, copper, lead and silver (silver nitrate may be considered theoretically due to its cost)
- Test for nitrates

15.2.7 Pollution effects of nitrogen compounds in the environment

16.0.0 SULPHUR AND ITS COMPOUNDS (25 lessons)

16.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the allotropes of sulphur
b) describe the extraction and state the properties and uses of sulphur
c) describe the preparation and state the properties and uses of sulphur(IV) oxide (sulphur dioxide) and sulphur(VI) oxide (sulphur trioxide)
d) carry out tests to distinguish between sulphite and sulphate ions
e) explain the preparation and manufacture of sulphuric acid and state its uses
f) distinguish between the reactions of dilute and concentrated sulphuric acid
g) describe the preparation and state properties of hydrogen sulphide
h) explain environmental pollution caused by sulphur containing compounds.

16.2.0 Content

16.2.1 Occurrence and extraction of Sulphur

- Extraction by Frasch process
- Allotropes of sulphur
- Physical and chemical properties of sulphur
- Uses of sulphur

16.2.2 Sulphur(IV) oxide (sulphur dioxide)

- Preparation (relate method of collection to properties of the gas)
- Properties (acid character, bleaching action, reducing action e.g. test with potassium chromate(VI) and combination with oxygen to form sulphur(VI) oxide (Sulphur trioxide). oxidizing action e.g. with magnesium and hydrogen sulphide
- Test for sulphate and sulphite ions
- Uses of sulphur(IV) oxide

16.2.3 Sulphur (VI) Oxide (Sulphur trioxide)

- Preparation (relate method of collection + Properties of the gas)
- Properties and uses of sulpur (IV) Oxide

NB: Only theoretical treatment required.

16.2.4 Manufacture of Sulphuric acid

- Contact process (state optimum conditions only) e.g. Kel Chemical Ltd in Thika, and East Africa Heavy Chemicals, Webuye
- Pollution control in contact process

16.2.5 Properties of Sulphuric acid

- Reaction of concentrated sulphuric acid as;
  - dehydrating agent (sucrose, ethanol, hydrated copper(II) sulphate)
  - oxidizing agent (copper, zinc, sulphur and carbon)
  - displacement reaction (sodium chloride solid, potassium nitrate solid)
- Reactions of dilute sulphuric acid with:
  - metals
  - carbonates
  - metal hydroxides
  - metal oxides

16.2.6 Hydrogen sulphide

- Preparation and physical properties
- Chemical properties (reducing action)

Note: Only theoretical treatment is required

16.2.7 Pollution of atmosphere by compounds of sulphur (hydrogen sulphide and oxides of sulphur)

17.0.0 CHLORINE AND ITS COMPOUNDS (20 Lessons)

17.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe and explain the laboratory preparation of chlorine
b) state and explain the properties and uses of chlorine
c) describe and explain the preparation of hydrogen chloride gas
d) state and explain the properties and uses of hydrogen chloride gas
e) explain the effect of a solvent on the properties of hydrogen chloride
f) describe the industrial manufacture of hydrochloric acid
g) explain environmental pollution caused by chlorine and chlorine containing compounds.

17.2.0 Content

17.2.1 Chlorine

- Preparation of chlorine by reaction of concentrated hydrochloric acid with manganese(IV) oxide or any other suitable oxidizing agent (relate method of collection to its properties)
- Physical properties
- Chemical properties
  Reactions of chlorine with;
  - hydrogen
  - metals (magnesium and iron)
  - non-metals phosphorous (caution!)
  - Reducing agents (hydrogen sulphide, sulphites and ammonia)
  - Water and alkali solutions (both dilute and concentrated)
  - Bromides and iodides (displacement reactions)
  - Bleaching action
- Test for chlorides in dry solids and aqueous solution
- Uses of chlorine

17.2.2 Hydrogen Chloride

- Preparation of hydrogen chloride gas by reaction of
  sodium chloride with concentrated sulphuric acid (relate method of collection to properties of the gas)
- Properties (physical and chemical)

17.2.3 Effect of solvent on the properties of hydrogen chloride

- Reactions of aqueous hydrogen chloride
  Compare the properties of aqueous hydrogen chloride and a solution of hydrogen chloride in methylbenzene
  - acid nature; litmus, reaction with metals, bases, carbonates and hydrogen carbonates
  - redox reaction with potassium manganate(VII) to produce chlorine
- Test for hydrogen chloride gas with ammonia

17.2.4 Uses of hydrogen chloride gas

- Industrial manufacture of hydrochloric acid (e.g. Pan Paper, Webuye)
- Uses of hydrochloric acid

17.2.5 Pollution of environment by chlorine and its compounds e.g. CFC, DDT etc

17.3.0 Projects

- determination of chlorine content of various bleaching powders and liquids
- investigation of water purification and treatment.

FORM FOUR

18.0.0 ACIDS, BASES AND SALTS (25 Lessons)

18.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define acids, bases and salts
b) explain the differences between aqueous solutions of weak and strong acids; weak and strong bases; based on the degree to which they dissociate into ions
c) write formulae and ionic equations for specified acid-base and precipitation reactions
d) explain the effect of solvent in acid-base character
e) test for the presence of specified cations and anions
f) identify the precipitates and complex ions produced by specified cation-anion reactions
g) explain the use of solubility curves in salt extraction
h) state the types and causes of hardness of water
i) state the effects and explain the methods of removal of water hardness.

18.2.0 Content

18.2.1 Acids and Bases

- Acids as substances which dissociate in water to give hydrogen ions
- Bases as substances which dissociate in water to give hydroxide ions
- Weak and strong acids and bases; pH scale and electrical conductivity, (use aqueous solutions of; hydrochloric acid, ethanoic acid, sodium hydroxide and ammonia of the same concentration to illustrate)

18.2.2 Characteristics of Amphoteric oxides and hydroxides

- Reaction with acids and alkalis (aluminium oxide, zinc(II) oxide, zinc hydroxide lead hydroxide, and aluminium hydroxide).

18.2.3 Effect of solvent.

- Characteristics of hydrogen chloride in methyl benzene and aqueous solution, (illustrate with dry litmus, magnesium and marble chips)
- Reactions of dry and aqueous ammonia

18.2.4 Salts

- Salts as ionic compounds formed when cations derived from bases combine with anions derived from acids
- Precipitation reactions (use ionic equations)
- Reactions involving the following cations in aqueous solutions: magnesium, calcium, iron(II), iron(III), Barium(II), Zinc(II), Aluminium(III), Copper(II) with; sodium hydroxide, ammonia solution, Chloride, Carbonate, sulphite and sulphate ions

18.2.5 Complex ions

Dissolving of specific metal hydroxides in excess aqueous ammonia and sodium hydroxide solution

Formulae of the following required,
$[Cu(NH_3)_4]^{2+}$
$[Zn(NH_3)_4]^{2+}$, $[Al(OH)_4]^-$
$[Pb(OH)_4]^{2-}$ and $[Zn(OH)_4]^{2-}$
Equations not required

- Solubility; definition and relationship with temperature
- Solubility curves for sodium chloride, potassium nitrate, potassium chlorate(V), calcium sulphate and sodium carbonate.
- Fractional crystallization of salts
- Extraction of sodium carbonate from Lake Magadi and sodium chloride at Ngomeni

18.2.6 Water hardness

- Types of water hardness: causes and effects
- Methods of removal of water hardness; boiling, distillation, precipitation and use of ion exchange

18.3.0 Projects

a) Salt extraction from ash or soil.
b) Investigation of water hardness and its removal

19.0.0 ENERGY CHANGES IN CHEMICAL AND PHYSICAL PROCESSES (25 Lessons)

19.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define exothermic and endothermic reactions using $\in H$ notation
b) draw energy level diagrams
c) explain fusion and vaporisation as evidence of inter-particle forces
d) explain that energy changes in chemical reactions are due to bond formation and bond breaking
e) define and explain various types of heat changes
f) carry out experiments to determine enthalpy changes for some reactions
g) write correct simple thermochemical equations
h) state Hess' Law and carry out related calculations
i) state and explain the factors that influence the choice of fuel
j) explain the environmental effects of fuels.

19.2.0 Content

19.2.1 Endothermic and Exothermic reactions

- Enthalpy notation ($\in H$) for exothermic reactions and endothermic reactions

19.2.2 Latent heat

- Molar heat of fusion and vaporisation as evidence of overcoming forces of attraction between particles.

19.2.3 Quantitative determination of enthalpies

- Formation of hydrogen chloride gas from hydrogen gas and chlorine gas; formation of chloromethane from methane and chlorine gas
- Quantitative determination of enthalpies of:
  - Solution (e.g. ammonium nitrate, sodium hydroxide and conc. sulphuric acid)
  - combustion (e.g. methanol/ethanol)
  - displacement (e.g. copper from copper (II) ions by iron or zinc)
  - neutralization (e.g. sodium hydroxide and dilute hydrochloric acid).

19.2.4 Simple energy level diagrams

- Hess' Law (energy level diagrams and thermo chemical cycles) (use molar enthalpy of formation for illustration)
- Relate heat of solution to hydration and lattice energy

19.2.5 Common fuels; Energy contents of:

- Charcoal, fuel oil, ethanol (methylated spirit), liquid petroleum gas (LPG), petroleum, kerosene and diesel
- Choice of fuel;
- Precautions necessary when using fuels

19.2.6 Pollution by common fuels e.g. internal combustion engine

19.3.0 Projects

Comparison of heat energy values of fuels

20.0.0 REACTION RATES AND REVERSIBLE REACTIONS (15 Lessons)

20.1.1 Specific objectives

By the end of this topic, the learner should be able to:

a) define rate of reaction
b) explain the term activation energy
c) describe some methods used to measure rates of reaction
d) explain the effects of different factors on reaction rates
e) illustrate reaction rates graphically and interpret experimental data

f) state examples of simple reversible reactions
g) explain chemical equilibrium as a state of 'balance'
h) explain the effect of different factors on the position of equilibrium.

20.2.0 Content

20.2.1 Reaction rates

- Definition of rate of reaction
- Collision theory and activation energy (qualitative treatment only)
- Qualitative treatment of the effects of concentration, pressure, temperature, surface area, light and catalysts on rates of reactions. (No reaction mechanisms required).
- Experiments involving the following reactions:
  - calcium carbonate (marble chips) with dilute acid (hydrochloric or nitric acid).
  - sodium thiosulphate with dilute hydrochloric acid
  - metal with dilute acid (e.g. magnesium with hydrochloric acid).
  - hydrogen peroxide with various catalysts e.g. manganese (IV) oxide

  (Graphical presentation of results required)

20.2.2 Reversible reactions

- Equilibrium as the state of balance (example acid/alkali plus indicator, chromate/dichromate, hydrated and anhydrous copper(II) sulphate)
- The effect of changing concentration, pressure and temperature on position of equilibrium. Le Chatelier's Principle
- Uses in industrial processes (Contact and Haber processes).

21.0.0 ELECTROCHEMISTRY
(25 Lessons)

21.1.0 Specific objectives

By the end of this topic, the learner should be able to:

a) explain redox reactions in terms of gain and loss of electrons
b) identify changes in oxidation numbers during redox reactions
c) write balanced redox equations
d) explain an electrochemical cell in terms of electron transfer process
e) draw cell diagrams and write the cell notations
f) explain the construction and working of an electrochemical cell such as zinc - copper cell
g) compare oxidizing and reducing power of ions from displacement reactions
h) Calculate Electromotive Force of a cell given the standard electrode potentials
i) state and explain the factors that affect preferential discharge of ions during electrolysis
j) relate the quantity of electricity passed to amount of substances liberated at the electrodes
k) describe some applications of electrolysis.

21.2.0 Content

21.2.1 Redox reactions

- Electron transfer (gain and loss of electrons)
- Determination of oxidation numbers
- Use an illustration of iron(II) (acidified with dilute sulphuric acid) to iron(III) with hydrogen peroxide.
- Identify reactant - Iron(II) (aq), and product Iron(III) (aq), with hydroxide ion.

  Other examples; sodium/water magnesium/dilute acid (hydrochloric acid/sulphuric acid)

21.2.2 Displacement reactions; (as redox reactions)

- Reducing power
  - Reaction of metal/metal - cation ($M|M^{2+}$). Calcium, magnesium, zinc, iron, lead, copper.
- Oxidizing power of halogens: chlorine, bromine and iodine only.

21.2.3 Electrochemical cell

- Qualitative treatment of the electron flow in:
  Zn (s) $|Zn^{2+}$ (aq) $||Cu^{2+}$ (aq) ||Cu (s) cell
  Note: Conventions, vertical line (|) represents a phase boundary where a potential difference develops e.g. Zn (s) $|Zn^{2+}$ (aq); two vertical parallel lines (||) represent a salt bridge.
- Standard electrode potentials (simple calculations involving E^{θ} values required)

21.2.4 Electrolysis

- The role of water in electrolysis.
- Preferential discharge in electrolysis of the following solutions:
  - Sodium chloride
  - Dilute sulphuric acid (acidified water).
  - Magnesium sulphate
  - Electrolysis of copper (II) sulphate using graphite and copper electrodes. (product changes in electrolytes)
- Factors affecting preferential discharge
  - Quantitative treatment of electrolysis
    (Note: First Faraday's law only).

21.2.5 Applications

- Extraction of metals
- Manufacture of sodium hydroxide, chlorine, hydrogen (electrolysis of brine).
- Copper refining, electroplating

21.3.0 Projects

- Investigating further electroplating processes, prevention of rusting (cathodic protection), investigate various types of cells.

22.0.0 METALS (20 Lessons)

22.1.0 Specific objectives

By the end of this topic, the learner should be able to:

a) name the chief ores of some metals
b) describe and explain general methods used in the extraction of metals from their ores
c) select and describe suitable methods for the extraction of some metals from their ores
d) describe and explain physical and chemical properties of some metals
e) state and explain various uses of these metals and their alloys
f) describe the effects of the industrial production processes of metals on the environment.

22.2.0 Content

22.2.1 Metals; methods of extraction:

- Chief metal ores of: sodium, aluminium, zinc, iron, copper and lead
- General methods of extraction (electrolysis and reduction)
- The electrolytic production of sodium and aluminium
- Extraction of iron, copper, and zinc from their ores.

22.2.2 Properties of Metals (sodium, aluminium, iron, copper and zinc):

- Physical properties (melting point, boiling point, thermal and electrical conductivity, density, malleability and ductility)
- Chemical properties (reaction with air, water, chlorine, dilute hydrochloric acid and oxidizing acids (concentrated nitric and sulphuric acid)

(Note: the reaction of sodium and dilute acid is explosive)

22.2.3 Uses of metals and their alloys
(alloys: brass, bronze, steel, duralumin)
- construction (air craft, bridges etc.), electrical materials (copper)

22.2.4 Pollution effect of the industrial production of metals on the environment

22.3.0 Projects
- Analysis of ores
- Construction of a mini-blast furnace
- Carrying out iron - smithing

23.0.0 ORGANIC CHEMISTRY II (ALKANOLS AND ALKANOIC ACIDS) (20 Lessons)

23.1.0 Specific Objectives
By the end of this topic, the learner should be able to:
a) name and draw the structures of simple alkanols and alkanoic acids
b) describe the preparation and explain the physical and chemical properties of alkanols and alkanoic acids
c) state the main features of the homologous series
d) state and explain the uses of some alkanols and alkanoic acids
e) describe the preparation, properties and uses of detergents
f) explain the effect of hard water on detergents
g) list some natural, synthetic polymers, fibres and state their uses
h) describe the preparation, properties and uses of some synthetic polymers
i) identify the structure of a polymer given the monomer
j) state the advantages and disadvantages of synthetic materials compared to those of natural origin in terms of both structure and properties.

23.2.0 Content
23.2.1 Alkanols
- General formula (ROH) Nomenclature (primary alcohols upto 10 carbon atoms)
- Preparation of alkanols from:
  - Hydrolysis of alkenes
  - Fermentation of carbohydrates
- Physical properties
  - Gradual changes in physical properties of primary alkanols (mention hydrogen bonding)
- Chemical properties
  - reactions with oxygen (burning), sodium, concentrated sulphuric acid (to give alkenes), ester formation and oxidation to give alkanoic acids
- Uses - solvents, fuels and pharmaceuticals.

23.2.2 Alkanoic acids
- General formula - RCOOH
- Nomenclature (primary alkanoic acids up to 10 carbon atoms)
- Preparation by oxidation of primary alkanols
- Physical properties
  - gradual change in physical properties of alkanoic acids (mention hydrogen bonding)
- Chemical properties
  - acid properties; salt and ester (alkanoates) formation [up to 2 carbons only]

Note: equations involving these reactions are required (state symbols are not required)

23.2.3 Detergents
- Soapy detergents (soaps)
  - laboratory preparation by hydrolysis of fats or oils with alkalis
  - mode of action
  - water hardness
  - pollution effects
- Soapless detergents
  - manufacture
  - mode of action
  - pollution effect
- Polymers
- Names of some natural polymers and fibres
  - cellulose materials (cotton, wood, paper;silk)
  - hydrocarbons (rubber and its vulcanisation)

- Names of some synthetic polymers and fibres
  - Polythene, polychloroethene (pvc)
  - polyphenylethene (polystyrene)
  - terylene, nylon, and Perspex.
- Synthetic rubber
  - Preparation properties and uses of synthetic polymers
  - Equations to show addition polymerisation for example formation of polythene, polychloroethene and polyphenylethene
- Advantages and disadvantages of synthetic polymers and fibres over those of natural origin should be mentioned. (include biological degradability of the materials).
- Uses of polymers and fibres. (manufacture of beer, spirits, soaps and detergents, drugs, textiles, packaging materials, pipes, tyres).

23.3.0 Projects

- fermentation of various carbohydrates to produce ethanol
- soap preparation
- investigate effects of soap and detergents on aquatic life
- investigate methods of recycling and disposal of plastics
- investigation of strength of polymers and fibres

24.0.0 RADIOACTIVITY (10 Lessons)

24.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define radioactivity, half-life, radioisotope and nuclides
b) state types of radioactivity
c) name the particles emitted during radioactive decay and state their properties
d) carry out simple calculations involving half-life ($t^1/_2$)
e) write balanced nuclear equations
f) distinguish between nuclear fission and fusion
g) state uses of some radioisotopes
h) state dangers associated with radioactivity.

24.2.0 Content

24.2.1 Stability of isotopes of elements

- Stability of isotopes of elements
- Radioactivity, types of radiation, (alpha (α), beta (β) particles and gamma (γ) rays; characteristics and properties
- Radioactive decay as measured by half-life ($t_{½}$), calculations involving half -life ($t_{1/2}$)
- Nuclear equations: changes in nuclei resulting from radioactive decay by alpha (α), beta (β) particles and gamma (γ) rays
- Qualitative treatment of fission and fusion
  - mention nuclear reactions as source of energy

NB: Nuclear reactions are different from chemical reactions.

24.2.2 Applications

Uses and importance of radioisotopes in chemistry, medicine, carbon dating and agriculture.

24.2.3 Pollution effects of radioactivity

Dangers of radio isotopes
Environmental pollution e.g. the chernobyl disaster, titanium mining in Kwale

SUGGESTED ASSESSMENT METHODS

- Oral Questions
- Observation of individual/group activities
- Short answer questions
- Practical test/assignments
- Written assignments
- Project work
- Field trips

BIOLOGY

INTRODUCTION

The study of Biology aims at equipping the learner with the knowledge, attitudes and skills necessary for controlling and preserving the environment. The subject enables the learner to appreciate humans as part of the broader community of living organisms. This subject is important in fields such as health, agriculture, environment and education. Biology is the precursor of biotechnology which is a tool for industrial and technological development

The content has been carefully reorganized to ensure that the required concepts and skills are realized. Sufficient practical activities have been suggested. These should be taught alongside the respective content rather than being treated as a separate entity. It is recommended that the teachers use discovery method in achieving the objectives of this subject. Most of the apparatus, chemicals and equipment required for practical activities are affordable. However, the teacher is highly encouraged to improvise using locally available materials to reduce costs.

Contemporary issues such as HIV/AIDS, S.T.Is, drug abuse and environmental pollution which have an impact on the learners lives have been incorporated for study.

The current system of using five kingdoms in classification has been adapted instead of the traditional two kingdom system

It is envisaged that this syllabus should be adequately covered within the allocated time. A suggested guideline on time allocation per topic has been provided to help the teacher in lesson planning. This however, can be adjusted to meet the requirements of the individual class.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1. communicate biological information in a precise, clear and logical manner
2. develop an understanding of interrelationships between plants and animals and between humans and their environment
3. apply the knowledge gained to improve and maintain the health of the individual, family and the community
4. relate and apply relevant biological knowledge and understanding to social and economic situations in rural and urban settings
5. observe and identify features of familiar and unfamiliar organisms, record the observation and make deductions about the functions of parts of organisms
6. develop positive attitudes and interest towards biology and the relevant practical skills
7. demonstrate resourcefulness, relevant technical skills and scientific thinking necessary for economic development
8. design and carry out experiments and projects that will enable them understand biological concepts
9. create awareness of the value of cooperation in solving problems
10. acquire a firm foundation of relevant knowledge, skills and attitudes for further education and for training in related scientific fields.

FORM ONE

1.0.0 INTRODUCTION TO BIOLOGY (5 lessons)

1.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define biology
b) list branches of biology
c) explain the importance of biology
d) state the characteristics of living organisms
e) state the main differences between plants and animals.

1.2.0 Content

1.2.1 Definition of biology
1.2.2 Branches of biology
1.2.3 Importance of biology
1.2.4 Characteristics of living organisms
1.2.5 Comparison between plants and animals

1.3.0 Practical Activities

1.3.1 Collecting, observing and recording external features of plants and animals

2.0.0 CLASSIFICATION 1 (12 lessons)

2.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) use the magnifying lens to observe the external features of plants and animals
b) record observations of the main external characteristics of living organisms, preserved specimens and photographs
c) state the necessity and significance of classification
d) name the major units of classification
e) state the application of Binomial nomenclature in naming organisms.

2.2.0 Content

2.2.1 Review the use of magnifying lens
2.2.2 External features of plants and animals
2.2.3 Necessity and significance of classification
2.2.4 Major units of classification: (naming)

- Kingdoms
  - Monera
  - Protoctista
  - Fungi
  - Plantae
  - Asnimalia

  (At least one example of each)
- For kingdom plantae and animalia, cover phylum/division, class, order,family,genus and species. Show relationship between the taxonomic units (Give at least one example of each taxon)

2.2.5 Discussion on Binomial nomenclature

2.3.0 Practical activities

2.3.1

- Use of collecting nets, cutting instruments and handlens
- Collection and detailed observation of:
  - Small animals e.g. insects
  - Plants - rhizoids, root systems (taproot, fibrous and adventitious), stems and leaves

3.0.0 THE CELL (20 lessons)

3.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define the cell
b) state the purpose of a light microscope
c) identify the parts of a light microscope and state their functions
d) use and care for the light microscope and state the magnification
e) identify the components of a cell as seen under the light and electron microscopes and relate their structure to functions
f) compare plant and animal cells
g) mount and stain temporary slides of plant cells
h) describe animal cells as observed from permanent slides
i) estimate cell size
j) state the differences between cells, tissues, organs and organ systems.

3.2.0 Content

3.2.1 Definition of the cell

3.2.2 Structure and functions of parts of a light microscope

3.2.3 Use and care of the light microscope

3.2.4 Cell structure and functions as seen under
- a light microscope
- an electron microscope

3.2.5 Preparation of temporary slides of plant cells

3.2.6 Estimation of cell size

3.2.7 Cell specialization, tissues, organs and organ systems

3.3.0 Practical activities

3.3.1 Observe, identify, draw and state the functions of parts of the light microscope

3.3.2 Prepare and observe temporary slides of plant cells

3.3.3 Observe permanent slides of animal cells

3.3.4 Comparison between plant and animal cells

3.3.5 Observe, estimate size and calculate magnification of plant cells

4.0.0 CELL PHYSIOLOGY (20 lessons)

4.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define cell physiology

b) correlate the membrane structure with cell physiology in relation to permeability

c) differentiate between diffusion, osmosis and active transport

d) state and describe factors affecting diffusion, osmosis and active transport

e) carry out experiments on diffusion and osmosis

f) explain the roles of diffusion, osmosis and active transport in living organisms

g) explain turgor and plasmolysis in terms of osmotic pressure.

4.2.0 Content

4.2.1 Meaning of cell physiology

4.2.2 Structure and properties of cell membrane (Theories of membrane structure not required)

4.2.3 Physiological processes - diffusion, osmosis and active transport

4.2.4 Factors affecting diffusion, osmosis and active transport

4.2.5 Role of diffusion, osmosis and active transport in living organisms

4.2.6 Water relations in plant and animal cells: turgor, plasmolysis, wilting and haemolysis

4.3.0 Practical Activities

4.3.1 Diffusion as demonstrated with potassium permanganate or potassium iodide/flower dyes/coloured plant extracts/smoke

4.3.2 Experiments with visking tubing and living tissues: fresh arrow roots/cassava/sweet potatoes/leaf petioles/irish potatoes/carrots

4.3.3 Plasmolysis can be demonstrated by using any of the following: spirogyra, epidermal cells of onion or raw egg that has been put in dilute hydrochloric acid overnight

5.0.0 NUTRITION IN PLANTS AND ANIMALS (59 lessons)

5.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define nutrition and state its importance in living organisms

b) differentiate various modes of feeding

c) describe photosynthesis and show its importance in nature

d) explain how the leaf is adapted to photosynthesis

e) explain the factors affecting photosynthesis

f) distinguish between carbohydrates, proteins and lipids

g) state the importance of various chemical compounds in plants and animals

h) explain the properties and functions of enzymes

i) relate various types of teeth in mammals to their feeding habits

j) differentiate between omnivorous, carnivorous and herbivorous modes of feeding
k) relate the structures of the mammalian (human) alimentary canal to their functions
l) explain the role of enzymes in digestion in a mammal (human)
m) explain the factors that determine energy requirements in humans.

5.2.0 Content

5.2.1 Meaning, importance and types of nutrition

5.2.2 Nutrition in plants (autotrophism)
- Definition of photosynthesis and its importance in nature
- Adaptations of leaf to photosynthesis
- Structure and function of chloroplast
- Process of photosynthesis - light and dark stages (omit details of electron transport system and chemical details of carbondioxide fixation)
- Factors influencing photosynthesis
  - light intensity
  - carbon dioxide concentration
  - water
  - temperature

5.2.3 Chemical Compounds which Constitute Living Organisms
- Chemical composition and functions of carbohydrates, proteins and lipids (omit details of chemical structure of these compounds and mineral salts in plant nutrition).
- Properties and functions of enzymes (omit lock and key hypothesis)

5.2.4 Nutrition in Animals (heterotrophism)
Meaning and types of heterotrophism
- Modes of feeding in animals
- Dentition of a named carnivorous, herbivorous and omnivorous mammal
- Adaptation of the three types of dentition to feeding
- Internal structure of mammalian teeth
- Common dental diseases, their causes and treatment

5.2.5 Digestive system and digestion in a mammal (human)
- Digestive system, regions, glands and organs associated with digestion
- Ingestion, digestion, absorption, assimilation and egestion

5.2.6 Importance of vitamins, mineral salts, roughage and water in human nutrition

5.2.7 Factors determining energy requirements in humans

5.3.0 Practical activities

5.3.1 Carry out experiments on factors affecting photosynthesis

5.3.2 Observe stomata distribution

5.3.3 Carry out food test experiments

5.3.4 Carry out experiments on factors affecting enzymatic activities

5.3.5 Investigate presence of enzymes in living tissues (plants and animals)

5.3.6 Observe, identify, draw and label different types of mammalian teeth

5.3.7 Carry out dissection of a small mammal to observe digestive system and associated organs (demonstration)

FORM TWO

6.0.0 TRANSPORT IN PLANTS AND ANIMALS (52 lessons)

6.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define transport and explain the necessity of transport in plants and animals
b) relate the structure of the root, root hair, xylem and phloem to their functions
c) relate the internal structure of the leaf to transpiration
d) explain possible forces involved in the movement of water and mineral salts through the plant
e) explain the significance of and factors affecting transpiration
f) demonstrate simple experiments on transpiration
g) distinguish between closed and open circulatory systems
h) relate the structure of the heart and the blood vessels to their functions
i) trace the path taken by blood from the heart to all parts of the body, and back to the heart
j) name the common diseases of the circulatory system in humans and suggest methods of control / prevention
k) relate the structure of the components of blood to their functions
l) explain how oxygen and carbon dioxide are transported in the blood
m) describe the mechanism of blood clotting and its importance
n) describe the human blood groups and their importance in blood transfusion
o) explain immunity and describe immune responses.

6.2.0 Content

6.2.1 Meaning and importance of transport systems

6.2.2 Absorption of Water and Mineral Salts
- Internal structure of root and root hairs
- Absorption of water
- Active uptake of mineral salts

6.2.3 Transpiration
- Definition of transpiration
- Review of the structure of the leaf
- Structure and function of xylem
- Factors affecting transpiration
- Forces involved in water movement in plants
  - Transpiration pull
  - Cohesion and adhesion
  - Capillarity
  - Root pressure

6.2.4 Translocation
- Structure and function of phloem
- Materials translocated (omit mechanisms of translocation)

6.2.5 Comparison between open and closed circulatory system

6.2.6 Mammalian Circulatory System
- Structure and function of the heart, arteries, veins, and capillaries
- Diseases and defects of the circulatory system (Thrombosis, Varicose veins, Arterio-sclerosis) and how to control them.

6.2.7 The Structure and Functions of Blood
- Composition of blood
- Functions of blood plasma
- The structure and functions of red blood cells and white blood cells
- Mechanism of blood clotting and its importance

6.2.8 Blood groups (ABO system and the Rhesus factor)

6.2.9 Immune responses
- Natural and artificial immunity
- Allergic reactions
- Importance of vaccinations against diseases (Tuberculosis, Poliomyletis, Measles, Diphtheria, Whooping cough)

6.3.0 Practical Activities

6.3.1 Observe permanent slides of sections of stems and roots

6.3.2 Carry out experiments to compare transpiration on lower and upper leaf surfaces

6.3.3 Observe wall charts/models

6.3.4 Analyse data on transpiration rate under different environmental conditions in Plants

6.3.5 Dissect a small mammal and observe its transport system (demonstration)

6.3.6 Make a longitudinal section of the mammalian heart to display the chambers and associated blood vessels

6.3.7 Record pulse rate at the wrist before and after vigorous activities and analyse the results

6.3.8 Demonstrate the unidirectional flow of blood in the cutaneous veins of the fore arm

7.0.0 GASEOUS EXCHANGE (36 lessons)

7.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) explain the need for gaseous exchange in living organisms
b) explain the mechanism of gaseous exchange in plants
c) compare the internal structures of aquatic and terrestrial roots, stems and leaves
d) examine various types of respiratory structures in animals and relate them to their functions
e) state the characteristics of respiratory surfaces
f) describe the mechanisms of gaseous exchange in protozoa, insects, fish, frog and mammal
g) describe the factors which control the rate of breathing in humans
h) state the causes, symptoms and prevention of respiratory diseases.

7.2.0 Content

7.2.1 Gaseous exchange in living organisms (necessity)

7.2.2 Gaseous Exchange in Plants

- Mechanisms of opening and closing of stomata
- The process of gaseous exchange in root, stem and leaves of both aquatic (floating) and terrestrial plants

7.2.3 Gaseous Exchange in Animals

- Types and Characteristics of Respiratory Surfaces - cell membrane, gills, buccal cavity, skin and lungs
- Mechanism of gaseous exchange in
  - Protozoa - amoeba
  - Insect - grasshopper
  - Fish - bonyfish
  - Amphibia - frog
  - Mammal - human

7.2.4 Factors affecting rate of breathing in humans

7.2.5 Respiratory diseases: Asthma, Bronchitis, Pulmonary tuberculosis, Pneumonia and Whooping cough

7.3.0 Practical Activities

7.3.1 Observe permanent slides of cross-sections of aerial and aquatic leaves and stems

7.3.2 Examine the distribution of spiracles on grasshopper or locust

7.3.3 Examine the gills of a bony fish

7.3.4 Dissect a small mammal and identify the structures of the respiratory system (demonstration)

7.3.5 Construct and use models to demonstrate breathing mechanisms in a mammal (human)

7.3.6 Demonstrate the effect of exercise on the rate of breathing

8.0.0 RESPIRATION (18 lessons)

8.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) explain the significance of respiration in living organisms
b) distinguish between aerobic and anaerobic respiration
c) describe the economic importance of anaerobic respiration in industry and at home
d) describe experiments to show that respiration takes place in plants and animals.

8.2.0 Content

8.2.1 Meaning and significance of respiration

8.2.2 Tissue respiration

- Mitochondrion - structure and function
- Aerobic respiration (Details of kreb's cycle not required)
- Anaerobic respiration in plants and animals, the products and by-products
- Application of anaerobic respiration in industry and at home
- Compare the energy output of aerobic and anaerobic respiration

8.3.0 Practical Activities

8.3.1 Carry out experiments to Investigate

- The gas produced when food is burnt
- The gas produced during fermentation
- Heat production by germinating seeds

9.0.0 EXCRETION AND HOMEOSTASIS (42 lessons)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) distinguish between excretion and egestion
b) explain the necessity for excretion in plants and animals
c) state the uses of excretory products of plants
d) describe the methods of excretion in a named unicellular organism
e) relate the structures of the human skin, lungs, liver and kidney to their functions
f) name common kidney diseases
g) explain the concept of internal environment and homeostasis
h) compare responses to changes in temperature by behavioural and physiological methods in animals
i) relate heat loss to body size in mammals
j) describe methods by which mammals gain and lose heat
k) explain how the functions of the following relate to homeostasis - skin, hypothalamus, liver and kidney
l) discuss the role of antidiuretic hormone, insulin and glucagons
m) describe simple symptoms of *Diabetes mellitus* and *Diabetes insipidus.*

9.2.0 Content

9.2.1 Excretion in Plants

- Methods of excretion in plants
- Useful and harmful excretory products of plants and their economic importance e.g. caffeine in tea and coffee, quinine, tannins, colchicine, cocaine, rubber, gum, papain (from pawpaw) and products of cannabis sativa (bhang) and khat (miraa)

9.2.2 Excretion and Homeostasis in Animals

- Distinction between excretion, homeostasis and egestion
- Excretion in a named uni-cellular organism (protozoa)
- Structure and functions of skin and kidney
- Neuro-endocrine system and homeostasis
  - Water balance (blood osmotic pressure)
  - Blood sugar level (control)
  - Temperature regulation (mention the role of hypothalamus)

9.2.3 Common kidney diseases, their symptoms and possible methods of prevention and control.

9.2.4 The role of the skin in thermoregulation, salt and water balance

9.2.5 Major functions of the liver and their contributions to homeostasis

9.2.6 Common diseases of the liver, their symptoms and possible methods of prevention/control

9.3.0 Practical Activities

9.3.1 Examine and draw the mammalian kidney

9.3.2 Make vertical sections of the kidney to identify cortex and medulla

9.3.3 Observe permanent slides of mammalian skin

9.3.4 Investigate effect of catalase enzyme on hydrogen peroxide

FORM THREE

10.0.0 CLASSIFICATION II (35 lessons)

10.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) state briefly the general principles of classification of living organisms
b) state general characteristics of each of the five kingdoms
c) state the main characteristics of arthropoda, chordata and major divisions of plantae
d) name classes of spermatophyta
e) describe the main characteristics of classes of phyla arthropoda and chordata
f) use observable external features to construct simple dichotomous keys of plants and animals
g) use already constructed dichotomous keys to identify organisms.

10.2.0 Content

10.2.1 Review of binomial nomenclature

10.2.2 General principles of classification

10.2.3 General characteristics of kingdoms

- Monera
- Protoctista
- Fungi
- Plantae
- Animalia

10.2.4 Main characterisitics of major divisions of plantae

- Bryophyta
- Pteridophyta
- Spermatophyta (cover only up to class level)

10.2.5 Main Characteristics of the Phyla Arthropoda and Chordata (cover up to classes as shown)

- Arthropoda
  - diplopoda
  - chilopoda
  - insecta
  - crustacea
  - arachnida
- Chordata
  - pisces
  - amphibia
  - reptilia
  - aves
  - mammalia

10.2.6 Construction and use of simple dichotomous keys based on observable features of plants and animals

10.3.0 Practical activities

10.3.1 Examine live/preserved specimens or photographs of representatives of major divisions of plantae and phyla arthropoda and chordata

10.3.2 Construct simple dichotomous keys using leaves/parts of common plants/arthropods/ common chordates in the local environment

10.3.3 Use dichotomous keys to identify organisms

11.0.0 ECOLOGY (55 lessons)

11.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define the terms ecology, habitat, biomass, ecosystem and carrying capacity
b) identify the physical (abiotic) and biological (biotic) factors in a given ecosystem
c) describe the inter-relationships of organisms in the ecosystem
d) differentiate between saprophytism, parasitism and symbiosis
e) explain the importance of fungi and bacteria as decomposers
f) relate the mode of transmission to prevention/control of named parasites
g) describe the adaptive characteristics of named parasites to hosts
h) explain the importance of symbiotic bacteria in leguminous plants
i) describe the nitrogen cycle

j) explain the flow of energy in the ecosystem
k) identify and construct food chains and food webs, pyramid of numbers and pyramid of biomass
l) explain the use of various methods of estimating population
m) relate adaptations of plants to various habitats
n) describe the effects of pollutants in air, water and soil on humans and other living organisms
o) identify symptoms of different types of human diseases, methods of transmission and control.

11.2.0 Content

11.2.1 Concepts of Ecology
- Ecology
- Habitat
- Niche
- Population
- Community
- Ecosystem
- Biomass
- Carrying capacity

11.2.2 Factors in an ecosystem
- Abiotic factors (environmental factors) - light, temperature, atmospheric pressure, salinity, humidity, pH and wind
- Biotic factors
- Inter-relationships - competition, predation, saprophytism, parasitism and symbiosis
- Nitrogen cycle

11.2.3 Energy flow in an ecosystem
Food chains, food webs, decomposers, pyramid of numbers and pyramid of biomass

11.2.4 Population estimation methods
- Quadrat method
- Line transect
- Belt transect
- Capture - recapture method

11.2.5 Adaptations of plants to various habitats
- Xerophytes
- Mesophytes (common terrestrial plants)
- Hydrophytes - Nymphea, Salvinia spp
- Halophytes – mangrove

11.2.6 Effect of pollution on human beings and other organisms
Causes, effects and control of pollutants in air, water and soil

11.2.7 Human diseases
- Bacterial diseases - Cholera and Typhoid
- Protozoa - Malaria and Amoebic dysentry (Amoebiasis)
- *Ascaris lumbricoides* and Schistosoma
  - Mode of transmission
  - Effects of the parasites on the hosts
  - Adaptive characteristics of the parasites
  - Control/prevention of diseases associated with the parasites

11.3.0 Practical activities

11.3.1 Collect, record, analyse and interpret data from ecological studies (examples of food chains should be used to join up to make food webs. Calculate ratios of consumers to producers from data provided)

11.3.2 Examine specimens of hydrophytes, mesophytes and xerophytes, and identify the features that adapt them to their habitats

11.3.3 Examine roots of legumes taken from fertile and poor soils to compare the number of root nodules

11.3.4 Estimate populations using sampling methods (for quadrat and line/belt transect, measure pH, temperature, wind direction and humidity)

12.0.0 REPRODUCTION IN PLANTS AND ANIMALS (50 lessons)

12.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) describe location and appearance of chromosomes and chromosome movement during mitosis and meiosis
b) differentiate between mitosis and meiosis stating their significance in reproduction
c) describe and state the importance of asexual reproduction, binary fission, spore formation and budding
d) compare adaptations of wind and insect pollinated flowers
e) describe the process of fertilization in flowering plants
f) describe and explain how different fruits and seeds are formed and dispersed
g) differentiate between internal and external fertilization as exhibited by amphibians and mammals (humans)
h) relate structure of the human reproductive system to functions
i) describe the role of hormones in human reproduction
j) identify the symptoms and explain the method of transmission and prevention of sexually transmitted infections (S.T.Is)
k) explain the advantages and disadvantages of sexual and a sexual reproduction.

12.2.0 Content

12.2.1 Concept of reproduction
- Importance of reproduction

12.2.2 Chromosomes, mitosis and meiosis (mention gamete formation)

12.2.3 A sexual reproduction
- Binary fission in amoeba
- Spore formation/reproduction in mucor/Rhizopus
- Budding in yeast

12.2.4 Sexual reproduction in plants
- Structure and functions of parts of named insect and wind pollinated flowers
- Pollination and agents of pollination
- Features and mechanisms that hinder self-pollination and self fertilization
- The process of fertilization
- Fruit and seed formation and dispersal

12.2.5 Sexual reproduction in animals
- External fertilization in amphibians
- Structure of the reproductive system of a named mammal (human)
- Functions of the parts of reproductive system
- Fertilization, implantation and the role of placenta
- Gestation period
- Role of hormones in reproduction in humans (secondary sexual characteristics, menstrual cycle)

12.2.6 Sexually transmitted infections (S.T.Is)
- Gonorrhoea
- Herpes simplex
- Syphilis, Trichomoniasis, Hepatitis, Candidiasis
- HIV/AIDS (Acquired Immune Deficiency Syndrome) - emphasize preventive measures especially change of behaviour

12.2.7 Advantages and disadvantages of asexual and sexual reproduction

12.3.0 Practical Activities

12.3.1 Examine stages of mitosis using squashed young onion tip/charts/electron micrographs
12.3.2 Examine stages of meiosis using anthers of a flower
12.3.3 Grow bread mould and examine using a handlens
12.3.4 Examine spores in sori of a fern
12.3.5 Examine various types of insect and wind pollinated flowers and relate structure to function
12.3.6 Collect, classify and dissect fruits and seeds and relate their structure to mode of dispersal
12.3.7 Dissect a small mammal to show organs associated with reproduction (demonstration)

13.0.0 GROWTH AND DEVELOPMENT (20 lessons)

13.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) differentiate growth from development
b) analyse experimental data on growth rates
c) identify parts of a named seed and factors affecting viability and dormancy in seeds
d) investigate conditions necessary for germination and distinguish the types of germination
e) measure one aspect of growth in a given seedling
f) determine the region of growth in seedlings
g) explain apical dominance
h) distinguish between complete and incomplete metamorphosis in insects
i) explain the role of hormones in regulating growth and development.

13.2.0 Content

13.2.1 Concepts of growth and development

13.2.2 Growth and development in plants

- Dormancy and ways of breaking it
- Conditions necessary for germination
- Epigeal and hypogeal germination
- Measurement of one aspect of growth in a named seedling e.g. region of growth
- Primary and secondary growth
- Role of growth hormones in plants
- Apical dominance

13.2.3 Growth and development in animals

- Complete and incomplete metamorphosis in insects
- Role of growth hormones in insects

13.3.0 Practical activities

13.3.1 Examine, draw and differentiate seeds
13.3.2 Determine the region of growth in shoots and roots
13.3.3 Investigate hypogeal and epigeal germination
13.3.4 Carry out experiments to demonstrate apical dominance
13.3.5 Observe stages of complete and incomplete metamorphosis in insects

13.4.0 Project work:

Measure either length of internodes/ breadth of leaves/height/dry weight of seedlings over a known period of time, analyse and present the data obtained in form of graphs, charts or histograms

FORM FOUR

14.0.0 GENETICS (34 lessons)

14.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) distinguish between continuous and discontinuous variations
b) describe the structure and properties of chromosomes
c) state the first law of inheritance and describe Mendel's work
d) construct and use punnet square/checker board
e) distinguish between F_1 and F_2 generations, genotype and phenotype, haploidy and diploidy, homozygosity and heterozygosity, dominance and recessiveness, linkage and sex linkage, mutations and mutagens
f) predict and explain the inheritance of the ABO blood groups and Rhesus (Rh) factor
g) state examples of genetically inherited disorders
h) explain causes of chromosomal mutations
i) explain the practical application of genetics.

14.2.0 Content

14.2.1 Concepts of genetics
- Variation within plant and animal species
- Review of chromosomes
- Brief mention of genes and DNA (without details of the molecular structure of genes and DNA)

14.2.2 First law of heredity
- Mendel's experiments - monohybrid inheritance (3:1 ratio)
- Complete and incomplete dominance, backcross/testcross
- Inheritance of ABO blood groups and Rh factor

14.2.3 Sex determination in humans

14.2.4 Linkage
Sex linked genes, sex linked characteristics e.g. Colour blindness, Haemophilia, Hairy ears and Nose

14.2.5 Mutations
- Types of mutations
- Causes and consequences of chromosomal mutations
- Gene mutations(only cover the following examples of genetic disorders: Albinism, Sickle cell Anaemia, Haemophilia, Colour blindness)

14.2.6 Practical applications of genetics
- Blood transfusion
- Plant and animal breeding using artificial selection
- Genetic counselling
- Genetic engineering

14.3.0 Practical Activities

14.3.1 Measure and record heights of class members and plot the data on graphs

14.3.2 Demonstrate chromosome behaviour in mitosis and meiosis by using clay/plasticine/insulated coloured wires/coloured thread

14.3.3 Carry out investigations on finger prints and tongue rolling

15.0.0 EVOLUTION (19 lessons)

15.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) explain the meaning of evolution and the current concepts of evolution
b) describe the struggle for existence and survival for the fittest
c) describe the evidences for organic evolution
d) explain resistance to antibiotics, fungicides and pesticides.

15.2.0 Content

15.2.1 Meaning of evolution

15.2.2 The origin of life
- Special creation
- Chemical evolution
  (Brief explanation required)

15.2.3 Evidences for organic evolution
- Fossil records - brief mention of human evolution
- Geographical distribution - continental drift
- Comparative embryology
- Comparative anatomy
  (Convergent and divergent evolution based on homology and analogy)
- Cell biology - occurrence of cell organelles and blood pigments

15.2.4 Mechanisms of evolution
- Lamarcks theory (Brief mention)
- Evolution by natural selection
- Natural selection in action e.g. peppered moth (industrial melanism)
- Resistance to drugs, pesticides and antibiotics

15.3.0 Practical activities

15.3.1 Compare vertebrate limbs

15.3.2 Compare wings of birds and insects

15.3.3 Education tour to an archeological site/local museum

16.0.0 RECEPTION, RESPONSE AND COORDINATION IN PLANTS AND ANIMALS (43 lessons)

16.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define irritability, stimulus and response
b) explain differences between tactic and tropic responses and their survival values
c) explain the production of plant hormones and their effects on tropisms (growth responses)
d) relate the structure of the mammalian nervous system to its functions
e) distinguish between simple and conditioned reflex actions
f) explain the role of endocrine system in humans
g) state the effects of drug abuse on the human health
h) relate structure to function of the human ear and eye
i) explain defects of the eye and ear and their corrections.

16.2.0 Content

16.2.1 Meaning of stimulus, response and irritability

16.2.2 Reception, response and coordination in plants
- Response to a variety of external stimuli
- Tropisms and tactic movements and their survival values
- Production of auxins and their effects on plant growth

16.2.3 Reception, responses and coordination in animals
- Components of the nervous system in a mammal
- Structure and functions of the neurones
- Functions of major parts of human brain
- Simple and conditioned reflex actions

16.2.4 The role of hormones in coordination in a mammal
- Effects of over secretion and under secretion of adrenaline and thyroxine in humans
- Functional differences and similarities between endocrine and nervous systems

16.2.5 Effects of drug abuse on the human health

16.2.6 Structure and functions of parts of the mammalian eye (human)
- Accommodation, image formation and interpretations
- Common eye defects and their corrections

16.2.7 Structure and functions of parts of the mammalian ear (human)
- Hearing (omit details of cochlea)
- Balance and posture (mention only parts involved)

16.3.0 Practical activities

16.3.1 Carry out experiments to investigate tactic responses e.g. chemotaxis - use any of the following organisms: worker termites/fly maggots/earth worms/honey bee/grasshoppers/ woodlice

16.3.2 Carry out experiments on tropisms and etiolation

16.3.3 Determine the distance of blind spot

16.3.4 Carry out knee jerk experiment

17.0.0 SUPPORT AND MOVEMENT IN PLANTS AND ANIMALS (39 LESSONS)

17.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) explain the necessity of support and movement in animals and plants
b) describe the arrangement and the role of supporting tissues in young and old plants
c) list functions of the exo and endo-skeletons
d) describe locomotion in a named finned fish
e) identify the bones of the axial and appendicular skeleton in a mammal
f) describe the structure and functions of different types of joints in a mammal and explain how muscles bring about movement
g) distinguish between the different types of muscles, their locations and functions.

17.2.0 Content

17.2.1 Plants

- Necessity for support and movement in plants
- Review of tissue distribution in monocotyledonous and dicotyledonous plants (Histological details of tissues are not required)

17.2.2 Animals

- Necessity for support and movement in animals
- Types and functions of the skeleton
  - exoskeleton in arthropods
  - endoskeleton in vertebrates

17.2.3 Locomotion in a finned fish

17.2.4 Identification of the bones of axial and appendicular skeletons (names of individual bones of coccyx not required)

17.2.5 Types and functions of movable joints (ball and socket, hinge joint)

17.2.6 Structure, function and location of cardiac, smooth and skeletal muscles (Details of fine structure not required) Role of muscles in movement of the arm in humans

17.3.0 Practical activities

17.3.1 Observe permanent slides of transverse sections of the stems of herbacious and woody plants

17.3.2 Observe wilting in young herbacious plants

17.3.3 Examine the exoskeleton in arthropods

17.3.4 Observe and identify external features of a finned fish

17.3.5 Examine and draw different types of bones in mammals

SUGGESTED ASSESSMENT METHODS

1. Practical Work
2. Project work
3. Field trips
4. Oral questions
5. Quizzes
6. Written tests and examinations

AGRICULTURE

INTRODUCTION

This syllabus has been compiled with a view to accomplishing two fundamental objectives. First, the learners should develop basic principles of agricultural production relevant to Kenya in general, and specifically to their own environments. Secondly, learners should be involved in practicals which aim at assisting them to acquire useful agricultural skills. Therefore, it is highly recommended that learners be involved in practical work for actual agricultural production.

Affective domain objectives in agriculture are as important as those in cognitive and psychomotor domains. However, they must not be seen as achievable at the end of each single topic. They are long term objectives and are set out in the general rather than specific objectives. The teacher must not forget them in teaching and in assessment.

The syllabus covers crop production, livestock production, farm power and machinery, farm structures, agricultural economics and agroforestry. These are distributed throughout the four-year course.

An attempt has been made to arrange the topics in a logical sequence. However, due to different ecological zones and weather patterns in the country, teachers are advised to take into account these differences when developing their schemes of work. They should also endeavour to cover the syllabus within the allocated time. In topics on crop and livestock production, teachers should select examples which are most suited to their ecological zones. It is highly recommended that a crop museum be established in each school. Students should also be encouraged to plant suitable trees in their schools and label them using common and botanical names for each tree.

Each school is encouraged to harvest its rain water from the roof catchment, hold it in reservoirs and use it for irrigation and for livestock, among other uses. Rain water harvesting does not only avail cheap water to the school, but also prevents soil erosion and undermining of building foundations. Agricultural and other related activities must not be used as punishment for wrong doers.

At the end of this syllabus are appendices on lists of tools, weeds, pests and diseases to be studied. However, teachers are encouraged to innovate and to use local resources in teaching. A guide on learner/assessment and self evaluation is given in appendix II.

GENERAL OBJECTIVES

The Secondary Agriculture course aims to:

1. develop an understanding of agriculture and its importance to the family and the nation

2. promote interest in agriculture as an industry and create awareness of opportunities existing in agriculture and related sectors.

3. demonstrate that farming is a dignified and profitable occupation

4. enhance skills needed in carrying out agricultural practices

5. provide a background for further studies in agriculture

6. develop self-reliance, resourcefulness and problem solving abilities in agriculture

7. develop occupational outlook in agriculture

8. enable schools to take an active part in national development through agricultural activities

9. create awareness of the role of agriculture in industrial and technological development

10. enhance understanding of the role of technology and industrialization in agricultural development

11. promote agricultural activities which enhance environmental conservation

12. promote consciousness of health promoting activities in agricultural production.

FORM ONE

1.0.0 INTRODUCTION TO AGRICULTURE

1.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define agriculture
b) state the main branches of agriculture
c) describe farming systems
d) explain the role of agriculture in the economy and demonstrate an appreciation of its importance to the country
e) demonstrate an appreciation for the wide and varied opportunities in agriculture.

1.2.0 Content

1.2.1 Definition of agriculture

1.2.2 Branches of agriculture

- Crop-farming (Arable farming)
  - i) Field crops
  - ii) Horticulture
    - Floriculture (flower farming)
    - Olericulture (vegetable farming)
    - Pomoculture (fruit farming)
- Livestock farming
  - i) Pastoralism - mammalian livestock farming
  - ii) Fish farming
  - iii) Apiculture (Bee keeping)
  - iv) Poultry keeping
- Agricultural economics
- Agricultural engineering

1.2.3 Systems of farming

- Extensive
- Intensive
- Large scale farming
- Small scale farming

Note:- Study each of the above systems under:

- Meaning
- Advantages
- Disadvantages

1.2.4 Methods of farming

- Mixed farming
- Nomadic pastoralism
- Shifting cultivation
- Organic farming
- Agroforestry

Note: Learners should be reminded that any of the above methods can be subsistence or commercial

1.2.5 Roles of agriculture in the economy

- Food supply
- Source of employment
- Foreign exchange earner
- Source of raw materials for industries
- Provision of market for industrial goods
- Source of capital

2.0.0 FACTORS INFLUENCING AGRICULTURE

2.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain the human factors influencing agriculture
b) explain biotic factors influencing agriculture
c) explain how climatic factors influence agriculture
d) define soil
e) describe the process of soil formation
f) describe soil profile
g) determine soil constituents
h) classify soils by physical characteristics
i) explain chemical properties of soils
j) relate crop and livestock distribution to soils in different regions.

2.2.0 Content

2.2.1 Human factors

- Levels of education and technology
- Health - HIV/AIDs and health in general
- Economy (include liberalization)
- Transport and communication
- Market forces (local and international)
- Government policy
- Cultural and religious beliefs

2.2.2 Biotic Factors
- Pests
- Parasites
- Decomposers
- Pathogens
- Predators
- Pollinators
- Nitrogen fixing bacteria

2.2.3 Climatic Factors
- Rainfall
  - intensity
  - reliability
  - quantity
  - distribution
- Temperature
  - How topography and altitude affect temperature
  - How temperature influences crop and livestock production
- Wind
  - Evapotranspiraton
  - Lodging
  - Pollination
  - Seed dispersal
  - Soil erosion (note section 21.11)
- Light
  - Intensity
  - Duration - long, neutral and short day plants
  - Wavelength

Note: Each factor to be discussed with respect to the following:
- Land potentiality
- Crop production
- Livestock production
- Crop and livestock distribution in Kenya

2.2.4 Edaphic factors
- Definition of soil
- Soil formation
- Soil profile
  - Definition
  - Characteristics of different soil layers
  - Difference between soil formed in situ and depositions
  - Soil depth and its influence on crop production
- Soil constituents
  - Constituents (demonstrate presence of each)
  - importance of each constituent
- Physical properties of soil
  i) Soil structure
    - Definition
    - Types
    - Influence on crop production
  ii) Soil texture
    - definition
    - soil textural classification
    - influences on crop growth and production, porosity, capillarity, drainage and water retention capacity.
  iii) Soil colour
- Chemical properties of soil
  - Soil pH
  - pH influence on crop growth and production
  - Effects of pH on mineral availability

3.0.0 FARM TOOLS AND EQUIPMENT

3.1.0 Specific objectives

By the end of the topic, the learner should be able to:
a) identify various farm tools and equipment
b) name parts of various farm tools and equipment
c) describe the use of various tools and equipment
d) carry out maintenance practices on tools and equipment
e) demonstrate an appreciation for care and maintenance of tools.

3.2.0 Content

3.2.1 Garden tools and equipment
3.2.2 Workshop tools and equipment
- Woodwork tools and equipment
- Metalwork tools and equipment

3.2.3 Livestock production tools and equipment
3.2.4 Plumbing tools and equipment
3.2.5 Masonry tools and equipment

Note: Study the above tools under the following headings:
- Name and uses
- Parts and uses
- Maintenance practices

Note: (see Appendix I for list of tools and equipment to be studied)

4.0.0 CROP PRODUCTION I (LAND PREPARATION)

4.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain the importance of land preparation
b) describe the various types of cultivation
c) relate cultivation operation to correct tools and or implements
d) prepare a piece of land ready for crop production.

4.2.0 Content

4.2.1 Land preparation
- Definition
- Importance

4.2.2 Operations in land preparation
- Clearing land before cultivation
  - Importance(include clearing as a method of land reclamation)
  - Methods and equipment
- Primary cultivation
  - Definition and importance
  - Timing
  - Choice of tools and implements
- Secondary cultivation
  - Definition and importance
  - Number of operations
  - Correct tools and implements for different operations
  - Relating final tilth to the intended planting material
- Tertiary operations
  - Ridging
  - Rolling
  - Levelling

Note: for each type:
- give reasons
- explain how it is carried out

- Sub-soiling
  - Meaning
  - Importance
  - Equipment used

4.2.3 Minimum tillage
- Definition
- Importance
- Practices

5.0.0 WATER SUPPLY, IRRIGATION AND DRAINAGE

5.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the sources of water for the farm
b) describe collection, storage, pumping, and conveyance of water;
c) describe water treatment and explain its importance
d) define irrigation
e) explain the importance of irrigation
f) describe methods of irrigating land
g) list the equipment used in irrigation
h) grow a crop through irrigation
i) carry out maintenance on irrigation equipment and facilities
j) define drainage
k) explain the importance of drainage
l) describe the methods of drainage
m) explain how agricultural activities pollute water and how this can be prevented
n) demonstrate an appreciation for clean water in farming and life in general.

5.2.0 Content

5.2.1 Water supply
- Sources of water
- Collection and storage of water
- Pumps and pumping
- Conveyance of water
  - Piping: - types of pipes
  - Choice of pipes
  - Canals
  - Transportation in containers
- Water treatment
  - Meaning
  - Methods
  - Importance
- Uses of water on the farm

5.2.2 Irrigation
- Definition
- Importance (include irrigation as a method of land reclamation)
- Methods
  - surface
  - sub-surface
  - overhead
  - drip

  Note: advantages and disadvantages of each
- Maintenance practices of each irrigation system

5.2.3 Project on crop production through any method of irrigation

5.2.4 Drainage
- Definition
- Importance (include as a method of land reclamation)
- Methods of drainage
  - Surface
  - Sub-surface
  - Pumping
  - Planting of appropriate trees

5.2.5 Water Pollution
- Meaning
- Agricultural practices that pollute water
- Methods of pollution prevention and control

SOIL FERTILITY I (ORGANIC MANURES)

6.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define soil fertility
b) explain how soil fertility can be maintained
c) describe how soil loses fertility
d) define and distinguish organic matter, manure and humus
e) explain the importance of organic matter in the soil
f) describe the different organic manures
g) prepare compost manure;
h) demonstrate a caring attitude towards soil.

6.2.0 Content

6.2.1 Soil fertility
- Definition
- How soil loses fertility
- Maintenance of soil fertility

6.2.2 Organic Manures
- organic matter and humus
- importance of organic matter in the soil
- types of organic manures
  - Green manure
  - Farm-yard manure
  - Compost manure

Note: For each type, describe its preparation, advantages and disadvantages and use

6.2.3 Compost manure:
- Meaning
- Materials used and materials to avoid
- Preparation methods and procedure
  - Heap
  - Pit

7.0.0 LIVESTOCK PRODUCTION I (COMMON BREEDS)

7.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) name various livestock species
b) define the terms livestock, breed and type
c) describe the various breed characteristics
d) state the origin of various livestock breeds
e) classify the various breeds into types
f) name the external parts of the various livestock species
g) demonstrate an appreciation of the socio-economic value of livestock.

7.2.0 Content

7.2.1 Importance of livestock

72.2 Livestock species
- Cattle
  - Exotic
  - Indigenous
- Goats
- Sheep
- Pigs
- Poultry (chicken)
- Rabbits
- Camels

Discuss each under the following:
- Breed origin and characteristics
- Type of each breed
- External parts of each livestock species
- Typical conformation

7.2.3 Terms used to describe livestock in different species by age, sex and use.

8.0.0 AGRICULTURAL ECONOMICS I (BASIC CONCEPTS AND FARM RECORDS)

8.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define economics and agricultural economics
b) explain basic concepts of economics
c) describe the importance of agricultural economics
d) explain the importance of farm records
e) describe the different types of farm records
f) keep farm records.

8.2.0 Content

8.2.1 Definition
- Economics
- Agricultural Economics

8.2.2 Basic concepts of economics
- Scarcity
- Preferences and choice
- Opportunity cost

8.2.3 Uses of farm records

8.2.4 Types of farm records
- Breeding
- Feeding
- Production
- Health
- Field operations
- Inventory
- Labour
- Marketing

FORM TWO

9.0.0 SOIL FERTILITY II (INORGANIC FERTILIZERS)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) list the essential elements
b) classify the essential elements
c) state the role of each macro-nutrient
d) describe the deficiency symptoms of the macro-nutrients
e) identify and classify fertilizers
f) describe the properties of various fertilizers
g) describe soil sampling and testing procedures
h) use appropriate methods of fertilizer application
i) calculate fertilizer application rates
j) explain how soil acidity and alkalinity affect crop production.

9.2.0 Content

9.2.1 Essential elements
- Macro-nutrients
  - carbon hydrogen and oxygen
  - fertilizer elements(N.P.K)
  - liming elements (Ca, Mg, S)
- Role of macro-nutrients in plant growth
- Deficiency symptoms of macro-nutrients in crops
- Micronutrients

9.2.2 Inorganic fertilizers
- Classification of fertilizers
- Identification of fertilizers
- Properties of fertilizers
- Methods of fertilizer application
- Determination of fertilizer rates

9.2.3 Soil sampling
- Meaning
- Soil sampling methods and procedures
- Sites to avoid
- Preparation and Procedure of sending soil for testing

9.2.4 Soil testing
- Meaning
- Importance
- Testing for pH
- How soil pH affects crop production

Note: Learners to make a table showing optimum pH range for various crops with the help of the teacher.

10.0.0 CROP PRODUCTION II (PLANTING)

10.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the correct planting materials for various crops
b) select and prepare planting materials
c) determine the optimum time of planting
d) state the factors which determine the depth of planting
e) describe the planting procedures for different crops
f) state the factors that determine seed rate, spacing and plant population
g) calculate plant population
h) demonstrate an appreciation for economical use of land.

10.2.0 Content

10.2.1 Types of planting materials
- Seeds
  - Description
  - Advantages
  - Disadvantages
- Vegetative materials
  - Description
  - Advantages
  - Disadvantages
- Plant parts used for vegetative propagation
  - Slips
  - Splits
  - Bulbils
  - Crowns
  - Suckers
  - Tubers
  - Vines
  - Cuttings and setts

10.2.2 Selection of planting materials
- Suitability to ecological

conditions (use maize hybrids and coffee varieties as examples)
- Purity
- Germination percentage
- Certified seeds

10.2.3 Preparation of planting materials
- Breaking dormancy
- Disease and pest control/seed dressing
- Seed innoculation
- Chitting

Note: Give appropriate crop for each Practice

10.2.4 Planting
- Timing
  - Factors to consider
  - Advantages of timely planting
- Methods of planting
  - Broadcasting
  - Row planting
  - Oversowing (refer to pastures)
  - Undersowing

Note: Give appropriate crop for each method

10.2.5 Plant population
- spacing
  - factors to consider
- seedrates
  - factors to consider
- calculation of plant population per unit area.

10.2.6 Depth of planting
- factors to consider

Note: Learners should:
- carry out the above practices
- develop a table showing spacing for different local crops

11.0.0 CROP PRODUCTION III (NURSERY PRACTICES)

11.1.0 Specific objectives
By the end of the topic, the learner should be able to:
a) describe a nursery bed
b) distinguish between a nursery bed, a seedling bed and a seed bed
c) state the importance of a nursery bed
d) select a suitable site for a nursery
e) prepare a nursery bed
f) manage a nursery bed
g) transplant crops from a nursery
h) bud a seedling
i) graft a seedling
j) explain the importance of budding, grafting, layering and tissue culture
k) describe damage caused by animals on tree seedlings and how to prevent it.

11.2.0 Content
11.2.1 Nursery bed
- Definition
- Difference between a nursery bed, seedling bed and a seed bed
- Importance
- Site selection
- Nursery establishment
  i) Vegetable nursery
  ii) Tree nursery
  iii) Vegetative propagation nursery (tea as an example)
    - use of sleeves and other innovations for growing young plants
    - making and using seedling boxes for growing young plants
    - preparation of rooting medium
    - preparation of cuttings

11.2.2 Routine management in raising
- seedlings
- Seed drilling
- Mulching
- Watering
- Shading
- Pricking out
- Hardening off
- Weed control
- Pest control
- Disease control

11.2.3 Budding
- Meaning
- Methods and procedure
- Appropriate plants
- Appropriate tools and materials

Note: Learners to practice budding of orange scions on lemon root-stocks or other appropriate plants.

11.2.4 Grafting
- Meaning
- Methods and procedure
- Appropriate plants
- Appropriate tools and materials

Note: Learners to practice grafting on appropriate fruit trees

11.2.5 Importance of budding and grafting

11.2.6 Layering
- Methods
- Importance
- Appropriate crops/plants for layering
- Materials used in layering

11.2.7 Tissue culture for crop propagation

11.2.8 Transplanting of vegetable seedlings from nursery to seedbed
- Timing
- Procedure and precautions

11.2.9 Transplanting of tree seedlings
- Timing
- Digging appropriate holes
- Planting including firming and watering
- Protecting the seedlings after transplanting
  - Shading
  - Damage caused by animals on tree seedlings and how to prevent it.

12.0.0 CROP PRODUCTION IV (FIELD PRACTICES)

12.0.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define crop rotation
b) state the importance of crop rotation
c) draw a crop rotation programme
d) distinguish terms used in crop farming
e) state the importance of mulching in crop production
f) describe the importance of various field practices in crop production
g) carry out various field practices
h) state the correct stage for harvesting various crops
i) describe harvesting practices for various crops.

12.2.0 Content

12.2.1 Crop rotation
- Definition
- Importance
- Factors influencing crop rotation
- Rotational programmes

12.2.2 Terms used in crop production
- Monocropping
- Intercropping
- Mixed cropping

12.2.3 Mulching
- Meaning
- Importance
- Types of mulching materials
  - organic
  - inorganic
- Advantages and disadvantages of mulching materials

12.2.4 Routine field practices
- Thinning
- Rogueing
- Gapping
- Training/staking/propping
- Pruning:
  i) Tea - table formation and maintenance
  ii) Coffee
  - single and multiple stem.
  - capping
  - de-suckering
  - changing cycles

  (iii) Banana stool management.
  (iv) Pyrethrum
  - cutting back
- Earthing up
- Crop protection:
  - Weed control
  - Pests and disease control (see unit 22 and 23)

Note: Study each of the above under
- Importance
- Timing
- Appropriate crops

12.2.5 Harvesting
- Stage and timing of harvesting
- Methods of harvesting
- Precautions during harvesting

12.2.6 Post - harvest practices:
- Threshing/shelling
- Drying

- Cleaning
- Sorting and grading
- Dusting
- Packaging

12.2.7 Storage
- Importance
- Types of storage
- Preparation of store

13.0.0 CROP PRODUCTION V (VEGETABLES)

13.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) grow a vegetable crop from nursery establishment to harvesting
b) keep crop production records
c) market farm produce
d) demonstrate an appreciation of agriculture as an economically lucrative activity.

13.2.0 Content

13.2.1 Vegetable crops
- Tomatoes - use varieties that require pruning and staking.
- Carrots
- Onions
- Cabbages/kales

Note:
- Each student should grow at least one of the above crops keeping all the necessary records
- The teacher should organise the class in such a way that there are students growing each of the crops
- Class discussions should be organised so that students tell and demonstrate to each other their work in the different vegetable crops. Discussion may be held at the crop plots for students to observe.
- The teacher may organise common nurseries for students growing tomatoes, cabbages/kales and onions. However, all students should actively participate in all nursery establishment and management practices.
- Topics 12.00 and 13.00 may be carried out concurrently as theory and practical

14.0.0 LIVESTOCK HEALTH I (INTRODUCTION TO LIVESTOCK HEALTH)

14.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define health and disease
b) describe signs of sickness in animals
c) state the predisposing factors of livestock diseases
d) categorize animal diseases;
e) carry out disease control practices
f) state the importance of maintaining livestock healthy
g) demonstrate a caring attitude towards livestock.

14.2.0 Content

14.2.1 Health and disease
- Definitions
- Importance of keeping livestock healthy
- Pre-disposing factors of livestock diseases
- Signs of ill -health in livestock

14.2.2 Classification of livestock diseases by cause
14.2.3 General methods of disease control
14.2.4 Appropriate methods of handling livestock

15.0.0 LIVESTOCK HEALTH II (PARASITES) (16 Lessons)

15.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe host-parasite relationship
b) identify different parasites
c) describe the life-cycle of parasites
d) explain methods of parasite control in livestock.

15.2.0 Content

15.2.1 Host - parasite relationship
- effects of parasites on hosts

15.2.2 External parasites
- Ticks
- Tsetseflies
- Mites
- Lice
- Fleas
- Keds

15.2.3 Internal parasites
- Roundworms (Ascaris spp)
- Tapeworms (Taenia spp)
- Flukes (Fasciola spp)

Note:
- The parasites in 15.2.2 and 15.2.3 should be studied under the following:-
  i) Identification
  ii) Livestock species attacked
  iii) Part(s) of livestock attacked or inhabited and mode of feeding
  iv) Signs and symptoms of attack

- Describe the life cycles of the following:
  i) Roundworm (ascaris spp.)
  ii) Tapeworm (Taenia spp.)
  iii) Liver Fluke (Fasciola spp.)
  iv) Ticks, appropriate examples of:
    - one - host
    - two - host
    - three - host

Note: Indicate whether soft or hard tick

- State methods of parasite control giving appropriate example of a parasite for each method.

16.0.0 LIVESTOCK PRODUCTION II (NUTRITION) (12 Lessons)

16.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) identify and classify livestock feeds
b) describe digestion and digestive systems of cattle, pig and poultry
c) define terms used to express feed values
d) compute a livestock ration
e) prepare balanced ration for various livestock
f) demonstrate a caring attitude towards livestock.

16.2.0 Content

16.2.1 Livestock nutrition
- Feeds and Feeding
  - Identification
  - classification of feeds
  - Terms used in expressing feed values
  - Computation of livestock rations
  - Preparation of livestock rations

- Digestive systems.
  - Ruminant cattle
  - Non-ruminant (pig and poultry)

- Digestion in cattle, pig and poultry

16.2.2 Appropriate livestock handling techniques while feeding

FORM THREE

17.0.0 LIVESTOCK PRODUCTION III (SELECTION AND BREEDING)

17.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) describe reproduction
b) describe reproductive systems,
c) select breeding stock
d) describe breeding systems
e) identify signs of heat in livestock
f) describe methods used in serving livestock
g) demonstrate a caring attitude towards livestock

17.2.0 Content

17.2.1 Reproduction and reproductive systems.
- Cattle
- Poultry

17.2.2 Selection:
- meaning
- Factors to consider in selecting a breeding stock
  - Cattle
  - Sheep
  - Goats
  - Pigs
  - Camels
- Methods of selection
  - mass selection
  - contemporary comparison
  - progeny testing

17.2.3 Breeding
- Meaning
- Terms used in breeding
  - Dorminant and recessive genes
  - Heterosis(hybrid vigour)
  - Epistasis

- Breeding systems
  - Cross-breeding
  - Up-grading
  - Inbreeding
  - Line breeding
  - Out-crossing

Note: Discuss under the headings:
- Definition
- Advantages
- Disadvantages

17.2.4 Signs of heat in:
- Cattle
- Pigs
- Rabbits

Note: Study the oestrus cycle of each of the above

17.2.5 Methods of service in livestock
- Natural mating
- Artificial insemination
- Embryo transplant

Note: Discuss advantages and disadvantages of each.

17.1.6 Signs of parturition
- Cattle
- Pigs
- Rabbits

Note: Learners to handle livestock in appropriate caring manner.

18.0.0 LIVESTOCK PRODUCTION IV (LIVESTOCK REARING PRACTICES)

18.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) describe livestock rearing practices
b) carry out livestock rearing practices
c) demonstrate a caring attitude towards livestock.

18.2.0 Content

18.2.1 Routine livestock rearing practices
- Feeding practices
  - Flushing
  - Steaming up
  - Creep feeding
- Parasites and Disease control practices
  - Vaccination
  - Deworming
  - Hoof trimming
  - Docking
  - Dipping/spraying
  - Dusting

- Breeding practices
  - Crutching
  - Tupping and serving
  - Raddling
  - Ringing
- Identification
- Debeaking
- Tooth clipping
- Culling: Describe general methods and carry out practicals on:
  - Cattle
  - Poultry
- Dehorning
- Shearing
- Castration
  - open
  - closed
  - caponization
- Management during paturation:-
  - Pigs
  - Cattle
  - Sheep
  - Goats
  - Rabbits

18.2.2 Bee Keeping (Apiculture)
- Importance
- Colony
- Siting of the apiary and hive
- Stocking the bee hive
- Management:
  - Feeding
  - Predator and pest control
- Honey harvesting and processing

18.2.3 Fish Farming (aquaculture)
- Importance
- Types of fish kept in farm ponds
- Management
- Harvesting
- Processing and preservation

18.2.4 Appropriate handling of livestock during routine management

19.0.0 FARM STRUCTURES (18 Lessons)

19.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe parts of a building
b) identify materials for construction
b) describe various farm structures and their uses
c) describe sitting of various structures
c) construct and maintain farm structures.

19.2.0 Content

19.2.1 Farm buildings and structures
- Siting
- Parts of a building
  - Foundation
  - Wall
  - Roof

19.2.2 Livestock buildings and structures
- Crushes
- Dips
- Spray race
- Dairy shed/parlour
- Calf pens
- Poultry houses and structures
  - Deep litter
  - Coops
  - Folds/Arks
  - Runs
  - Battery cages
- Rabbit hutches/Rabbitry
- Piggery/pig sty
- Fish ponds
- Silos (for silage)
- Zero grazing unit
- Bee hives

19.2.3 Farm stores
- Feed
- Farm produce
- Chemical
- Machinery
- Tools

19.2.4 Green house
- Meaning
- Construction materials
- uses

19.2.5 Fences in the farm
- Types of fences and materials used
- Uses - advantages and disadvantages
- Gates and passes in fences
- Fence reinforcements

Note
- Construct either of the following structures:
  i) a crush
  ii) a beehive
  iii) a hutch
- Visit nearby construction sites for observation.

20.0.0 AGRICULTURAL ECONOMICS II (LAND TENURE AND LAND REFORM) (8 Lessons)

20.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define the term tenure
b) describe tenure systems
c) describe land reforms.

20.2.0 Content

20.2.1 Land tenure

- definition
- tenure systems
  - (i) individual
    - Types
    - Advantages and disadvantages
  - (ii) collective
    - Description
    - Advantages
    - Disadvantages

20.2.2 Land reforms

- Definition
- Types of reform and reasons for each
  - Fragmentation
  - Consolidation
  - Adjudication
  - Registration (Emphasise the importance of a title deed)
  - Settlement and resettlement

21.0.0 SOIL AND WATER CONSERVATION (19 Lessons)

21.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define soil erosion
b) explain the various factors that influence erosion
c) list the agents of erosion
d) describe the various types of erosion
e) describe various methods of erosion control
f) demonstrate a caring attitude towards soil and water
g) carry out soil erosion control measures
h) describe water harvesting and conservation techniques
i) describe micro-catchments and their uses.
j) design and construct a micro-catchment .

21.2.0 Content

21.2.1 Soil erosion

- Definition
- Factors influencing erosion -
  - Land use and ground cover
  - Topography - gradient and length of slope (horizontal and vertical intervals)
  - Soil type and condition (Erodability)
  - Rainfall intensity (Erosivity)
- Agents of erosion
  - Water
  - Wind
  - Human beings
  - Animals
- Types of erosion
  - i) Splash/rain drop
  - ii) Sheet
  - iii) Rill
  - iv) Gully
    - gully formation
    - types of gullies
  - v) River bank
  - vi) Solifluction
  - vii) Landslides
- Soil erosion control
  - (i) Biological/cultural control
    - Grass strips
    - Cover crops
    - Grassed waterways
    - Contour farming and strip cropping
    - Mulching
    - Afforestation/forestation
  - (ii) Physical/structural controls
    - Stone lines
    - Filters /strip
    - Trashlines
    - Terraces - level, graded, broad based narrow-based. bench, fanya juu, fanya chini.
    - Bunds
    - Cut-off - drains/Diversion ditches
    - Gabions/porous dams
    - Ridging

21.2.2 Water harvesting
- Roof catchment
- Rock catchment
- Weirs and dams
- Ponds
- Retention ditches/Level terraces

21.2.3 Micro-catchments
- Types
- Laying out and construction methods
- Uses

Note
- A local soil conservation officer to be contacted for necessary tools and demonstration of skills in establishing level and graded terraces
- Learners to practice using leveling boards, line and spirit level to develop conservation structures.
- Learners to carry out soil and water conservation work in and or out of school wherever appropriate

22.0.0 WEEDS AND WEED CONTROL

22.1.0 Specific objectives

By the end of the topic, the learner should be able to:
a) define a weed
b) identify weeds
c) classify weeds
d) explain the characteristics which make the weeds competitive
e) describe ways of controlling weeds
f) state harmful effects of weeds
g) control weeds
h) exercise safety measures to oneself, to crops and to the environment while controlling weeds.

22.2.0 Contents

22.2.1 Weeds
- Definition of weed
- Weed identification and classification
- Competitive ability of weeds (Appropriate examples for each ability)
- Harmful effects of weeds (appropriate examples for each effect) (See Appendix II for weeds to be studied)

22.2.2 Weed control methods
- Chemical weed control:
  - Classes of herbicides
  - Methods of application
  - Safety measures in use of chemicals
- Mechanical weed control
- Cultural weed control
- Biological weed control
- Legislative control

23.0.0 CROP PESTS AND DISEASES

23.1.0 Specific objectives

By the end of the topic, the learner should be able to:
a) define pest and disease
b) state the main causes of crop diseases
c) describe the harmful effects of crop pests and diseases
d) identify and classify some of the common pests and diseases
e) carry out general disease and pest control measures
f) demonstrate a caring attitude towards the environment while controlling pests and diseases.

23.2.0 Content

23.2.1 Pests
- Definition
- Classification of pests:
  - Mode of feeding
  - Crops attacked
  - Stage of growth of crop attacked
  - Field and storage pests
- Identification of common pests
- Harmful effects of pests
- Pest control measures.

23.2.2 Diseases:
- Definition
- Classification of diseases according to cause
- Identification of common diseases
- Disease control
- Harmful effects of diseases
- Disease control measures (see appendices III and IV for pests and diseases to be studied)

Note: Remind learners of safety in mixing, using and storing of chemicals including container disposal as in unit 22.00)

24.0.0 CROP PRODUCTION VI (FIELD PRACTICES II) (17 Lessons)

24.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe management practices in crop production
b) carry out management practices for a given crop
c) demonstrate an appreciation of agriculture as an economically lucrative activity.

24.2.0 Content

24.2.1 Production of :

- Maize/millet/sorghum
- Beans

Discuss under the following:-

- Meaning of hybrids, composites and cultivars
- Selecting best hybrids, composites or cultivars for a given climatic region.
- Raising of a maize/sorghum/millet and bean crop from seed bed preparation to harvesting
- Keeping records in production of maize/sorghum/millet and beans

24.2.2 Rice production

- Land preparation
- Water control
- Use of flooding in rice field
- Fertilizer application
- Weed control

24.2.3 Harvesting of the following crops

- Cotton
- Pyrethrum
- Sugarcane
- Tea
- Coffee

Under the following

- Stage of harvesting
- Method and procedure of harvesting
- Precautions in harvesting

Note:
Compare cost of production with value of product for maize/sorghum/millet and beans

Discuss why there is a loss or a profit and improvement needed.

25.0.0 FORAGE CROPS (9 Lessons)

25.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define and classify pastures
b) identify forage crops
c) describe the ecological requirements of forage crops
d) describe the establishment and management of pastures and fodder
e) describe forage utilization and conservation.

25.2.0 Content

25.2.1 Pastures

- Definition
- Classification
- Establishment
- Management

25.2.2 Utilization

- Grazing systems
  - Rotational
  - Herding
- Zero grazing

25.2.3 Fodder crops

- Napier/bana grass
- Guatemala grass
- Sorghum
- Kale
- Edible cana
- Lucerne
- Clovers
- Desmodium
- Manigolds
- Agroforestry trees/bushes used as fodder

Under the following:

- Ecological requirements
- Establishment and management
- Production per unit area
- Utilization

25.2.4 Forage conservation
- Hay making
- Silage making
- Standing hay

26.0.0 LIVESTOCK HEALTH III (DISEASES) (20 Lessons)

26.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe causes and vectors of main livestock diseases
b) state the incubation period of the livestock diseases
c) describe the signs of each disease
d) state the predisposing factors where applicable
e) carry out simple control measures of livestock diseases
f) demonstrate a caring attitude towards livestock.

26.2.0 Content

26.2.1 Protozoan diseases
- East coast fever
- Anaplasmosis
- Coccidiosis
- Trypanosomiasis(Nagana)

26.2.2 Bacterial diseases
- Fowl typhoid
- Foot rot
- Contagious abortion(Brucellosis)
- Scours
- Black quarter
- Mastitis
- Anthrax
- Pneumonia

26.2.3 Viral diseases
- Rinderpest
- Foot and mouth
- Newcastle
- Fowl pox
- Gumboro
- African Swine fever

26.2.4 Nutritional diseases
- Milk fever
- Bloat

The above diseases should be studied under the following:
- Animal species attacked
- Cause/causal organism/agent and or vector
- Predisposing factors(where applicable)
- Incubation period (where applicable)
- Signs and symptoms of disease
- Simple control measures of the diseases

Note

- Learners to exercise care and use appropriate livestock handling practices

- Exercise care not to pollute the environment with chemicals

FORM FOUR

27.0.0 LIVESTOCK PRODUCTION V (POULTRY) (25 Lessons)

27.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) identify parts of an egg
b) select eggs for incubation
c) identify suitable sources of chicks
d) describe broodiness and natural brooding
e) describe brooder and brooder management
f) describe conditions necessary for artificial incubation
g) describe rearing systems
h) describe the feeding for each age and category of poultry
i) identify stress and vices
j) state the causes of stress and vices in poultry
k) state the effects of vices and stress in poultry
l) state control measures of vices and stress
m) describe marketing of eggs and poultry meat
n) select sort and grade eggs for marketing
o) demonstrate an appreciation of poultry production as an economically lucrative activity.

27.2.0 Content

27.2.1 Parts of an egg

27.2.2 Incubation
- Meaning
- Selection of eggs for incubation
- Natural incubation
  - Signs of broodiness in poultry
  - Preparation and management of natural incubation
- Artificial incubation
  - Management of the incubator

27.2.3 Sources of chicks

27.2.4 Brooding
- Meaning
- Natural brooding
- Artificial brooding
  - Brooder and brooder management
  - Conditions
  - Equipment
  - Management of:-
    i) layers
    ii) broilers

27.2.5 Rearing systems
- Extensive
  - Free range
- Semi - intensive
  - Fold system
- Intensive
  - Deep litter
  - Battery cage system

Note: Include advantages and disadvantages of each system.

27.2.6 Chicken feeding
- Broilers
- Layers

27.2.7 Stress and vices in chicken.
- Identification
- Causes
- Control

27.2.8 Marketing
- eggs - include, grading of eggs for marketing
- meat

Note: Learners to exercise care and use appropriate methods while handling poultry

28.0.0 LIVESTOCK PRODUCTION VI (CATTLE) (16 Lessons)

28.1.0 Specific objectives

By the end of the topic, the learner should be able to:

i. raise young stock
ii. demonstrate a caring attitude towards livestock
(c) describe milk by its Components
(d) describe milk secretion and let – down
(e) milk using correct procedure and technique

1. describe marketing of beef cattle and milk
2. Demonstrate an appreciation of cattle production as an economically lucrative activity.

28.2.0 Content

28.2.1 Raising young stock
- Feeding
- Weaning
- Housing
- Routine practices (see unit 18)

28.2.2 Milk and Milking
- Milk composition
- Milk secretion and let down
- Clean milk production
  - Equipment and materials (include milking machine)
  - Cleanliness of the milkman / milkwoman
  - Milking procedure (by hand and by machine
  - Milking techniques
- Dry cow therapy

28.2.3 Marketing of milk

28.2.4 Marketing beef cattle

Note: Learners to exercise care and use appropriate methods in handling livestock

29.0.0 FARM POWER AND MACHINERY (18 Lessons)

29.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) describe various sources of power in the farm
b) describe various systems of a tractor
c) describe the various tractor implements, their uses and maintenance
d) describe the various animal drawn implements, their uses and maintenance
e) describe tractor service and maintenance practices.

29.2.0 Content

29.2.1 Sources of power in the farm
- Human
- Animal
- Wind
- Water
- Biomas
  - Wood/charcoal
  - Biogas
- Fossil fuel
  - Coal
  - Petroleum
  - Natural gas
- Electrical
  - Hydro
  - Geothermal
  - Nuclear
  - Storage battery
- Solar

29.2.2 Tractor Engine
- Four stroke cycle engine
  - diesel
  - petrol
- Two stroke cycle engine

29.2.3 Systems of the tractor
- Fuel system
- Electrical
- Ignition
- Cooling
- Lubrication
- Transmission
  - Clutch
  - Gears
  - Differential
  - Final Drive

29.2.4 Tractor service maintenance

29.2.5 Tractor drawn implements, their uses and maintenance.
- Attachment methods
  i) One point hitch
     - draw bar
  ii) Three point hitch
     - hydraulic
  iii) Power take off (P.T.O)
- Implements
  i) Trailer
  ii) Disc plough
  iii) Mouldboard plough
  iv) Harrows
     - disc
       - plain
       - notched
         - spike tooth
         - spring tined
  v) Sub - soilers
  vi) Ridgers
- Rotary tillers
- Mowers

- Gyro
- Reciprocating

- Planters and seeders
- Cultivators/weeders
- Sprayers
- Harvesting machines
  - grain
  - root crops
  - forage
- Shellers

29.2.6 Animal drawn implements, uses and maintenance
- Ploughs
- Carts
- Ridgers

Note : Teacher should use local resources and diagrams. The school does not need to have tractor, tractor drawn implements, animals and animal drawn implements.

30.0.0 AGRICULTURAL ECONOMICS III (PRODUCTION ECONOMICS) (20 Lessons)

30.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain various parameters of national development
b) relate national development to agricultural production
c) state the factors of production and explain how each affects production
d) describe how the law of diminishing returns relates to agricultural production
e) describe agricultural planning and budgeting in a farm business
f) state sources of agricultural support services
g) describe risks and uncertainities in farming
h) explain ways of adjusting to risks and uncertainities.

30.2.0 Content

30.2.1 National income
- Household - firm relationship
- Gross Domestic product (GDP)
- Gross National Product (GNP)
- Per Capita Income
- Contribution of agriculture to national development

30.2.2 Factors of production
- Land
  - Definition
  - Methods of acquisition
- Labour
  - Definition
  - Types
  - Measures of labour
  - Ways of increasing labour efficiency
- Capital
  - Definition
  - Types
  - Sources
- Management
  - Definition
  - Role of a farm manager

Note: Emphasize that by law, a Kenyan can acquire land, settle, invest capital or work anywhere within the country.

30.2.3 Production function.
- Increasing returns
- Constant returns
- Decreasing returns

30.2.4 Economic laws and principle
- The law of diminishing returns
- The law of substitution
- The law of equimarginal returns
- Principle of profit maximization

30.2.5 Farm planning
- meaning
- factors to consider
- steps

30.2.6 Farm budgeting
- Definition
- Importance
- Types
  - Partial
  - Complete

30.2.7 Agricultural services available to the farmer

30.2.8 Risks and uncertainties in farming
- Meaning
- Common risks and uncertainties
- Ways of adjusting

31.0.0 AGRICULTURAL ECONOMICS IV (FARM ACCOUNTS) (10 Lessons)

31.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the importance of farm
b) accounts
c) distinguish and describe the
d) various financial documents
e) and their uses
f) prepare and analyse financial
g) statements
h) identify various books of
i) accounts and their uses.

31.2.0 Content

31.2.1 Financial documents and books of accounts

- Financial documents
  - Invoices
  - Statements
  - Receipts
  - Delivery notes
  - Purchase orders

- Books of Accounts
  - Ledger
  - Journal
  - Inventory
  - Cash book

31.2.2 Financial statements

- Cash analysis
- Balance sheet
- Profit and loss account

32.0.0 AGRICULTURAL ECONOMICS V (AGRICULTURAL MARKETING AND ORGANISATIONS) (10 Lessons)

32.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define market and marketing
b) describe the various types of markets
c) describe how the law of supply and demand affects the prices of agricultural products
d) state various marketing functions, agents and institutions
e) identify problems in marketing of agricultural products
(f) list various agricultural Organizations
(g) describe the role of each of the agricultural organizations.

32.2.0 Content

32.2.1 Market and marketing
32.2.2 Types of markets
32.2.3 Demand, supply and price theory
32.2.4 Marketing functions
32.2.5 Problems of marketing agricultural products and possible solutions
32.2.6 Marketing boards, agents and institutions
32.2.7 Co-operatives

- Formation
- Functions

32.2.8 Associations and unions

- Agricultural society of Kenya (ASK)
- Young Farmers Clubs (YFC)
- Kenya National Farmers Union (KNFU)
- Agricultural based Women groups.

33.0.0 AGROFORESTRY

33.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define agroforestry
b) state the importance of agroforestry
c) describe various forms of agroforestry
d) explain the importance of trees
e) select appropriate trees for different uses
f) describe tree nursery management and transplanting
g) explain routine tree management
h) select appropriate sites for trees in the farm and other areas
i) describe various methods of tree harvesting.

33.2.0 Content

33.2.1 Definition of agroforestry

- forms of agroforestry

33.2.2 Importance of agroforestry

33.2.3 Importance of trees and shrubs

- important trees and shrubs for particular purposes
- Trees and shrubs to avoid at certain sites and reasons

33.2.4 Tree nursery
- types of nurseries
- seed collection and preparation
- nursery management
- transplanting

Note: Refer to 11.00 nursery practices

33.2.5 Care and management of trees
- Protection
- Pruning and training
- Grafting old trees

33.2.6 Agroforestry practices
- Alley cropping
- Multistory cropping
- Woodlots in farms

33.2.7 Sites for agroforestry trees
- Boundaries
- River banks
- Terraces
- Slopes
- Homestead

33.2.8 Tree harvesting methods

APPENDIX I - RESOURCES

A TOOLS AND EQUIPMENT TO BE STUDIED

1. GARDEN TOOLS AND EQUIPMENT TO BE STUIED

panga
axe
mattock/pick axe
jembe/hoe
fork jembe
spade
wheelbarrow
watering can
spring balance
rake
tape measure
soil auger
knap -sack sprayer
sprinkler
hose pipe
garden shear
pruning saw
pruning knife
meter rule
secateurs
garden trowel
garden fork
pruning - hook
levelling boards

2. LIVESTOCK PRODUCTION TOOLS AND EQUIPMENT

elastrator
burdizzo
syringes and needles
thermometer
halter
hoof trimmer
strip cup
trochar and canular
hard broom
wool shears
ear notcher
bull ring and lead stick
bucket
stir-up pump
milk churn
strainer/sieve
rope
milking stool
weighing balance
hot iron
teeth clipper
drenching gun
dosing gun
bolus gun
dehorning wire
chaff cutter

3. WORKSHOP TOOLS AND EQUIPMENT

cross cut saw
tenon/back saw
coping saw
compass saw/key hole saw
rip saw
bow saw
hack saw
wood chisel
cold chisel
files and rasps
wire brush
marking gauge
divider
centre punch
spoke shave
screw drivers
spanners
jack plane
scrapper
try square
wood clamp
sash clamp
G-clamp
mallet
soldering gun
tin -snip
claw hammer
paint brush
ball -pein hammer
sledge hammer
wire strainer
pliers
brace and bits
hand drills and bits

pipe wrench	riveting machine
pipe cutter	crow bar
levelling rod	masons square
spirit level	plumb bob
mason	trowel
wood float	metal float
meter rule	shovel

B. WEEDS TO BE STUDIED

COMMON NAME	**BOTANICAL NAME**
1. Black Jack	*Bidens pilosa*
2. Mexican marigold	*Tagetes minuta*
3. Oxalis/sorrel	Oxalis species
4. Double thorn	*Oxygonum sinuatum*
5. Thorn apple	*Datura stramonium*
6. Couch grass	*Digitaria scalarum*
7. Nut grass	*Cyperus rotundas*
8. Wandering Jew	*Commelina bengalensis*
9. Sow thistle	*Sonchus oleraceus*
10. Devil's horsewhip	*Achranthes aspera*
11. Macdonaldi/gallant soldier	*Gallinsoga parviflora*
12. Sodom apple	*Solanum incanum*
13. Black nightshade	*Solanuim nigrum*
14. Chinese lantern	*Nicandra physalodes*
15. Bracken fern	*Pteridium aquillinum*
16. Love grass/Bristly foxtail	*Seteria verticillata*
17. Cleavers	*Gallium spurium*
18. Stinging nettle	*Utica massaica*
19. Fat hen/Goosefoot	Chenopodium species
20. Rape Weed	*Brassica napus*
21. Wild Oats	*Avena fatua*
22. Lantana/Tick berry	*Lantana camara*
23. Water hyacinth	*Eichhornial crassipes*
24. Witchweed	*Striga hermonthica*
25. Creeping indigo	*Indigofera spicata*

C. CROP PESTS TO BE STUDIED

1. Armyworm
2. Cut worm
3. Locust
4. Moths
5. Fruitfly
6. Mealybug
7. Thrips
8. Beetles
9. Weavils - field and store
10. Birds - Weaver, Sudan dioch, Mouse bird
11. Rodents - Squirrels, Moles and Rats
12. Boll worms
13. Stainers
14. Nematodes
15. Leaf miners
16. Aphids
17. Stalk borers
18. Loopers
19. Scales

D. CROP DISEASE TO BE STUDIED

1. Maize streak
2. Smuts
3. Blasts
4. Leaf blight
5. Anthracnose
6. Rusts – in cereals and leaf rust in coffee
7. Leaf spot
8. Blight –hallow, early and late
9 Panama disease
10. Cigar end rot
11. Mildew
12. Mosaic
13. Die back
14. Greening
15. Tristeza
16. Wilts –Fusarium and Bacterial
17. Black arm
18. Damping off
19. Coffee Berry Disease
20. Rosette
21. Ratoon stunting disease
22. Armilaria root-rot

APPENDIX II

EVALUATION

It is important for the teacher to evaluate his teaching and to assess learners performance. Both of these measurements can be carried out by determining the extent to which the intended objectives have achieved by the end of each topic.

At the beginning of each topic, a list of specific objectives is given. Note that, the stem of each list of objectives says;

"By the end of the topic, the learner should be able to:" perform a certain task. Each specific objective then starts with a verb which gives the task that the learner should be able to perform by the end of the topic.

Such verbs include:

- State
- Explain
- Describe
- Relate
- Distinguish
- Prepare
- Carry out

A good assessment therefore will attempt to determine whether the learner is able to perform the task expressed by the verb.

The objectives are meant to serve certain purposes:-

1) They guide the teacher to determine what the learner is expected to do. In some cases when the objectives are very specific they may demand the determination of extent to which the learner is able to perform a task eg the learner should be able to complete milking a cow within seven minutes from the beginning is different from the learner "the learner will be able to milk a cow"

   In the first objective, assessment will not only be on the ability to milk but also within what time. Grades may then be allocated for performance of the task and for the time it takes.

2. They guide the teacher on the methodology for example, if the task is that the learner be able to **explain** something, then the teacher may use lecture or discussion method.

   If the task is to **prepare** e.g. a nursery bed, then the methodology will be a demonstration followed by a practical.

3 They guide on the method of assessment i.e. if the task was to **state**, then the learner should be asked to **state** but not to **explain**.

   If on the other hand, the objective required learners to **describe**, the question should read, **describe** but not **demonstrate**

   The teacher must therefore always get the **verb** in the objective to ask the question.

4 They guide on the depth of coverage e.g. **name** the tick that carries ECF is shallower than **describe** the tick that carries ECF.

   Therefore if the objective states that the learner should be able to name, then description is not called for.

5. The teacher is able to evaluate his/her teaching through assessment of learners. The number of learners able to perform the task(s) set out in the objective(s) to a certain extent by the end of the specified time that is end of topic, shows how effective the teaching has been. The results of such an evaluation can help the teacher to determine what changes are required in future teaching such as, changes in:-
   - Teaching methods
   - Teaching resources
   - Time given per content area

METHODS OF ASSESSMENT

It is recommended that the teacher carries out continuous assessment. Since, the specific objectives state that learners will be able to perform certain task(s) **by the end of the topic**. Therefore, through the teacher may need to test certain contents before the end of the topic, it is important that a test is done at the end of each topic. Mid-term, term and end year examinations are also encouraged. Some methods of testing are:

i) Oral for example for brainstorming on a topic, exploring learners knowledge of a new topic or as an indication to the teacher whether the learners are following the lesson.
ii) Short/written quizzes at the end of the lesson or topic/short answer questions.
iii) Written assignments/long answer questions/essays
iv) Practical work - in class or field
v) Observation - this is used mostly of assessing of psychomotor and affective domain objectives
vi) Practical projects for individuals or groups

It is important for the teacher to understand that **how a task is performed** tells not only the competence gained but also the **attitude** with which it is done.

Observation will therefore include:
a) Degree of exactness in performance of a task.
b) Creativity
c) Timeliness in completing a task and reporting
d) Enthusiasism/keenness
e) Care in handling materials and tools
f) Care of the environment
g) Co-operation/teamwork spirit
h) Leadership/planning/organizational abilities/responsibility/command/respect

HOME SCIENCE

INTRODUCTION

Home science is an applied and integrated science which aims at improving the quality of life for the individual, the family and the community.

This Home science syllabus incorporates subject areas such as health education foods, nutrition, textiles, clothing, home care, maternal health-care and consumer education. Issues such as HIV/AIDS, STIs, drug misuse, sanitation have been dealt with under health education. Gender responsiveness has also been addressed to encourage both male and female learners to take the subject.

The syllabus has been formatted for uniform interpretation by teachers. In view of this, teachers are advised to use it as a guide and to integrate content areas appropriately during lesson planning. Teachers are called upon to be creative and improvise materials and equipment appropriately. Use of locally available resources and incorporation of the electronic media are encouraged in the enhancement of the learning and teaching of Home Science. Information update in all areas incorporated in this subject is essential.

Emphasis should be laid on economical use of resources through group practicals and, where possible, field visits within the locality. Practical and written assignments should be given regularly so that the teacher can assess the learners' mastery of content and acquisition of relevant skills.

The content has been reorganized and can be covered within the suggested number of lessons, however, flexibility is acceptable. Teachers are advised to make use of the teachers guide in lesson preparation.

It is expected that this syllabus will adequately prepare learners for further education and training in a wide variety of careers.

GENERAL OBJECTIVES

By the end of the course the learner should be able to:

1 adapt to environmental, social and economic changes

2 practice principles of good health with respect to self, others and the environment

3 manage and improvise resources

4 practice preventive and promotive health care strategies

5 develop artistic values in the selection, preparation and serving of food

6 preserve and store foods

7 appreciate foods from different communities

8 develop artistic values in clothing and interior design

9 select, use and care for different fabrics

10 develop skills in garment construction and soft furnishings

11 acquire knowledge in maternal child health care

12 acquire awareness of consumer education and be able to utilize it wisely

13 form a foundation for further education and training in various fields.

FORM ONE

1.0.0 INTRODUCTION TO HOME SCIENCE (2 Lessons)

1.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define Home Science
b) explain the importance of Home Science
c) relate Home Science to various career opportunities.

1.2.0 Content

1.2.1 Definition of Home Science

1.2.2 Importance of Home Science to:

- individual
- family
- nation

1.2.3 Home Science as a basis for various careers

2.0.0 PERSONAL HYGIENE (11 Lessons)

2.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) practice principles of good grooming
b) choose and use cosmetics appropriately
c) state changes in adolescence and relate them to personal hygiene
d) make correct choice, use and care for clothes and shoes.

2.2.0 Content

2.2.1 Good grooming:

- care of the body
- ways of enhancing personal appearance
- care of personal items - handkerchiefs, combs, hair brushes, towels, tooth brushes, underwear

2.2.2 Choice, use and misuse of cosmetics

2.2.3 Changes in adolescence

- physical
  - personal hygiene
- emotional
- social

2.2.4 Choice, use and care of clothes and shoes - leather and canvas shoes

3.0.0 SAFETY IN THE HOME AND FIRST AID (9 Lessons)

3.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify causes of common accidents in the home
b) take appropriate measures to prevent and manage common accidents
c) prepare and assemble items in a First Aid kit
d) use medicine correctly
e) differentiate between misuse and abuse of medicine.

3.2.0 Content

3.2.1 Common accidents in the home, their causes, prevention and management

- burns and scalds
- cuts and bruises
- fractures and sprains
- suffocation and choking
- foreign bodies in the eyes, ears and nose
- shock
- fainting
- nose bleeding
- drowning
- insect stings and bites
- snake bites
- poisoning

3.2.2 Assembling a First Aid kit

3.2.3 Medicine

- basic instruction on using medicine
- misuse and abuse

4.0.0 HOUSING THE FAMILY(6 Lessons)

4.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) compare house designs in different communities
b) identify and relate locations of different areas in a house to their functions
c) explain different ways of providing family shelter
d) state and discuss factors to consider when providing family shelter.

4.2.0 Content

4.2.1 Types of houses
- traditional houses
- modern houses

4.2.2 Essential areas and their placement in a house

4.2.3 Relationship between locations of different areas in a house and their functions

4.2.4 Methods of providing family shelter

4.2.5 Factors to consider when providing family shelter.

5.0.0 CARE OF THE HOME (12 Lessons)

5.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify different types of dirt found in the home
b) choose, use and care for different types of cleaning materials and equipment
c) improvise cleaning materials and equipment
d) practice methods of removing dirt from different surfaces
e) practice cleaning different areas in the home.

5.2.0 Content

5.2.1 Classification of dirt:
- loose dirt
- fixed dirt

5.2.2 Choice, use and care of different types of cleaning materials and equipment

5.2.3 Improvisation of cleaning materials and equipment

5.2.4 Reasons for cleaning a house

5.2.5 Removing dirt from surfaces
- sweeping
- dusting
- scrubbing
- suction

5.2.6 Daily, weekly and special cleaning of different areas in a house:
- sitting/living area
- sleeping area
- sanitation area
- storage area
- dining area
- cooking area

6.0.0 KITCHEN EQUIPMENT (8 Lessons)

6.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify, use and care for kitchen equipment
b) exercise safety precautions when handling kitchen equipment
c) improvise kitchen equipment where necessary.

6.2.0 Content

6.2.1 Types of kitchen equipment and their use

6.2.2 Care of kitchen equipment
- plastics
- metals
  - stainless steel
  - aluminium
  - iron
  - enamel
- wood
- glass
- earthenware
- calabashes

6.2.3 Safety precautions when handling kitchen equipment

6.2.4 Improvisation of kitchen equipment.

7.0.0 FOOD HYGIENE (9 Lessons)

7.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) practice rules of food hygiene
b) explain the causes and prevention of food spoilage and poisoning
c) state the signs and symptoms of food poisoning
d) store perishable and dry food appropriately
e) treat water for drinking.

7.2.0 Content

7.2.1 Kitchen and food hygiene

7.2.2 Food spoilage and poisoning

7.2.3 Signs and symptoms of food poisoning

72.4 Storage of perishable and dry foods

7.2.5 Water treatment at home
- sedimentation
- filtration
- boiling
- storage

8.0.0 METHODS OF COOKING (12 Lessons)

8.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss reasons for cooking food
b) state general rules for different methods of cooking
c) state the advantages and disadvantages of different methods of cooking
d) practice different methods of cooking.

8.2.0 **Content**

8.2.1 Reasons for cooking food

8.2.2 Methods of cooking

- General rules
- Advantages and disadvantages for each method:
  - i) Moist Methods
    - boiling
    - steaming
    - frying
    - stewing
  - ii) Dry Methods
    - roasting
    - baking

9.0.0 TEXTILE FIBRES (9 Lessons)

9.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify textile fibres
b) state properties of textile fibres
c) identify types of textile fibres.

9.2.0. Content

9.2.1 Classification of fibres

- i) Natural fibres
  - animal (wool, silk)
  - plant (cotton, linen)
  - mineral (asbestos)
- ii) Man-made fibres
  - regenerated
    - viscose rayon
    - acetate rayon
  - synthetic
    - polyamides (nylon)
    - acrylonitrile (acrylic)
    - polyester (terylene)
  - elastofibres (lycra)

9.2.2 Properties of common textile fibres

- cotton
- linen
- wool
- silk
- viscose rayon
- nylon
- acrylic
- polyester

9.2.3 Physical identification of textile fibres.

10.0.0 SEWING TOOLS AND EQUIPMENT (9 Lessons)

10.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) choose, use and care for basic sewing tools and equipment
b) use and care for a sewing machine.

10.2.0 Content

10.2.1 Choice, use and care for basic sewing tools and equipment

10.2.2 Parts of a sewing machine and their functions

11.0.0 STITCHES (12 Lessons)

11.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify stitches
b) work out different types of stitches.

11.2.0 Content

11.2.1 Classification of stitches

- temporary
- permanent (joining, neatening and decorative)

11.2.2 Different types of stitches

- temporary
  - i) tacking
    - even tacks
    - long and short
    - basting/diagonal tacks
    - tailor tacks
- permanent
  - joining
  - neatening
  - decorative

FORM TWO

12.0.0 ENVIRONMENTAL HYGIENE (9 Lessons)

12.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define environmental hygiene
b) dispose refuse appropriately
c) describe the types of drainage and care for them appropriately
d) explain dangers of poor sanitation
e) discuss causes, signs, symptoms and prevention of common communicable diseases.

12.2.0 Content

12.2.1 Definition of environmental hygiene

12.2.2 Disposal of household refuse
- organic refuse
- inorganic refuse
- recycling

12.2.3 Drainage
- types of drainage
- care

12.2.4 Sanitation
- causes of poor sanitation
- dangers of poor sanitation
- common communicable diseases
  - typhoid
  - cholera
  - dysentery
  - malaria
  - bilharzia
  - scabies
  - ringworms
  - T.B. (Tuberculosis)
  - worm infestation

13.0.0 LAUNDRY EQUIPMENT (3 Lessons)

13.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify laundry equipment
b) choose, use and care for different laundry equipment

13.2.0 Content

13.2.1 Types of laundry equipment used for washing, drying, finishing and storage

13.2.2 Choice, use and care for different laundry equipment.

14.0.0 DETERGENTS AND LAUNDRY AGENTS (6 Lessons)

14.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) distinguish between soap and soapless detergents and their suitability to various fabrics
b) explain the difference between hard and soft water
c) soften hard water for laundry work
d) identify laundry agents.

14.2.0 Content

14.2.1 Soap and soapless detergents

14.2.2 Suitability of different detergents to various fabrics

14.2.3 Hard and soft water

14.2.4 Soften hard water

14.2.5 Other laundry agents
- bleaches
- starch
- laundry blue
- fabric conditioner
- salt

15.0.0 LAUNDRY PROCESSES (1 Lesson)

15.1.0 Specific Objective

By the end of the topic the learner should able to identify different laundry processes.

15.2.0 Content

15.2.1 Laundry processes
- repairing
- sorting
- soaking/steeping
- washing
- rinsing
- drying
- finishing
- storage

16.0.0 REPAIR OF CLOTHES AND HOUSEHOLD ARTICLES (6 Lessons)

16.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the importance of repairing clothes and household articles
b) differentiate wear and tear in clothes and household articles
c) repair wear and tear in clothes and household articles.

16.2.0 Content

16.2.1 Importance of timely repair of clothes and household articles
16.2.2 Wear and tear
16.2.3 Repair of clothes and household articles
- darning (holes, thin areas)
- hanging hems
- gaping seams
- replacement of buttons
- buttonhole repairs
- repair of belt loops
- patches (plain, print)

17.0.0 LAUNDERING DIFFERENT FABRICS (9 Lessons)

17.1.0 Specific Objective

By the end of the topic, the learner should be able to launder different fabrics appropriately.

17.2.0 Content

17.2.1 Laundering different fabrics
- white and coloured cottons and linens
  - knitted
  - woven
- woollens
- silks
- nylons
- acrylics
- viscose rayon's
- polyesters

17.2.2 Care labels

18.0.0 SPECIAL TREATMENT IN LAUNDRYWORK (9 Lessons)

18.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identity and remove stains
b) carry out special treatment in laundrywork.

18.2.0 Content

18.2.1 Stain Removal
- blood
- tea
- grass
- oil
- ink
- banana sap
- chewing gum
- perspiration

18.2.2 Other Special treatment in laundry work
- disinfecting
- fixing colour
- starching
- blueing
- valeting
- dry cleaning
- spotting and sponging
- fabric conditioning

19.0.0 STORAGE OF CLOTHES AND HOUSEHOLD ARTICLES (3 Lessons)

19.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) store clothes and household articles;
b) improvise storage facilities for clothes and household articles.

19.2.0 Content

19.2.1 Storage facilities
19.2.2 Methods of storing clothes and household articles
- folding
- hanging

19.2.3 Improvisation of storage facilities

20.0.0 FOOD NUTRIENTS AND NUTRITIONAL DISORDERS (18 Lessons)

20.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify food nutrients and their sources
b) explain the functions of food nutrients
c) discuss the common nutritional disorders, their signs, symptoms and management
d) discuss causes of malnutrition
e) explain principles of nutrient conservation
f) state reason for food fortification.

20.2.0 Content

20.2.1 Definitions of food, food nutrient, nutrition, balanced diet and malnutrition

20.2.2 Classification of nutrients and their sources

20.2.3 Functions of nutrients in the body

20.2.4 Causes of malnutrition

20.2.5 Common nutritional disorders, their signs, symptoms and management

- kwashiorkor
- marasmus
- anaemia
- scurvy
- goiter
- rickets/osteomalacia
- beriberi
- keratomalacia
- pellagra

20.2.6 Nutritional disorders associated with lifestyles

- diabetes
- gout
- hypertension
- obesity
- anorexia nervosa

20.2.7 Principles of nutrient conservation during

- preparation of food
- cooking
- storage

20.2.8 Food fortification

21.0.0 SEAMS (9 Lessons)

21.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) list commonly used seams
b) make samples of commonly used seams
c) choose appropriate seams.

21.2.0 Content

21.2.1 Definition of a seam

21.2.2 Commonly used seams

- inconspicuous
  - open seam
  - French seam
- conspicuous
  - overlaid seam
  - double stitched seams

21.2.3 Procedures of working commonly used seams

21.2.4 Choice of seams

22.0.0 PATTERNS AND GARMENT CONSTRUCTION (24 Lessons)

22.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) take body measurements
b) identify pattern symbols and markings and their use
c) draft and develop pattern pieces for an apron
d) lay out and transfer pattern symbols and markings on to the fabric correctly
e) cut out and make the apron.

22.2.0 Content

22.2.1 Body measurements

22.2.2 Pattern symbols and markings

22.2.3 Drafting and developing patterns for an apron

- double bib
- waistband
- skirt
- pocket
- neckband
- frills (optional)

22.2.4 Making the apron

23.0.0 CONSUMER AWARENESS (2 Lessons)

23.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of consumer education
b) state sources of consumer information.

23.2.0 Content

23.2.1 Definitions of consumer, consumer education, goods, services
23.2.2 Importance of consumer education
23.2.3 Sources of consumer information

24.0.0 ADVERTISEMENT (3 Lessons)

24.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) discuss types of advertisements
b) state forms of advertisement
c) interpret and use advertisements wisely.

24.2.0 Content

24.2.1 Types of advertisements
- informative
- persuasive
- competitive

24.2.2 Forms of advertisement
- electronic media
- print media
- person to person

24.2.3 Effects of advertisements on the consumer
- negative
- positive

FORM THREE

25.0.0 MEAL PLANNING AND MANAGEMENT (24 Lessons)

25.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) state the importance of meal planning
b) discuss factors to consider when planning meals
c) plan and prepare meals to meet individuals needs
d) present meals attractively
e) plan and prepare packed meals.

25.2.0 Content

25.2.1 Importance of meal planning

25.2.2 Factors to consider when planning meals

25.2.3 Plan, prepare and present meals for the family and special groups

- young children
- adolescents
- manual workers
- invalids
- convalescents
- elderly

25.2.4 Packed meals

26.0.0 MATERNAL CHILD HEALTH CARE (12 Lessons)

26.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the importance of safe parenthood
b) state the signs of pregnancy
c) explain common problems in pregnancy
d) discuss the needs of a pregnant woman
e) explain the importance of ante-natal and post-natal care.

26.2.0 Content

26.2.1 Safe parenthood

- nutritional needs
- social preparation
- psychological preparation
- voluntary counselling and testing (VCT) in HIV
- age of the parents

26.2.2 Pregnancy

- signs of pregnancy
- common problems during pregnancy

26.2.3 Needs of a pregnant woman

- nutritional needs
- physical needs
- emotional needs
- social needs
  - role of the family

26.2.4 Ante-natal care

- definition
- factors that affect normal foetal development
  - STIs
  - H.I.V/AIDS
  - alcohol
  - smoking
  - drugs
  - trauma
  - german measles
  - nutrient deficiency
- activities at the antenatal clinics
- role of Traditional Birth Attendants (TBA)

26.2.5 Post-natal care

- definition
- importance of post-natal care
- activities at the post-natal clinic
- care of the lactating mother
- growth monitoring and promotion

27.0.0 CHILD IMMUNIZATION (2 Lessons)

27.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define immunization
b) discuss the importance of immunization
c) explain the immunization schedule.

27.2.0 Content

27.2.1 Definition of immunization
27.2.2 Importance of immunization
27.2.3 Immunization schedule for young children
- BCG
- diptheria, whooping cough (pertussis), tetanus, hepatitis B, H. influenza type B
- polio
- measles
- yellow fever
- supplementation - vitamin A

28.0.0 BREAST FEEDING (6 Lessons)

28.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) explain how to care for a lactating mother
b) explain the importance of breastfeeding
c) state the problems related to breastfeeding
d) state advantages and disadvantages of supplementary/complementary feeding
e) practice proper care of feeding equipment.

28.2.0 Content

28.2.1 Care of a lactating mother
28.2.2 Importance of breastfeeding
28.2.3 Problems related to breastfeeding and how to overcome them
28.2.4 Advantages and disadvantages of supplementary/complementary feeding
28.2.5 Care of feeding equipment
- handling
- cleaning
- storage

29.0.0 WEANING THE BABY (4 Lessons)

29.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) define weaning;
b) state factors to consider when weaning a baby
c) choose and prepare suitable weaning foods
d) discuss problems related to weaning and their management.

29.2.0 Content

29.2.1 Definition of weaning
29.2.2 Factors to consider when weaning a baby
29.2.3 Choice and preparation of weaning foods
29.2.4 Problems related to weaning and how to deal with them

30.0.0 HABIT TRAINING (6 Lessons)

30.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) explain the importance of habit training
b) discuss the role of play in child development
c) choose, make and care of play items.

30.2.0 Content

30.2.1 Importance of habit training
30.2.2 Role of play in child development
30.2.3 Choice and care of play items
30.2.4 Making play items

31.0.0 FLOUR MIXTURES AND RAISING AGENTS (28 Lessons)

31.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) classify different flour mixtures
b) explain how raising agents work
c) make food items using flour mixtures.

31.2.0 Content

31.2.1 Classification of flour mixtures
- batters
- dough

31.2.2 Types and functions of raising agents
- biological
- chemical
- mechanical

31.2.3 Food items made from different flour mixtures
- pancakes
- short crust pastries
- cakes
  - rubbed in
  - creamed
- bread/doughnuts

32.0.0 CLOTHING CONSTRUCTION PROCESSES (44 Lessons)

32.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss processes in garment construction
b) apply the processes in the construction of a garment.

32.2.0 Content

32.2.1 Management of fullness

32.2.2 Pockets

- in-seam pocket
- patch pocket

32.2.3 Interfaced waistband

32.2.4 Openings and fastenings

- button and worked button holes
- hook and eye/bar
- zips
  - concealed
  - semi-concealed

32.2.5 Hem management

- hemming
- slip hemming

32.2.6 Make one of the following:

- skirt
- pair of shorts
- pair of trousers

33.0.0 PRINCIPLES OF WISE BUYING (3 Lessons)

33.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss factors influencing consumer buying
b) explain principles of wise buying
c) state the advantages and disadvantages of common methods of buying.

33.2.0 Content

33.2.1 Factors influencing consumer buying

33.2.2 Principles of wise buying

33.2.3 Common methods of buying goods and services

34.0.0 MAKING A BUDGET (3 Lessons)

34.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of budgeting;
b) make a budget.

34.2.0 Content

34.2.1 Importance of budgeting

34.2.2 Steps in making a budget

FORM FOUR

35.0.0 CARE OF THE SICK AT HOME (12 Lessons)

35.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) state reasons for taking care of the sick at home
b) identify the needs of the sick at home
c) discuss preventative measures in the spread of infections.

35.2.0 Content

35.2.1 Reasons for caring for the sick at home

35.2.2 Care for the sick at home

- physical needs
- emotional needs
- nutritional needs
- social needs
- spiritual needs

35.2.3 Preventative measures in the spread of infections

36.0.0 VENTILATION (4 Lessons)

36.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss reasons for sufficient ventilation in a room
b) identify ways of ventilating a room.

36.2.0 Content

36.2.1 Reasons for adequate ventilation in a room

36.2.2 Dangers of poor ventilation

36.2.3 Ways of ventilating a room

- natural
- mechanical

37.0.0 FUELS IN THE HOME (8 Lessons)

37.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify fuels used in the home
b) discuss the advantages and disadvantages of the fuels
c) explain the precautions to take while handling fuels in the home
d) explain methods of conserving energy.

37.2.0 Content

37.2.1 Fuels used in the home

- wood
- charcoal
- kerosene
- gas
- electricity
- bio-gas
- solar
- others

37.2.2 Advantages and disadvantages of fuels used in the home

37.2.3 Precautions to take while handling and storing fuels in the home

37.2.4 Methods of conserving energy

38.0.0 LIGHTING IN THE HOME (8 Lessons)

38.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify sources of light;
b) explain methods of lighting a house;
c) discuss reasons for appropriate lighting;
d) care for lighting fixtures and lamps.

38.2.0 Content

38.2.1 Sources of light
- natural
- artificial

38.2.2 Methods of lighting the home
- direct lighting
- semi-direct lighting
- indirect lighting
- decorative lighting

38.2.3 Reasons for appropriate lighting

38.2.4 Care of lighting fixtures and lamps

39.0.0 SOFT FURNISHINGS IN THE HOME (20 Lessons)

39.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the colour wheel
b) discuss factors to consider when choosing soft furnishings for the home
c) choose and arrange flowers for different occasions.

39.2.0 Content

39.2.1 Colour wheel
- choice of colour
- colour scheme

39.2.2 Furniture and soft furnishings
- definitions
- reasons for using soft furnishings
- choice of soft furnishings

39.2.3 Flower arrangement
- points to consider in flower arrangements

40.0.0 FOOD PRESERVATION (12 Lessons)

40.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) explain the reasons for preserving food
b) state advantages and disadvantages of food preservation
c) discuss methods of preserving food.

40.2.0 Content

40.2.1 Definition of food preservation
40.2.2 Reasons for preserving food
40.2.3 Advantages and disadvantages of food preservation
40.2.4 Methods of preserving food
- traditional
- modern

41.0.0 CONVENIENCE FOODS (2 Lessons)

41.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) explain the meaning of convenience foods
b) identify convenience foods
c) state the advantages and disadvantages of convenience foods.

41.2.0 Content

41.2.1 Meaning of convenience foods
41.2.2 Convenience foods
41.2.3 Advantages and disadvantages of convenience foods

42.0.0 RÉCHAUFFÉ COOKERY (8 Lessons)

42.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define réchauffé cookery
b) state the advantages and disadvantages of using left-over foods
c) discuss factors to consider when using left-over foods
d) make réchauffé dishes.

42.2.0 Content

42.2.1 Definition of réchauffé cookery
42.2.2 Advantages and disadvantages of using left over foods
42.2.3 Storage of left over foods
42.2.4 Factors to consider when using left over foods
42.2.5 Réchauffé dishes

43.0.0 CLOTHING CONSTRUCTION PROCESSES (52 Lessons)

43.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss selected processes in garment construction
b) apply the processes in garment construction.

43.2.0 Content

43.2.1 Processes in garment construction

- collars
  - straight
  - curved
- cuffs
- set-in sleeves
- facings and interfacings

43.2.2 Make one of the following

- shirt
- blouse

44.0.0 PROBLEMS OF THE CONSUMER (2 Lessons)

44.1.0 Specific Objective

By end of the topic the learner should be able to discuss common problems affecting the consumer.

44.2.0 Content

44.2.1 Problems of a consumer

- scarcity of resources
- inflation
- lack of information
- lack of awareness of ones rights

45.0.0 CONSUMER PROTECTION (4 Lessons)

45.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of consumer protection
b) state the rights of a consumer
c) identify consumer protection agencies.

45.2.0 Content

45.2.1 Importance of consumer protection
45.2.2 Rights of a consumer
45.2.3 Agencies dealing with consumer protection

APPENDIX 1

SUGGESTED LEARNING/TEACHING RESOURCES
Needlework Tools and Equipment

1. Sewing Machines (choose whichever is suitable)
   - Treadle
   - Electric
   - Hand
2. Ironing Surfaces
   - Ironing board
   - Ironing table/blanket/sheet
   - Sleeve board
3. Cutting out table
4. Large mirror
5. Storage cupboards/wardrobes
   - clothes hangers
6. Scissors
   - dressmakers shears
   - buttonholes scissors
   - embroidery scissors
   - paper scissors
7. Tape measures
8. Dressmakers pins
9. Needles
10. Tracing wheels/dressmakers carbon papers
11. Metre rulers
12. Seam rippers
13. Stilettos *
14. Bodkin *
15. Tailors chalk
16. French curve *

* Not compulsory

Sewing Notions

- machine sewing threads
- tacking thread
- materials for coursework and samples
- trimmings – ribbons, lace, embroidery threads (depending on coursework articles)
- fasteners

Cooking tools and equipment

1. Cookers/stoves (choose which ever is suitable)
   - gas
   - electric
   - kerosene
   - charcoal
   - firewood
   - micro wave
2. Food storage equipment
   - cupboards
   - refrigerators
3. Saucepans/sufurias/ pots (all with covers)
4. Frying pans
   - deep frying pan
   - flat frying pan
5. Clay pots
6. Pressure cooker
7. Knives
   - kitchen knife (French chef knife)
   - vegetable knife
   - bread knife
   - palette knife
   - potato peeler
   - table knives
8. Spoons
   - tablespoons
   - dessert spoons
   - teaspoons
   - serving spoon
   - ladle
   - wooden spoons (mwiko)
9. Forks
10. Cups
    - plastic
    - tea cups
    - mugs
11. Drinking glasses
12. Fish slice
13. Flour dredgers
14. Sieves
    - large
    - small
15. Mixing bowls
16. Chopping boards
17. Plates
    - kitchen - plastic, enamel
    - table
    - platters
18 Measuring/equipment
    - measuring jug
19. Rolling pins
20. Casserole dishes *
21. Serving dishes
22. Graters
23. Kettles
24. Kitchen scissors *
25. Mortar and pestle *
26. Salt shakers

27. Water jug
28. Trays
29. Whisks
    - hand
    - rotary
30. Potato mashers
31. Skewers *
32. Weighing scales
33. Roasting dish
34. Dustbin with cover
35. Labour saving, equipment *
    - meat miner
    - food processors
    - blenders
    - juicers
    - extractors
    - deep friers
    - rice cookers
    - shredders
    - sandwich makers

* Not compulsory

Baking Equipment

1. baking tins
2. baking trays
3. cooling trays
4. bread tins

Cleaning and Laundering Equipment

1. Water storage equipment
2. Water heater
3. Basins
4. Buckets
5. Dustpan
6. Brooms
    - yard broom
    - soft broom
    - carpet brush *
7. Brushes
    - clothes brush
    - scrubbing brush
    - shoe brushes
    - cobweb brush
    - bottle brush
8. Rubber squeezers *
9. Floor mops, rags or clothes
10. Dusters
11. Clothes line
12. Pegs
13. Hangers
14. Irons
15. Ironing surfaces
16. Soap dishes
17. Garbage bin with cover (large)

* Not compulsory

APPENDIX II

SUGGESTED ASSESSMENT METHODS

1. Practical work
2. Project work
3. Field trips
4. Oral questions
5. Quizzes
6. Written tests and examination
7. Group reports

This new secondary syllabus replaces the original 8-4-4 education syllabus which was first introduced in 1986 and revised in 1992. It is available in four volumes. **Volume one** contains English, Kiswahili, Arabic, French, German and Physical Education. **Volume two** contains Mathematics, Physics, Chemistry, Biology, Agriculture and Homescience. **Volume three** contains History and Government, Geography, Business Studies, Christian Religious Education, Islamic Religious Education and Hindu Religious Education. **Volume four** contains Art and Design, Computer Studies and Music.

In each syllabus the objectives have been more clearly defined and the content spelt out more specifically to give better guidance to the users.

The issue of overload in the secondary curriculum has been addressed by a reduction in the number of subjects and content in the different subject areas. The reorganization of the syllabuses has been done in such a way that better mastery of the knowledge, skills and attitudes required at the end of the secondary cycle is ensured.

The reorganisation has also tried to ensure that the cost of education on the part of both the government and households will be significantly reduced. Careful consideration has been given to the resources required to implement this curriculum in order to make the cost manageable. Most of the resources can either be improvised, obtained locally or acquired at fairly low costs.

A special feature of the revised curriculum is the deliberate attempt to respond to the contemporary needs of society. This has been done by the inclusion of such emerging issues as health, environmental and civic education, gender and the anticipated industrial transformation of the nation.

In this rationalization most of the Technical and Industrial subjects have been moved to training institutions. Essential competencies earlier acquired through the Business Education subjects will be taught in the new integrated Business Studies subject.

The teaching of English and Kiswahili will remain integrated. The revised syllabuses have clearly defined the integrated approach to make the teaching of the languages more effective.

NAOMY W. WANGAI
Director of Education

NATIONAL GOALS OF EDUCATION

Education in Kenya should:

2. foster nationalism, patriotism and promote national unity

Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. It is a paramount duty of education to help the youth acquire this sense of nationhood by removing conflicts and by promoting positive attitudes of mutual respect which enable them to live together in harmony, and foster patriotism in order to make a positive contribution to the life of the nation.

2. promote the social economic, technological and industrial needs for national development

Education should prepare the youth of the country to play an effective and productive role in the life of the nation.

a) Social Needs

Education in Kenya must prepare children for the changes in attitudes and relationships which are necessary for the smooth process of a rapidly developing modern economy. There is bound to be a silent social revolution following in the wake of rapid modernization. Education should assist our youth to adapt to this change.

b) Economic Needs

Education in Kenya should produce citizens with skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a modern and independent economy which is in need of adequate domestic manpower.

c) Technological and Industrial Needs

Education in Kenya should provide the learners with the necessary skills and attitudes for Industrial development. Kenya recognizes the rapid industrial and technological changes taking place especially in the developed world.

We can only be part of this development if our education system deliberately focused on knowledge, skills and attitudes that will prepare the youth for these changing global trends.

3. promote individual development and self –fulfillment

Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential interests and abilities. A vital aspect of individual development is character building.

4. promote sound moral and religious values

Education should provide for the development of knowledge, skills and attitudes that will enhance acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

5. promote social equality and responsibility

Education should promote social equality and foster a sense of social responsibility within an education system which provides equal educational opportunities for all. It should give all children varied and challenging opportunities for collective activities ad corporate social service irrespective of gender, ability or geographical environment.

6. promote respect for and development of Kenya's rich and varied cultures

Education should instill in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. The children should be able to blend the best of traditional values with the changed requirements that must follow rapid development in order to build a stable and modern society.

7. promote international consciousness and foster positive attitudes towards other nations

Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should therefore lead the youth of the country to accept membership in this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

8. promote positive attitudes towards good health and environmental protection

Education should inculcate in the youth the value of good health in order to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth to appreciate the need for a healthy environment.

OBJECTIVES OF SECONDARY EDUCATION

Secondary Education should provide the learner with opportunities to:

1. acquire necessary knowledge, skills and attitudes for the development of the self and the nation

2. promote love for and loyalty to the nation

3. promote harmonious co-existence among the peoples of Kenya

4. develop mentally, socially morally, physically and spiritually

5. enhance understanding and respect for own and other people's cultures and their place in contemporary society

6. enhance understanding and appreciation of inter-relationships among nations

7. promote positive environmental and health practices

8. build a firm foundation for further education and training

9. develop ability for enquiry, critical thinking and rational judgment

10. develop into a responsible and socially well adjusted person

11. promote acceptance of and respect for all persons

12. enhance enjoyment in learning

13. identify individual talents and develop them

14. build a foundation for technological and industrial development

15. develop into a self-disciplined individual who appreciates work and manages time properly.

MATHEMATICS

INTRODUCTION

Secondary Mathematics aims at producing a person who will be numerate, orderly, logical, accurate and precise in thought. The person should also be competent in appraising and utilizing mathematical skills in playing a positive role in the development of a modern society.

In preparing this course care has been taken to ensure not only continuity, but also the reinforcement and broadening of the basic skills already established in the eight years of primary education. While greater emphasis has been placed in the needs of learners who will leave the normal education at the end of the four year secondary cycle, the course will also prepare learners who will pursue further studies in the subject and other related courses.

This syllabus has been reorganized and streamlined to remove overloads in the content and overlaps of certain content evident in the previous Mathematics syllabus. Effort has been made to bridge the gap between Primary and Secondary Mathematics.

The syllabus has emphasized application of Mathematics to real life experiences and practical approaches to teaching and learning in an effort to address such contemporary issues as information technology, health, gender and integrity. However, apart from the use of calculators which has been introduced in the course, as a technological device most of the other issues will be addressed by way of examples and exercises in support materials.

The objectives of teaching Mathematics have been expanded to enhance clarity. In addition notes have been included with the aim of not only assisting in the interpretation of the syllabus, but also to alert the teacher on some precautions required in handling the different topics. Also included in the notes are suggested resources and further assessment. Time for each topic have been suggested.

The course has been designed to enable the learner to acquire attitudes, knowledge and skills which will be relevant to his/her life after school. It is also expected to enable the learner to foster a positive attitude towards Mathematics appreciating its usefulness and relevance to a modern society.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

10. develop a positive attitude towards learning Mathematics

11. perform mathematical operations and manipulations with confidence, speed and accuracy

12. think and reason precisely, logically and critically in any given situation

13. develop investigative skills in Mathematics

14. identify, concretise, symbolise and use Mathematical relationships in everyday life

15. comprehend, analyse, synthesise evaluate and make generalizations so as to solve mathematical problems

16. collect, organise, represent, analyse, interprete data and make conclusions and predictions from its results

17. apply mathematical knowledge and skills to familiar and unfamiliar situations

18. appreciate the role, value and use of Mathematics in society

10. develop a willingness to work collaboratively

11. acquire knowledge and skills for further education and training

12. communicate mathematical ideas

Symbols:

The use of SI units will be applied throughout this syllabus. Besides the usual operational symbols **+, -,** x**, ÷,** the combined ± will also be used.

Rational symbols

= is equal to.

≠ is not equal to.

> is greater than.

≥ is greater than or equal to.

< is less than.

is less than or equal to.

a: b ratio of a to b.

α Varies as.

≡ is congruent to or is identical to.

≈ is approximately equal to.

FORM ONE

1.0.0 NATURAL NUMBERS
(4 Lessons)

1.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
e) identify, read and write natural numbers in symbols and words
f) round off numbers to the nearest tens, hundreds, thousands, millions and billions
g) classify natural numbers as even, odd or prime
h) solve word problems involving natural numbers.

1.2.0 Content
1.2.1 Place values of numbers
1..2.2 Round off numbers to the nearest tens, hundreds, thousands, millions and billions
1.2.3 Odd numbers
1.2.4 Even numbers
1.2.5 Prime numbers
1.2.6 Word: problems involving natural numbers

Notes
- Include reading and writing large numbers - millions and billions
- Use word problems to involve the four basic operations
- Reinforce the idea of place value and total value of natural numbers.
- **Suggested Resources**
  - Place value charts
  - The abacus
  - Bank cheques and State ments
- **Suggested Further Assessment**
  - puzzles and games

2.0.0 FACTORS (4 lessons)

2.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
d) express composite numbers in factor form
e) express numbers as product of prime factors
f) express factors in power form.

2.2.0 Content
2.2.1 Factors of composite numbers
2.2.2 Prime factors
2.2.3 Factors in power form

Notes
- Use of "index" for "power" is discouraged at this stage.
- **Suggested Resources**
  Charts to illustrate factorisation e.g. factor tree diagrams.
- **Suggested Further Assessment**
  - puzzles and games

3.0.0 DIVISIBILITY TESTS

3.1.0 Specific Objectives
By the end of the topic, the learner should be able to test the divisibility of numbers by 2, 3, 4, 5, 6, 8, 9, 10 and 11

3.2.0 Content
3.2.1 Divisibility test of numbers by 2, 3,4,5,6,8,9,10, and 11

Notes
- **Suggested Resources**
  - Multiplication table
  - Charts to illustrate divisibility test
- **Suggested Further Assessment**
  - Puzzles and games

4.0.0 GREATEST COMMON DIVISOR(GCD) / HIGHEST COMMON FACTOR (HCF)
(4 lessons)

4.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
c) find the GCD/HCF of a set of numbers
d) apply GCD to real life situations.

4.2.0 **Content**
4.2.1 Greatest common divisor of a set of numbers
4.2.2 Application of GCD/HCF to real life situations

Notes

- **Suggested Resources**
  - Containers of different capacities
- **Suggested Further Assessment**
  - Quiz
  - Practical exercises

5.0.0 LEAST COMMON MULTIPLE (L.C.M.) (5 Lessons)

5.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) list multiples of numbers
e) find the least common multiple of a set of numbers
f) apply knowledge of LCM in real life situations.

5.2.0 Content

5.2.1 Multiples of a number
5.2.2 LCM of a set of numbers
5.2.3 Application of LCM in real life situations

Notes

- **Suggested Resources**
  - Bells, flickering light, alarms, containers of different capacities etc.
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 1.00 to 5.00 can be given at this stage

6.0.0 INTEGERS (12 Lessons)

6.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) define integers
g) identify integers on a number line
h) perform the four basic operations on integers using the number line
i) work out combined operations on integers in the correct order
j) apply knowledge of integers to real life situations.

6.2.0 Content

6.2.1 Integers
6.2.2 The number line
6.2.3 Operation on integers
6.2.4 Order of operations
6.2.5 Application to real life situations

Notes

- Practical exercises are encouraged
- More practice required on directed numbers especially when subtracting negative integers
- Explain the term directed numbers.
- **Suggested Resources**
  - the number line
  - stairways
  - ladder
  - thermometer
  - real life situations
- **Suggested Further Assessment**
  - Short test on 6.00
  - Puzzles and games

7.0.0 FRACTIONS (12 lessons)

7.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) identify proper and improper fractions and mixed numbers
h) convert mixed numbers to improper fractions and vise versa
i) compare fractions
j) perform the four basic operations on fractions
k) carry out combined operations on fractions in the correct order
l) apply the knowledge of fractions to real life situations.

7.2.0 Content

7.2.1 Fractions
7.2.2 Proper, improper fractions and mixed numbers
7.2.3 Conversion of improper fractions to mixed numbers and vice versa
7.2.4 Comparing fractions
7.2.5 Operations on fractions
7.2.6 Order of operations on fractions
7.2.7 Word problems involving fractions in real life situations

Notes

- Treat fractions with positive and negative cases in the same way as integers or as directed numbers.
- Give emphasis and time to the correct order of operations.
- Use of real objects is encouraged
- Include equivalent fractions

- **Suggested Resources**

- Chart illustrating operations on fractions and equivalent fractions
- Real life situations

- **Suggested Further Assessment**
  - Puzzles and games
  - Short test on fractions

8.0.0 DECIMALS (12 Lessons)

8.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) convert fractions into decimals and vice versa
j) identify recurring decimals
k) convert recurring decimals into fractions
l) round off a decimal number to the required number of decimal places
m) write numbers in standard form
n) perform the four basic operations on decimals
o) carry out operations in the correct order
p) apply the knowledge of decimals to real life situations.

8.2.0 Content

8.2.1 Fractions and decimals
8.2.2 Recurring decimals
8.2.3 Recurring decimals and fractions
8.2.4 Decimal places
8.2.5 Standard form
8.2.6 Operations on decimals
8.2.7 Order of operations
8.2.8 Real life problems involving decimals

Notes

- Explain the recurring decimal notation of the form;

  6.3 = (6.33 ……)

  6.34 = (6.3434……..)

  6.34 = (6.3444……)

  6.345 = (6.345345 ……)

  6.345 = (6.34545 …….)

  6.345 = (6.34555…….)

- Explain numbers in standard form i.e. A x 10^n where 1 # A < 10^n and n is an integer
- Mention the use of statements such as 5.6million, 3.9 million, 2.1 billion
- Emphasize on the cancellation process on problems of the type;
  $\frac{0.036 \times 0.0049}{0.07 \times 0.048}$
- **Suggested Resources**
  - real life situations
- **Suggested Further Assessment**
  - Test on topics 6.00 - 8.00 can be given at this stage.
  - puzzles and games.

9.0.0 SQUARES AND SQUARE ROOTS (12 Lessons)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

e) find squares of numbers by multiplication
f) find squares from tables
g) find square root by factor method
h) find square root from tables.

9.2.0 Content

9.2.1 Squares by multiplication
9.2.2 Squares from tables
9.2.3 Square roots by factorization
9.2.4 Square roots from tables

Notes

- Use four figure mathematical tables.
- When finding the square roots of a number, the number should be written in the form A x 10^n where 1 # A < 100 and n is an even integer.
- **Suggested Resources**
  - Mathematical tables
  - Real life experiences
- **Suggested Further Assessment**
  - Puzzles and games
  - Short test on 9.00

10.0.0 ALGEBRAIC EXPRESSIONS (14 Lessons)

10.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) use letters to represent numbers
i) write statements in algebraic form
j) simplify algebraic expressions
k) factorise an algebraic expressions by grouping
l) remove brackets from algebraic expressions
m) evaluate algebraic expressions by substituting numerical values
n) apply algebra in real life situations.

10.2.0 **Content**
10.2.1 Letters for numbers
10.2.2 Algebraic expressions including algebraic fractions
10.2.3 Simplification of algebraic expressions
10.2.4 Factorisation by grouping
10.2.5 Removal of brackets
10.2.6 Substitution and evaluation
10.2.7 Problem solving in real life situation

Notes

- Use the idea of like and unlike terms in simplification and factorisation of algebraic expressions
- Use the term expansion when removing brackets
- Apply brackets in simplifying expressions

Suggested Resources

- Real life experiences

Suggested Further Assessment

- Short test on algebra
- Puzzles and games

11.0.0 RATES, RATIO, PERCENTAGES AND PROPORTION (18 Lessons)

11.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

m) define rates
n) solve problems involving rates
o) define ratio
p) compare two or more quantities using ratios
q) change quantities in a given ratio
r) compare two or more ratios
s) represent and interpret proportional parts
t) recognise direct and inverse proportions
u) solve problems involving direct and inverse proportions
v) convert fractions and decimals to percentages and vice-verse
w) calculate percentage change in a given quantity
x) apply rates, ratio, percentage to real life situations.

11.2.0 **Content**
11.2.1 Rates
11.2.2 Solving problems involving rates
11.2.3 Ratio
11.2.4 Comparing quantities using ratio
11.2.5 Increase and decrease in a given ratio
11.2.6 Comparing ratios
11.2.7 Proportion: direct and inverse.
11.2.8 Solve problems direct and inverse proportions.
11.2.9 Fractions and decimals as percentages
11.3.10 Percentage increase and decrease
11.3.11 Application of rates, ratios, percentages and proportion to real life situations

Notes

- Exclude graphs on rates at this stage
- Include speed, velocity and acceleration

- **Suggested resources**
  - Real life situations involving quantities, shares, sharing etc.
- **Suggested further assessment**
  - Test on topics 9.00 and 10.00 can be given here

12.0.0 LENGTH (6 Lessons)

12.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

e) state the units of measuring length
f) convert units of length from one form to another
g) express numbers to required number of significant figures
h) find the perimeter of a plane figure and circumference of a circle(include length of arcs).

12.2.0 Content
12.2.1 Units of length

12.2.2 Conversion of units of length from one form to another
12.2.3 Significant figures
12.2.4 Perimeter
12.2.5 Circumference(include length of arcs)

Notes

- Encourage practical approach to establish the value of π and the relationship $C = \pi D$ or $C = 2\pi r$
- Include lengths of arcs taken as fractions of circumference
- **Suggested Resources**
  - Measuring instrument eg. Metre rule, vernier callipers, micrometre screw gauge, tape measure etc
  - Environment
- **Suggested Further Assessment**
  - Practical exercises in measuring
  - Short test on 12.00

13.0.0 AREA (6 Lessons)

13.1.0 Specific Objectives

By the end of the topic the learner should be able to:

f) state units of area
g) convert units of area from one form to another
h) calculate the area of a regular plane figure including circles
i) estimate the area of irregular plane figures by counting squares
j) calculate the surface area of cubes, cuboids and cylinders.

13.2.0 Content

13.2.1 Units of area
13.2.2 Conversion of units of area
13.2.3 Area of regular plane figures
13.2.4 Area of irregular plane shapes
13.2.5 Surface area of cube, cuboid and cylinder

Notes

- Deriving area of circle practically using very small sectors is required.
- Include "acres" and "hectares"
- Derive surface area of cylinders.
- Include combined areas of shapes
- Include conversion of cm^2 to m^2 etc.

- **Suggested Resources**
  - Model of cube, cuboid and cylinder
  - Charts illustrating regular plane figures
  - Plane figures
  - Environment
- **Suggested Further Assessment**
  - Practical exercises in the process of deriving formulae for areas.

14.0.0 VOLUME AND CAPACITY (6 Lessons)

14.1.0 Specific Objectives

By the end of the topic the learner should be able to:

h) state units of volume
i) convert units of volume from one form to another
j) calculate volume of cubes, cuboids and cylinders
k) state units of capacity
l) convert units of capacity from one form to another
m) relate volume to capacity
n) solve problems involving volume and capacity.

14.2.0 Content

14.2.1 Units of volume
14.2.2 Conversion of units of volume
14.2.3 Volume of cube, cuboid and cylinders
14.2.4 Units of capacity
14.2.5 Conversion of units of capacity
14.2.6 Relationship between volume and capacity
14.2.7 Solving problems involving volume and capacity

Notes

- deriving the formula for finding volume of a cylinder is not required.
- Involve conversion of sm^3 to m^3 etc
- **Suggested Resources**
  - Containers
  - Measuring cylinders
  - Burrettes
- **Suggested Further Assessment**
  - Practical exercises.
  - Short test on volume

15.0.0 MASS, DENSITY AND WEIGHT (4 LESSONS)

15.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) define mass
i) state units of mass
j) convert units of mass from one form to another
k) define weight
l) state units of weight
m) distinguish mass and weight
n) relate volume, mass and density.

15.2.0 Content

15.2.1 Mass and units of mass
15.2.2 Density
15.2.3 Problem solving involving real life experiences on mass, volume and density and weight
15.2.4 Weight and units of weight
15.2.5 Mass and weight

Notes

- Explain the difference between mass and weight
- Explain the relationship $\frac{\text{mass}}{\text{volume}} = \text{density}$ and units of density
- **Suggested Resources**
  - Beam balance
  - Lactometer
- **Suggested Further Assessment**
  - Practical exercises in finding density of solids
  - Short test on 15.00

16.0.0 TIME (4 Lessons)

16.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

e) convert units of time from one form to another
f) relate the 12 hour and 24 hour clock systems
g) read and interpret travel time-tables
h) solve problems involving travel time tables

16.2.0 **Content**

16.2.1 Units of time
16.2.2 12 hour and 24 hour systems
16.2.3 travel time-tables
16.2.4 problem solving involving travel time tables

Notes

- Actual travel time-tables should be used
- Include speed and distance
- Mention distance and fare tables
- **Suggested Resources**
  - Charts illustrating conversion of time from one system to another
  - Clocks and watches
  - Travel time table charts for buses, trains, ships and aeroplanes
- **Suggested Further Assessments**
  - Test on topics 11.00 - 15.00 can be given at this stage

17.0.0 LINEAR EQUATIONS (12 Lessons)

17.1.0 Specific Objectives

By the end of the topic the learner should be able to:

d) solve linear equations in one unknown
e) solve simultaneous linear equations by substitution and elimination
f) form and solve linear equations in one and two unknown.

17.2.0 **Content**

17.2.1 Linear equations in one unknown
17.2.2 Simultaneous linear equations
17.2.3 Formation and solution of linear equations in one and two unknowns from given real life situations

Notes

- **Suggested Resources**
  - Beam balances
  - Real life situations and experiences
- **Suggested Further Assessment**
  - puzzles and games
  - Test on topics 16.00 and 17.00 can be given here

18.0.0 COMMERCIAL ARITHMETIC 1 (6 Lessons)

18.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) state the currencies of different countries
h) convert currency from one form into another given the exchange rates
i) calculate profit and loss
j) express profit and loss as percentages
k) calculate discount and commission
l) express discount and commission as percentage.

18.2.0 **Content**
18.2.1 Currency
18.2.2 Current currency exchange rates
18.2.3 Currency conversion
18.2.4 Profit and loss
18.2.5 Percentage profit and loss
18.2.6 Discounts and commissions
18.2.7 Percentage discounts and commissions

Notes

- Include currency exchange and buying and selling tables.
- Knowledge of change and balances in purchases is assumed. However, problems involving change and balances should be given.

- **Suggested Resources**
  - Actual current exchange rate table from newspapers etc
  - Prevailing real life situations
- **Suggested Further Assessment**
  - Short test on 18.00

19.0.0 CO-ORDINATES AND GRAPHS(14 Lessons)

19.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) draw and label the complete cartesian plane
i) locate and plot points on the cartesian plane
j) choose and use appropriate scale for a given data
k) make a table of values for a given linear relation
l) use values to draw a linear graph
m) solve simultaneous linear equations graphically
n) draw, read and interprete graphs.

19.2.0 **Content**
19.2.1 Cartesian plane
19.2.2 Cartesian co-ordinates
19.2.3 Points on the cartesian plane
19.2.4 Choice of appropriate scale
19.2.5 Table of values for a given linear relation
19.2.6 Linear graphs
19.2.7 Graphical solutions of simultaneous linear equations
19.2.8 Interpretation of graphs

Notes

- Co-ordinates should include both positive and negative values

- **Suggested Resources**
  - Cartesian plane
  - Square board
  - Pegboards/geoboards
  - Graph papers
  - Topographical maps
- **Suggested Further Assessment**
  - Test on Topics 18.00 and 19.00 can be given here

20.0.0 ANGLES AND PLANE FIGURES (6 Lessons)

20.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) name and identify types of angles
j) solve problems involving angles on a straight line
k) solve problems involving angles at a point
l) solve problems involving angles on a transversal
m) solve problems involving corresponding angles
n) state angle properties of polygons
o) solve problems involving angle properties of polygons
p) apply the knowledge of angle properties to real life situations.

20.2.0 **Content**
20.2.1 types of angles
20.2.2 angles on a straight line

20.2.3 angles at a point
20.2.4 angles on a transversal
20.2.5 corresponding angles
20.2.6 angle properties of polygons
20.2.7 application to real life situations

Notes

- Include exterior angles of a polygon
- Include the formula for finding the sum of interior angles of a polygon i.e sum = 2(n-2) right angles or 180(n-2), where n is the number of sides. This formula should be derived.
- **Suggested Resources**
  - Geometrical instruments
  - Polygonal shapes
- **Suggested Further Assessment**
  - Practical exercises
  - Short test on 20.00

21.0.0 GEOMETRICAL CONSTRUCTIONS
(18 lessons)

21.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) use a ruler and compasses only to construct
   i) a perpendicular bisector of a line
   ii) an angle bisector
   iii) a perpendicular to a line from a given point
   iv) a perpendicular to a line through a given point on the line
   v) angles whose values are multiples of 7½°
   vi) parallel lines
b) use a ruler and a set square to;
   i) construct parallel lines
   ii) divide a line proportionally
   iii) construct perpendicular lines
c) construct a regular polygon using
   i) ruler and compasses only
   ii) ruler, compasses and protractor
d) construct irregular polygons using a ruler, compasses and protractor

21.2.0 **Content**

21.2.1 Construction of lines and angles using a ruler and compasses only
21.2.2 Construction of perpendicular and parallel lines using a ruler and a set square only
21.2.3 Proportional division of a line
21.2.4 Construction of regular polygons (upto a hexagon)
21.2.5 Construction of irregular polygons (upto a hexagon)

Notes

- The polygons should include triangles, quadrilaterals, pentagons trapezia, parallelograms, hexagons, octagons etc.
- **Suggested Resources**
  - Geometrical instruments,
  - Polygonal shapes
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 20.00 and 21.00 can be given here

22.0.0 SCALE DRAWING
(18 Lessons)

22.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) interpret a given scale;
j) choose and use an appropriate scale
k) draw suitable sketches from given information
l) state the bearing of one point from another
m) locate a point using bearing and distance
n) determine angles of elevation and depression
o) solve problems involving bearings, elevations and scale drawing
p) apply scale drawing in simple surveying.

22.2.0 **Content**

22.2.1 Types of scales
22.2.2 Choice of scales

22.2.3 Sketches from given information and scale drawing.
22.2.4 Bearings
22.2.5 Bearings, distance and locating points
22.2.6 Angles of elevation and depression
22.2.7 Solving problems involving bearings, scale drawing, angles of elevation and depression
22.2.8 Simple surveying techniques

Notes

- Accuracy to be emphasised
- Should include true and compass bearings
- Include problems involving a combination of bearings, angles of elevation and depression and scale drawing
- **Suggested Resources**
  - geometrical instruments
  - clinometer
  - magnetic compass
  - metre rule
  - tape measure

- **Suggested Further Assessment**
  - practical exercises
  - short test on 22.00

23.0.0 COMMON SOLIDS
(18 Lessons)

23.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) identify and sketch common solids
g) sketch and accurately draw nets of solids
h) make models of solids from nets
i) calculate surface area of solids from nets
j) find distance between two points on a solid.

23.2.0 **Content**

23.2.1 Common solids, eg cubes, cuboids pyramdis, prisms, cones, spheres, cylinders etc.
23.2.2 Sketches of solids
23.2.3 Nets of solids
23.2.4 Models of solids from nets
23.2.5 Surface area of solids from nets (include cubes, cuboids, cones, pyramids, prisms)
23.2.6 Distance between two points on the surface of a solid

Notes

- Use and making of models is recommended.
- **Suggested Resources**
  - Geometrical instruments
  - Manila papers
  - Models of solids
- **Suggested Further Assessment**
  - Practical exercises
  - Test on topics 20.00 to 23.00 may be given here

FORM TWO

24.0.0 CUBES AND CUBE ROOTS (4 Lessons)

24.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) find the cube of a number by multiplication
g) find the cube root of a number by factor method
h) find cubes of numbers from mathematical tables
i) evaluate expressions involving cubes and cube roots
j) apply the knowledge of cubes and cube roots in real life situations.

24.2.0 Content

24.2.1 Cubes of numbers by multiplication
24.2.2 Cubes from tables
24.2.3 Cuberoots of numbers by factor method
24.2.4 Evaluation of cube and cuberoot expressions
24.2.3 Application of cubes and cuberoots to real life situations

Notes

- Cube roots should be found by using factor method first before using tables
- **Suggested Resources**
  - Mathematical tables
  - Real life situations
- **Suggested Further Assessment**
  - Short test on 24.20

25.0.0 RECIPROCALS (7 Lessons)

25.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) find reciprocals of numbers by division
e) find reciprocals of numbers from tables
f) use reciprocals of numbers in computation.

25.2.0 Content

25.2.1 Reciprocals of numbers by division
25.2.2 Reciprocals of numbers from tables
25.2.3 Computation using reciprocals

Notes

- Decimal numbers should be converted to standard form before finding their reciprocals using tables.
- **Suggested Resources**
  Mathematical tables
- **Suggested Further Assessment**
  - short test on 25.00

26.0.0 INDICES AND LOGARITHMS (18 Lessons)

26.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) define indices (powers);
g) state the laws of indices;
h) apply the laws of indices in calculations;
i) relate the powers of 10 to common logarithms;
j) use the tables of common logarithms and anti-logarithms in computation.

26.2.0 **Content**

26.2.1 Indices (powers) and base
26.2.2 Laws of indices (including positive integers, negative integers and fractional indices)
26.2.3 Powers of 10 and common logarithms
26.2.4 Common logarithms;
  - characteristics
  - mantissa
26.2.5 Logarithm tables
26.2.6 Application of common logarithms in multiplication, division and finding roots

Notes

- Introduce laws using integral indices.
- Laws of indices should include
  - $a^m \times a^n = a^{m+n}$
  - $a^m \div a^n = a^{m-n}$
  - $(a^m)^n = a^{mn}$
  - $a^\circ = 1$
  - $\frac{1}{} = a^m$

a^{-m}
- $a^{m/n} = \sqrt[n]{a^m}$

- **Suggested Resources**
  Logarithm tables.
  Charts illustrating laws of indices
- **Suggested Further Assessment**
  - Test on 24.00, 25.00, 26.00

27.0.0 EQUATIONS OF STRAIGHT LINES (12 Lessons)

27.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) define gradient of a straight line
l) determine the gradient of a straight line through known points
m) determine the equation of a straight line using gradient and one known point
n) express a straight line equation in the form $y = mx + c$
o) interpret the equation $y = mx + c$
p) find the x- and y- intercepts from an equation of a line
q) draw the graph of a straight line using gradient and x and y intercept
r) state the relationship of gradients of perpendicular lines
s) state the relationship of gradients of parallel lines
t) apply the relationship of gradients of perpendicular and parallel lines to get equations of straight lines.

27.2.0 Content

27.2.1 Gradient of a straight line
27.2.2 Equation of a straight line
27.2.3 The equation of a straight line of the form $y = mx + c$
27.2.4 The x and y intercepts of a line
27.2.5 The graph of a straight line
27.2.6 Perpendicular lines and their gradients
27.2.7 Parallel lines and their gradients
27.2.7 Equations of parallel and perpendicular lines.

Notes

- **Suggested Resources**
  - Square boards, graph books, straight edges/rulers, real life situations
- **Suggested Further Assessment**
  Short test on 27.00

28.0.0 REFLECTION AND CONGRUENCE (12 Lessons)

28.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) state the properties of reflection as a transformation
h) use the properties of reflection in construction and identification of images and objects
i) make geometrical deductions using reflection
j) apply reflection in the cartesian plane
k) distinguish between direct and opposite congruence
l) identify congruent triangles.

28.2.0 Content

28.2.1 lines and planes of symmetry
28.2.2 mirror lines and construction of objects and images.
28.2.3 reflection as a transformation.
28.2.4 reflection in the cartesian plane.
28.2.5 direct and opposite congruency.
28.2.6 Congruency tests (SSS, SAS, AAS, ASA and RHS)

Notes

- Practical aspects should be used as much as possible
- ASS does not prove triangles congruent except when the triangles are right angled
- Images are oppositely congruent to their objects under reflection
- **Suggested Resources**
  Mirrors, cartesian plane, various Symmetrical objects, tracing and graph papers, real life experiences
- **Suggested Further Assessment**
  - Practical exercises using mirrors and constructions
  - Short test on 28.00

29.0.0 ROTATION (12 Lessons)

29.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) state properties of rotation as a transformation
j) determine centre and angle of rotation

k) apply properties of rotation in the cartesian plane
l) identify point of rotational symmetry
m) state order of rotational symmetry of plane figure
n) identify axis of rotational symmetry of solids
o) state order of rotational symmetry of solids
p) deduce congruence from rotation.

29.2.0 Content

29.2.1 Properties of rotation
29.2.2 Centre and angle of rotation
29.2.3 Rotation in the cartesian plane
29.2.4 Rotational symmetry of plane figures and solids (point axis and order)
29.2.5 Congruence and rotation

Notes

- Encourage practicals
- Emphasise that images are directly congruent to their objects under rotation
- **Suggested Resources**
  Square boards, graph papers geometrical instruments, tracing paper and real life situations
- **Suggested Further Assessment**
  - Practical exercises,
  - Short test on 29.12

30.0.0 SIMILARITY AND ENLARGEMENT (19 Lessons)

30.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) identify similar figures
i) construct similar figures
j) state properties of enlargement as a transformation
k) apply the properties of enlargement to construct objects and images
l) apply enlargement in cartesian planes
m) state the relationship between linear, area and volume scale factors
n) apply the scale factors to real life situations.

30.2.0 Content

30.2.1 Similar figures and their properties
30.2.2 Construction of similar figures
30.2.3 Properties of enlargement
30.2.4 Construction of objects and images under enlargement.
30.2,5 Enlargement in the Cartesian plane.
30.2.6 Linear, area and volume scale factors
30.2.7 Real life situations

Notes

- Enlargement should include fractional and negative scale factors
- Apply enlargement in the cartesian coordinate system
- **Suggested Resources**
  Geometrical instruments, models maps photographs, charts illustrating similarity and enlargement.
- **Suggested Further Assessment**
  - Practical exercises.
  - Test on 27.00, 29.00, and 30.00

31.3.0 PYTHAGORAS THEOREM (4 Lessons)

31.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) derive Pythagoras Theorem
e) solve problems using Pythagoras Theorem
f) apply Pythagoras Theorem to real life situations.

31.2.0 Content

31.2.1 Pythagoras Theorem
31.2.2 Solution of problems using Pythagoras Theorem
31.2.3 Application to real life situations

Notes

- Use square cuttings to verify Pythagoras Theorem.
- **Suggested Resources**
  Square boards, tape measures and metre rules
- **Suggested Further Assessment**
  Practical exercises, Quiz

32.0.0 TRIGONOMETRY (19 Lessons)

32.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) define tangent, sine and cosine ratios from a right angled triangle
j) read and use tables of trigonometric ratios

k) use sine, cosine and tangent in calculating lengths and angles
l) establish and use the relationship of sine and cosine of complimentary angles
m) relate the three trigonometric ratios
n) determine the trigonometric ratios of special angles 30°, 45°, 60° and 90° without using tables
o) read and use tables of logarithms of sine, cosine and tangent
p) apply the knowledge of trigonometry to real life situations.

32.2.0 Content

32.2.1 Tangent, sine and cosine of angles
32.2.2 Trigonometric tables
32.2.3 Angles and sides of a right angled triangle
32.2.4 Sine and cosine of complimentary angles
32.2.4 Relationship between tangent, sine and cosine
32.2.5 Trigonometric ratios of special angles 30°, 45°, 60° and 90°
32.2.6 Logarithms of sines, cosines and agents
32.2.7 Application of trigonometry to real life situations

Notes

- Use a general right angled triangle to define the ratios
- Apply trigonometry to bearings, angles of elevation and depression
- **Suggested Resources**
  - Right angled triangles,
  - Mathematical tables
  - Real life situations
- **Suggested Further Assessment**
  Test on 31.00, 32.00

33.0.0 AREA OF A TRIANGLE
(7 Lessons)

33.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) Derive the formula;
Area = ½ ab sin C
e) Solve problems involving area of triangles using the formula
Area = ½ ab sin C
f) Solve problems on area of a triangle using the formula
area = $\sqrt{}$ s(s - a)(s - b)(s - c).

33.2.0 Content

32.2.1 Area of triangle
A = ½ ab sin C.
32.2.2 Area of a triangle
A = $\sqrt{}$s(s - a)(s - b)(s - c)
32.2.3 Application to Real life situations

Notes

- $s = \frac{a + b + c}{2}$

  where a, b and c are the sides of triangle ABC
- **Suggested Resources**
  charts illustrating different ways of showing area of a triangle.
- **Suggested Further Assessment**
  - practical exercises
  - Short test on 33.00

34.0.0 AREA OF QUADRILATERALS AND OTHER POLYGONS
(4 Lessons)

34.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

c) find the area of a quadrilateral
d) find the area of other polygons (regular and irregular).

34.2.0 Content

34.2.1 Area of quadrilaterals
34.2.2 Area of other polygons (regular and irregular)

Notes

- Other polygons include pentagon, hexagon, heptagon and octagon.
- Use trigonometry.
- **Suggested Resources**
  - Charts illustrating various polygons
  - Polygonal shapes
- **Suggested Further Assessment**
  - practical exercises
  - short test on 34.00

35.0.0 AREA OF PART OF A CIRCLE
(9 Lessons)

35.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) find area of a sector
e) find area of a segment
f) find area of common region between two circles

35.2.0 Content

35.2.1 Area of a sector

32.2.2 Area of a segment
32.2.3 Area of a common regions between two circles

Notes

- **Suggested Resources**
  Circular cutouts, charts illustrating sectors, segments and common region between two circles.
- **Suggested Further Assessment**
  Short test on 35.00

36.0.0 SURFACE AREA OF SOLIDS (10 Lessons)

36.1.0 Specific Objectives

By the end of the topic the learner should be able to:

f) find the surface area of a prism
g) find the surface area of a pyramid
h) find the surface area of a cone
i) find the surface area of a frustum
j) find the surface area of a sphere.

36.2.0 Content

36.2.1 Surface area of prisms, pyramids, cones, frustums and spheres

Notes

- **Suggested Resources**
  Models of pyramids, frustums, prisms, cones and spheres
- **Suggested Further Assessment**
  - Practical exercises
  - short test on 36.00

37.0.0 VOLUME OF SOLIDS (12 Lessons)

37.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) find the volume of a prism
g) find the volume of a pyramid
h) find the volume of a cone
i) find the volume of a frustum
j) find the volume of a sphere.

37.2.0 Content

37.2.1 Volumes of prisms, pyramids, cones, frustums and spheres

Notes

- Linear scale factor and volume scale factor are useful in finding the volume of a frustum.
- **Suggested Resources**
  Models of solids (prism, pyramid cone, frustum and sphere)
- **Suggested Further Assessment**
  Test on 33.00, 34.00, 35.00, 36.00

38.0.0 QUADRATIC EXPRESSIONS AND EQUATIONS (12 Lessons)

38.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) expand algebraic expressions that form quadratic equations
h) derive the three quadratic identities
i) identify and use the three quadratic identities
j) factorise quadratic expressions including the identities
k) solve quadratic equations by factorization
l) form and solve quadratic equations.

38.2.0 Content

38.2.1 Expansion of algebraic expressions
38.2.2 The three quadratic identities
38.2.3 Using the three quadratic identities
38.2.4 Factorisation of quadratic expressions
38.2.5 Solutions of quadratic equations by factor method
38.2.6 Formation and solution of quadratic equations

Notes

- Use the idea of area to derive the quadratic identities
- Use quadratic identities to evaluate numerical cases
- Include real life situations
- **Suggested Resources**
  - Charts illustrating quadratic identities
  - Situations that lead to Formation of quadratic equations
- **Suggested Further Assessment**
  - Practical exercises
  - Short test on 38.00
  - Puzzles and games

39.0.0 LINEAR INEQUALITIES (12 Lessons)

39.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) identify and use inequality symbols
h) illustrate inequalities on the number line
i) solve linear inequalities in one unknown
j) represent the linear inequalities graphically
k) solve the linear inequalities in two unknowns graphically
l) form simple linear inequalities from inequality graphs.

39.2.0 Content

39.2.1 Inequalities on a number line.
39.2.2 Simple and compound inequality statements.
39.2.3 Linear inequality in one unknown.
39.2.4 Graphical representation of linear inequalities.
39.2.5 Graphical solutions of simultaneous linear inequalities.
39.2.6 Simple linear inequalities from inequality graphs.
39.2.7 Inequalities from inequality graphs.

Notes

- Use the symbols <, >, #, ∃ correctly.
- Shade the unwanted regions
- Explain the term integral value(s)
- **Suggested Resources**
  Square boards, graph papers
- **Suggested Further Assessment**
  Short test on 39.00

40.0.0 LINEAR MOTION (10 Lessons)

40.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) define displacement, speed, velocity and acceleration
i) distinguish between
   i) distance and displacement
   ii) speed and velocity
j) determine velocity and acceleration
k) plot and draw graphs of linear motion(distance and velocity time graphs)
l) interpret graphs of linear motion
m) define relative speed
n) solve problems involving relative speed.

40.2.0 Content

40.2.1 Displacement, velocity, speed and acceleration
40.2.2 Determining velocity and acceleration
40.2.3 Solve problems involving relative speed
40.2.4 Distance - time graph
40.2.5 Velocity time graph
40.2.6 Interpretation of graphs of linear motion
40.2.7 Relative speed

Notes

- The terms vector and scalar should not be used at this stage
- Include approaching and overtaking bodies.
- **Suggested Resources**
  Linear motion tables, graph papers and drawn graphs.
- **Suggested Further Assessment**
  - Test on 37.00, 38.00, 39.00, and 40.00

41.0.0 STATISTICS (20 Lessons)

41.2.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) define statistics
i) collect and organise data
j) draw a frequency distribution table
k) group data into reasonable classes
l) calculate measures of central tendency.
   i) mean
   ii) mode
   iii) median for ungrouped and grouped data.
m) represent data in form of linegraph, bargraphs, pie-charts, pictogram, histogram and frequency polygons
n) interpret data from real life situations

41.2.0 **Content**

41.2.1 Definition of statistics
41.2.2 Collection and organization of data
41.2.3 Frequency distribution tables (for grouped and ungrouped data)
41.2.4 Grouping data
41.2.5 Mean, mode and median
41.2.6 Representation of data
- Line graph
- Bar graph
- Pie chart
- Pictogram
- Histogram
- Frequency polygon

41.2.7 Interpretation of data

Notes

- Data from the learners experiences should be used.
- Class limits and class boundaries should be distinguished.
- Equal and unequal class intervals should be used in drawing and interpreting histograms.

- **Suggested Resources**
  - Data from the environment, charts illustrating various presentation of data.
- **Suggested Further Assessment**
  - Practical exercises
  - Test on 41.00

42.0.0 ANGLE PROPERTIES OF A CIRCLE (19 Lessons)

42.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) identify an arc, chord and segment
h) relate and compute angle subtended by an arc at the circumference
i) relate and compute angle subtended by an arc at the centre and at the circumference
j) state the angle in the semi- circle
k) state the angle properties of a cyclic quadrilateral
l) find and compute angles of a cyclic cyclic quadrilateral.

42.2.0 Content

42.2.1 Arc, chord and segment
42.2.2 Angle subtended by the same arc at the circumference
42.2.3 Relationship between angle subtended at the centre and angle subtended on the circumference by the same arc
42.2.4 Angle in a semi-circle
42.2.5 Angle properties of a cyclic quadrilateral.
42.2.6 Finding angles of a cyclic quadrilateral

Notes

- Distinguish between angle subtended by an arc and angle subtended by a chord
- Reasons in the process of solving for angles should be emphasized
- **Suggested Resources**
  - Mathematical instruments
  - Charts illustrating angle properties of a circle.
- **Suggested Further Assessment**

  Short test on 42.00

43.0.0 VECTORS(1) (20 Lessons)

43.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) define vector and scalar
l) use vector notation
m) represent vectors both single and combined geometrically
n) identify equivalent vectors
o) add vectors
p) multiply vectors by scalars
q) define position vector and column vector
r) find magnitude of a vector
s) find mid-point of a vector
t) define translation as a transformation.

43.2.0 Content

43.2.1 Vector and scalar quantities
43.2.2 Vector notation
43.2.3 Representation of vectors
43.2.4 Equivalent vectors
43.2.5 Addition of vectors
43.2.6 Multiplication of a vector by a scalar
43.2.7 Column vectors
43.2.8 Position vectors
43.2.9 Magnitude of a vector
43.2.10 Midpoint of a vector
43.2.11 Translation vector

Notes

- Students should be exposed to various vector notations. One of the notations should be adopted.
- Use practical situations to introduce translation

- **Suggested Resources**

  Square boards, graph papers, geometrical instruments.
- **Suggested Further Assessment**

  Quiz, test on 42.00 and 43.00

FORM THREE

44.0.0 QUADRATIC EXPRESSIONS AND EQUATIONS (2) (22 Lessons)

44.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

m) factorise quadratic expressions
n) identify perfect squares
o) complete the square
p) solving quadratic equations by completing the square
q) derive the quadratic formula
r) solve quadratic equations using the formula
s) form and solve quadratic equations from roots and given situations
t) make tables of values from a quadratic relation
u) draw the graph of a quadratic relation
v) solve quadratic equations using graphs
w) solve simultaneous equations (one linear and one quadratic) analytically and graphically
x) apply the knowledge of quadratic equations to real life situations.

44.2.0 **Content**

44.2.1 Factorisation of quadratic expressions
44.2.3 Perfect squares
44.2.4 Completion of the square
44.2.5 Solution of quadratic equations by completing the square

44.2.6 Quadratic formula

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

44.2.7 Solution of quadratic equations using the formula.
44.2.8 Formation of quadratic equations and solving them
44.2.9 Tables of values for a given quadratic relation
44.2.10 Graphs of quadratic equations
44.2.11 Simultaneous equations - one linear and one quadratic
44.2.12 Application to real life situation

Notes

- Use quadratic equation to solve other related quadratic equations graphically
- Interpret the discriminant i.e. $\sqrt{(b^2-4ac)}$.
- **Suggested Resources**
  - Square boards
  - Graph papers
- **Suggested Assessment**
  Test on 44.00

45.0.0 APPROXIMATIONS AND ERRORS (16 Lessons)

45.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) use calculators in various computations
h) make reasonable approximations and estimations of quantities in computations and measurements
i) express values to a given number of significant figures
j) define absolute, relative, percentage, round-off and truncation errors
k) determine possible errors made from computations
l) find maximum and minimum errors from operations.

45.2.0 **Content**

45.2.1 Computing using calculators
45.2.2 Estimations and approximations
45.2.3 Significant figures
45.2.4 Absolute, relative, percentage, round-off and truncation errors
45.2.5 Propagation of errors from simple calculations
45.2.6 Maximum and minimum errors

Notes

- Use calculators in various computations involving the four basic operations, squares, squareroots, cubes and cuberoots.
- Confine to errors propagated in addition, subtraction, multiplication and division.
- Include maximum and minimum errors from operations.

- **Suggested Resources**
  - Measuring instruments
  - Calculators
  - Real life experiences
- **Suggested Further Assessment**
  - Practical Exercises
  - Quiz

46.0.0 TRIGONOMETRY (2)
(22 Lessons)

46.1.0 Specific Objectives

By the end of the topic the learner should be able to: #

l) define and draw the unit circle
m) use the unit circle to find trigonometric ratios in terms of co-ordinates of points for O # θ # 360°
n) find trigonometric ratios of negative angles
o) find trigonometric ratios of angles greater than 360° using the unit circle
p) use mathematical tables and calculators to find trigonometric ratios of angles in the range O # θ # 360°
q) define radian measure
r) draw graphs of trigonometric functions; y = sin x, y = cos x and y = tan x using degrees and radians
s) derive the sine rule
t) derive the cosine rule
u) apply the sine and cosine rule to solve triangles (sides, angles and area)
v) apply the knowledge of sine and cosine rules in real life situations.

46.2.0 **Content**
46.2.1 The unit circle
46.2.2 Trigonometric ratios from the unit circle
46.2.3 Trigonometric ratios of angles greater than 360° and negative angles
46.2.4 Use of trigonometric tables
46.2.5 Radian measure
46.2.6 Simple trigonometric graphs
46.2.7 Derivation of sine and cosine rule
46.2.8 Solution of triangles
46.2.9 Application of sine and cosine rule to real situation.

Notes

- Conversion of radians to degrees and vice versa is necessary
- Sine rule:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

and Cosine rule:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

- Use calculators to verify values of trigonometric ratios
- Apply trigonometry to problems involving bearings and angles of elevation and depression and surveying.
- **Suggested Resources**
  - Unit circle
  - Graph paper
  - Square boards
  - Mathematical tables
  - Calculators
  - Real life experiences
- **Suggested Further Assessment**
  - Test on 45.00 and 46.00

47.0.0 SURDS (9 Lessons)

47.1.0 Special Objectives

By the end of the topic, the learner should be able to:

d) define rational and irrational numbers
e) simplify expressions with surds
f) rationalise denominators with surds

47.2.0 **Content**
47.2.1 Rational and irrational numbers
47.2.2 Simplification of surds
47.2.3 Rationalisation of denominators

Notes

- Determination of conjugates is necessary
- Simplifications be left in surd form unless instructed otherwise
- Where evaluation is required, a calculator may be used but the process of working out the sum must be shown
- **Suggested Resources**
  Charts illustrating process of rationalisation.
- **Suggested Further Assessment**
  Short test on 47.00

48.0.0 FURTHER LOGARITHMS (11 Lessons)

48.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

e) derive logarithmic relation from index form and vice-versa
f) state the laws of logarithms
g) use logarithmic laws to simplify logarithmic expressions and solve logarithmic equations
h) apply laws of logarithms for further computations.

48.2.0 Content

48.2.1 Logarithmic notation
48.2.2 The laws of logarithms
48.2.3 Simplification of logarithmic expressions
48.2.4 Solution of logarithmic equations
48.2.5 Further computations using logarithmic laws.

Notes

- Logarithmic equations will also include indices.

  Logarithmic Laws:

  $\log ab = \log a + \log b$

  $\log \frac{a}{b} = \log a - \log b$

  $\log a^n = n \log a$

- **Suggested Resources**
  - Chart illustrating logarithmic laws
  - Logarithm tables
  - Calculators

- **Suggested Further Assessment**
  - Short test on 48.00

49.0.0 COMMERCIAL ARITHMETIC (2) (22 Lessons)

49.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

j) define principal, rate and time in relation to interest
k) calculate simple interest using simple interest formula
l) calculate compound interest using step by step method
m) derive the compound interest formula
n) apply the compound interest formula for calculating interest
o) define appreciation and depreciation
p) use compound interest formula to calculate appreciation and depreciation
q) calculate hire purchase
r) calculate income tax given the income tax bands.

49.2.0 Content

49.2.1 Principal rate and time
49.2.2 Simple interest
49.2.3 Compound interest using step by step method
49.2 4 Derivation of compound interest formula
49.2.5 Calculations using the compound interest formula
49.2.6 Appreciation and depreciation
49.2.7 Calculation of appreciation and depreciation using the compound interest formula
49.2.8 Hire purchase
49.2.9 Income tax

Notes

- Current income tax schedules to be used.
- Consider cases where compounding is done monthly, quarterly, and semi annually.

Suggested Resources

- Income tax schedule/bands
- Real life experiences
- Ready reckoner tables
- calculators

Suggested Further Assessment

Tests on 47.00, 48.00 and 49.00

50.0.0 CIRCLES CHORDS AND TANGENTS (21 Lessons)

50.1.0 Specific Objectives

By the end of the topic the learner should be able to:

j) calculate length of an arc and a chord
k) calculate lengths of tangents and intersecting chords
l) state and use properties of chords
m) construct tangent to a circle
n) construct direct and transverse common tangents to two circles

o) relate angles in alternate segment
p) construct circumscribed, inscribed and escribed circles
q) locate centroid and orthocentre of a triangle
r) apply knowledge of circles, tangents and chords to real life situations.

50.2.0 Content

50.2.1 Arcs, chords and tangents
50.2.2 Lengths of tangents and intersecting chords
50.2.3 Properties of chords
50.2.4 Construction of tangents to a circle
50.2.5 Direct and transverse common tangents to two circles
50.2.6 Angles in alternate segment
50.2.7 Circumscribed, inscribed and escribed circles
50.2.8 Centroid and orthocentre
50.2.9 Apply knowledge of tangents and chords to real life situations

NOTES

- Mention circumcircle, circumcentre, incentre and incircle and excentre

Suggested Resources

- Charts to illustrate the various properties
- Pulleys and wheels

Suggested Further Assessment

- Short on 50.00

51.0.0 MATRICES (21 Lessons)

51.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) define a matrix
l) state the order of a matrix
m) define a square matrix
n) determine compatibility in addition and multiplication of matrices
o) add matrices
p) multiply matrices
q) identify identity matrix
r) find determinant of a 2 x 2 matrix
s) find the inverse of a 2 x 2 matrix
t) use matrices to solve simultaneous equations.

51.2.0 Content

51.2.1 Matrix
51.2.2 Order of a matrix
51.2.3 Square matrix
51.2.4 Compatibility in addition and multiplication of matrices
51.2.5 Multiplication of a matrix by a scalar
51.2.6 Matrix multiplication
51.2.7 Identity matrix
51.2.8 Determinant of a 2 x 2 matrix
51.2.9 Inverse of a 2 x 2 matrix and
51.2.10 Singular matrix
51.2.11 Solutions of simultaneous equations in two unknowns

Notes

- Reduction of a 2 x 2 metrix to echelon form is not required

Suggested Resources

- Charts illustrating compatibility of matrices
- Real life situations
- Calculators

Suggested Further Assessment

- Test on 50.00 and 51.00

52.0.0 FORMULAE AND VARIATIONS (21 Lessons)

52.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) rewrite a given formula by changing the subject
h) define direct, inverse, partial and joint variations
i) identify constants of proportionality
j) form and solve equations involving variations
k) draw graphs to illustrate direct and inverse proportions
l) use variations to solve everyday life problems

52.2.0 Content

52.2.1 Change of the subject
52.2.2 Direct, inverse, partial and joint variations
52.2.3 Constant of proportionality
52.2.4 Graphs of direct and inverse proportion
52.2.5 Formation of equation on variation from real life situations

Notes

- Need to clarify the relation connecting "$\propto$" and "=" signs.

Suggested Resources

- Square boards
- Graph papers
- Real life situations
- Calculators

Suggested Further Assessment

- Short test

53.0.0 SEQUENCES AND SERIES (21 Lessons)

53.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

j) identify simple number patterns
k) define a sequence
l) identify the pattern for a given set of numbers and deduce the general rule
m) determine a term in a sequence
n) recognise arithmetic and geometric sequences
o) define a series
p) recognise arithmetic and geometric series (Progression)
q) derive the formula for partial sum of an arithmetic and geometric series (Progression)
r) apply A.P and G.P formula to solve problems in real life situations.

53.2.0 Content

53.2.1 Simple number patterns
53.2.2 Sequences
53.2.3 Arithmetic sequence
53.2.4 Geometric sequence
53.2.5 Determining a term in a sequence
53.2.6 Arithmetic progression (A.P)
53.2.7 Geometric progression (G.P)
53.2.8 Sum of an A.P
53.2.9 Sum of a G.P
53.2.10 Application of A.P and G.P to real life situations

Notes

- Sum up to infinity is not required
- Deduction of general rule for simple cases only is necessary

Suggested Resources

- Charts illustrating number patterns
- Real life situations
- calculators

Suggested Further Assessment

Test on 52.00 and 53.00

54.0.0 VECTORS (2) (24 Lessons)

54.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) locate a point in two and three dimension co-ordinate systems
l) represent vectors as column and position vectors in three dimensions
m) distinguish between column and position vectors
n) represent vectors in terms of **i, j,** and **k**
o) calculate the magnitude of a vector in three dimensions
p) use the vector method in dividing a line proportionately
q) use vector method to show parallelism
r) use vector method to show collinearity
s) state and use the ratio theorem
t) apply vector methods in geometry.

54.2.0 Content

54.2.1 Coordinates in two and three dimensions
54.2.2 Column and position vectors in three dimensions
54.2.3 Column vectors in terms of unit vectors **i, j** and **k**.
54.2.4 Magnitude of a vector
54.2.5 Parallel vectors
54.2.6 Collinearity
54.2.7 Proportional division of a line
54.2.8 Ratio theorem
54.2.9 Vector methods in geometry

Notes

- Discuss collinearity in two and three dimensional spaces
- Discuss the various vector notations.
- Include column vectors i and j in two dimensions.

Suggested Resources

- Graph papers
- Square board
- Skeleton model of a cuboid

Suggested Further Assessment

- Test on 54.00

55.0.0 BINOMIAL EXPANSIONS
(11 Lessons)

55.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) expand binomial expressions up to the power of four by multiplication
b) build up - Pascal's Triangle up to the eleventh row
c) use Pascal's triangle to determine the coefficient of terms in a binomial expansion up to the power of 10
d) apply binomial expansion in numerical cases.

55.2.0 Content

55.2.1 Binomial expansion up to power four
55.2.2 Pascal's triangle
55.2.3 Coefficent of terms in binomial expansion
55.2.4 Computation using binomial expansion
55.2.5 Evaluation of numerical cases using binomial expansion

Notes

- Binomial expansion by multiplication up to power four only
- Compute numerical cases such as $(1.05)^{10}$ and $(0.99)^{10}$ to specified number of terms and significant figures.
- Use calculators but, process of working out the figures must be shown

Suggested Resources

- Charts illustrating Pascal's triangle
- Calculators

Suggested Further Assessment

- Short test on 55.00

56.0.0 PROBABILITY (22 Lessons)

56.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) define probability
j) determine probability from experiments and real life situations
k) construct a probability space
l) determine theoretical probability
m) differentiate between discrete and continuous probability
n) differentiate mutually exclusive and independent events
o) state and apply laws of probability
p) use a tree diagram to determine probabilities.

56.2.0 Content

56.2.1 Probability
56.2.2 Experimental probability
56.2.3 Range of probability measure O# P(x) <1
56.2.4 Probability space
56.2.5 Theoretical probability
56.2.6 Discrete and continuous probability (simple cases only)
56.2.7 Combined events (mutually exclusive and independent events)
56.2.8 Laws of probability
56.2.9 The tree diagrams

Notes

- Explain the terms; at least, at most, not more than, not less than, with respect to probability.

Suggested Resources

- Real life situations
- Probability games
- Calculators

Suggested Further Assessment

- Practical exercises
- Test on 55.00 and 56.00

57.00 COMPOUND PROPORTIONS AND RATES OF WORK
(9 Lessons)

57.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) solve problems involving compound proportions using unitary and ratio methods
e) apply ratios and proportions to real life situations
f) solve problems involving rates of work

57.2.0 Content

57.2.1 Proportional parts
57.2.2 Compound proportions
57.2.3 Ratios and rates of work

57.2.4 Proportions applied to mixtures

Notes

- Revise ratios and proportions covered previously
- Use unitary and ratio methods

Suggested Resources

- Real life situations
- Calculators

Suggested Further Assessment

- Short test on 57.00

58.0.0 GRAPHICAL METHODS (21 Lessons)

58.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) make a table of values from given relations
l) use the table of values to draw the graphs of the relations
m) determine and interpret instantaneous rates of change from a graph
n) interpret information from graphs
o) draw and interpret graphs from empirical data
p) solve cubic equations graphically
q) draw the line of best fit
r) identify the equation of a circle
s) find the equation of a circle given the centre and the radius
t) determine the centre and radius of a circle and draw the circle on a cartesian plane.

58.2.0 Content

58.2.1 Tables and graphs of given relations.
58.2.2 Graphs of cubic equations
58.2 3 Graphical solutions of cubic equations.
58.2.4 Average rate of change
58.2.5 Instantaneous rate of change
58.2.6 Empirical data and their graphs
58.2.7 The line of best fit
58.2.8 Equation of a circle
58.2.9 Finding of the equation of a circle
58.2.10 Determining of the centre and radius of a circle

Notes

- Include linear graphs and curves
- Line of best fit does not always start from the origin
- Include the following equations of a circle;
  $x^2 + y^2 = r^2$
  $(x - a)^2 + (y - b)^2 = r^2$

Suggested Resources

- Graph papers
- Square boards
- Real life situations

Suggested Further Assessment

- Test on 57.00 and 58.00

FORM FOUR

59.0.0 MATRICES AND TRANSFORMATIONS (21 Lessons)

59.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) relate image and object under a given transformation on the cartesian plane
l) determine the matrix of a transformation
m) perform successive transformations
n) determine and identify a single matrix for successive transformation
o) relate identity matrix and transformation
p) determine the inverse of a transformation
q) establish and use the relationship between area scale factor and determinant of a matrix
r) determine shear and stretch transformations
s) define and distinguish isometric and non-isometric transformation
t) apply transformation to real life situations.

59.2.0 Content

59.2.1 transformation on the Cartesian plane
59.2.2 identification of transformation matrix
59.2.3 successive transformations
59.2 4 single matrix of transformation for successive transformations.
59.2.5 identity matrix and transformation
59.2.6 inverse of a transformation
59.2.7 area scale factor and determinant of a matrix
59.2.8 shear and stretch (include their matrices)
59.2.9 isometric and non-isometric transformation
59.2.10 application of transformation to real life situations

Notes

- Revise transformation covered previously

Suggested Resources

- Square boards
- Peg boards and strings
- Rubber bands
- Models
- Calculators

Suggested Further Assessment

- Practical exercises
- Test on 59.00 and related topics

60.1.0 STATISTICS (2) (27 Lessons)

60.1.0 Specific objectives

By the end of the topic, the learner should be able to:

g) state the measures of central tendency
h) calculate the mean using the assumed mean method
i) make cumulative frequency table
j) estimate the median and the quartiles by
   (i) calculation and
   (ii) ogive
k) define and calculate the measures of dispersion: range, quartiles, interquartile range, quartile deviation, variance and standard deviation
l) interpret measures of dispersion.

60.2.0 Content

60.2.1 Mean from assumed mean
60.2.2 Cumulative frequency table
60.2.3 Ogive
60.2.4 Median
60.2.5 Quartiles
60.2.6 Range
60.2.7 Interquartile range
60.2.8 Quartile deviation
60.2.9 Variance
60.2.10 Standard deviation

Notes

- Revise statistics (I)
- For measures of dispersion include both ungrouped and grouped data
- Relate quartiles with percentages.

Suggested Resources

- Square boards
- Graph papers
- Data from real life situations

Suggested Further Assessment

- Practical exercises
- Test on unit 60.00

61.0.0 LOCI (21 Lessons)

61.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) define Locus
e) describe common types of Loci
f) construct
   (i) loci involving inequalities
   (ii) loci involving chords
   (iii) loci involving points under given conditions
   (iv) intersecting loci

61.2.0 Content

61.2.1 common types of Loci
61.2.2 Perpendicular bisector loci
61.2.3 Loci of a point at a given distance from a fixed point and a fixed line
61.2.4 Angle bisector loci
61.2.5 Constant angle loci
61.2.6 other loci under given condition including intersecting loci
61.2.7 loci of inequalities
61.2.8 loci involving chords

Notes

- Understanding of the language used in locus is important
- Knowledge of geometric construct is a prerequisite

Suggested Resources

- Geometrical patterns
- Square boards
- Graph papers

Suggested Further Assessment

- Practical exercises
- Test on unit 61.00

62.0.0 TRIGONOMETRY (3) (21 Lessons)

62.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

d) recall and define trigonometric ratios
e) derive trigonometric identity $\sin^2 x + \cos^2 x = 1$
f) draw graphs of trigonometric ratios of the form
   y= sin x, y = cos x,
   y= tan x y = a sin x,
   y= a cos x, y = a tan x
   y= a sin bx, y= a cos b x,
   y=a tan bx
   y=a sin(bx ± θ),
   y= a cos(bx ± θ)
   y=a tan(bx ± θ)
d) solve simple trigonometric equations analytically and graphically
e) deduce from the graph amplitude, period, wavelength and phase angles.

62.2.0 Content

62.2.1 Trigonometric ratios
62.2.2 deriving the relation $\sin^2 x + \cos^2 x = 1$
62.2.3 graphs of trigonometric functions
y =sinx, y=Cosx, y=tanx
y=a sinx, y=a cosx,
y= a tanx y= a sin bx,
y= a cos bx, y=a tan bx
y= a sin (bx ± θ),
y = a cos (bx ± θ)
y = a tan (bx ± θ)

62.2.4 simple trigonometric equations amplitude, period, wavelength and phase angle of trigonometric functions.

Notes

- Making a correct table of values from a trigonometric function and correct plotting of points are essential.
- Identification of symmetry and its use in drawing waves is important

Suggested Resources

- Square boards
- Graph papers
- Charts to illustrate amplitude period and phase angle

Suggested Further Assessment

Test on 62.00 and related topics

63.0.0 THREE DIMENSIONAL GEOMETRY (24 Lessons)

63.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) state the geometric properties of common solids
g) identify projection of a line onto a plane
h) identify skew lines
i) calculate the length between two points in three dimensional geometry

j) identify and calculate the angle between
   (i) two lines
   (ii) a line and a plane
   (iii) two planes

63.2.0 Content

63.2.1 Geometrical properties of common solids
63.2.2 Skew lines and projection of a line onto a plane
63.2.3 length of a line in 3- dimensional geometry
63.2.4 the angle between
(i) a line and a line
(ii) a line and a plane
(iii) a plane and a plane
63.2.5 angles between skewlines

Notes
- Revise sketching common solids
- 3 -dimensional models must be used

Suggested Resources
- 3- dimensional models both skeleton and solid and detacheable models objects used in real life situations

Suggested Further Assessment
- Practical exercises
- Test on 63.00 related topics

64.0.0 LONGITUDES AND LATITUDES (21 Lessons)

64.1.0 Specific Objectives

By the end of the topic, the learner should be able to:
g) define the great and small circles in relation to a sphere (including the earth)
h) establish the relationship between the radii of small and great circles
i) locate a place on the earths surface in terms of latitude and longitude
j) calculate the distance between two points along the great circles and small circles (longitude and latitude) in nautical miles (nm) and kilometers (km)
k) calculate time in relation to longitudes
l) calculate speed in knots and kilometres per hour.

64.2.0 Content

64.2.1 Latitude and longitude(great and small circles)
64.2.2 The Equator and Greenwich Meridian
64.2.3 Radii of small and great circles
64.2.4 Position of a place on the surface of the earth
64.2.5 Distance between two points along the small and great circles in nautical miles and kilometres.
64.2.6 Distance in nautical miles and kilometers along a circle of latitude
64.2.7 Time and longitude
64.2.8 Speed in knots and Kilometres per hour

Notes
- Revise (i) trigonometric ratios
  (ii) Length of an arc
  (iii) Co-ordinates
- Take the Equator and GMT as reference points
- take 1nm = 1.853 km
  radius of the earth = 6370 km
- include problems involving speed, time and distance

Suggested Resources
- Globe
- Calculator
- Ball

Suggested Further Assessment

Test on unit 64.00 and related topics

65.0.0 LINEAR PROGRAMMING (21 Lessons)

65.1.0 Specific Objectives

By the end of the topic, the learner should be able to:
e) form linear inequalities based on real life situations
f) represent the linear inequalities on a graph
g) solve and interpret the optimum solution of the linear inequalities
h) apply linear programming to real life situations.

65.2.0 Content

65.2.1 Formation of linear inequalities
65.2.2 Analytical solutions of linear inequalities
65.2.3 solutions of linear inequalities by graphs

65.2.4 optimisation (include objective function)
65.2.5 application to real life situations

Notes
- Revise on linear inequalities
- Emphasise should be put on key words and their related symbols such as - at least, less than, at most, more than, not less than, not more than and so on.

Suggested Resources
- Square boards
- Graph papers

Suggested Further Assessment
- Test on 65.00 and related topics

66.0.0 DIFFERENTIATION
(19 Lessons)

66.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
k) find average rates of change and instantaneous rates of change
l) find the gradient of a curve at a point using tangent
m) relate the delta notation to rates of change;
n) find the gradient function of a function of the form $y = x^n$ (n is a positive integer)
o) define
   (i) derivative of a function
   (ii) derived function of a polynomial
   (iii) differentiation
p) determine the derivative of a polynomial
q) find equations of tangents and normals to the curves
r) sketch a curve
s) apply differentiation in calculating distance, velocity and acceleration
t) apply differentiation in finding maxima and minima of a junction.

66.2.0 Content
66.2.1 Average and instantaneous rates of change
66.2.2 Gradient of a curve at a point
66.2.3 Gradient of $y=x^n$ (where n is a positive integer)
66.2.4 Delta notation (Δ)
66.2.5 Derivative of a polynomial
66.2.6 Equations of tangents and normals to the curve
66.2.7 Stationery points
66.2.8 Curve sketching
66.2.9 Application of differentiation in calculation of distance, velocity and acceleration.
66.2.10 Maxima and minima

Notes
- exclude the product and quotient rule in differentiation

Suggested Resources
- square boards
- graph papers

Suggested Further Assessment
- Test on 66.00 and related topics

67.0.0 AREA APPROXIMATION
(10 Lessons)

67.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
g) approximate the area of irregular shapes by counting techniques
h) derive the trapezium rule
i) apply trapezium rule to approximate areas of irregular shapes
j) apply trapezium rule to estimate areas under curves
k) derive the mid-ordinate rule
l) apply mid-ordinate rule to approximate area under a curve.

67.2.0 Content
67.2.1 Area by counting techniques
67.2.2 Trapezium rule
67.2.3 Area using trapezium rule
67.2.4 Mid–ordinate
67.2.5 Area by the mid-ordinate rule

Notes
- Revise area of irregular shapes and area of a trapezium

Suggested Resources

- Square boards
- Graph papers
- Tracing papers for tracing irregular shapes from maps
- Worksheet containing practical work on trapezium and mid-ordinate rules

Suggested Further Assessment

- Practical exercises
- Test on 67.00 and related topics

68.0.0 INTEGRATION (19 Lessons)

68.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

g) carry out the process of differentiation
h) interpret integration as a reverse process of differentiation
i) relate integration notation to sum of areas of trapezia under a curve
j) integrate a polynomial
k) apply integration in finding the area under a curve
l) apply integration in kinematics.

68.2.0 Content

68.2.1 Differentiation
68.2.2 Reverse differentiation
68.2.3 Integration notation and sum of areas of trapezia
68.2.4 Indefinite and definite integrals
68.2.5 Area under a curve by integration
68.2.6 Application in kinematics

Notes

- Revise differentiation
- Consider area of curves above and below the x - axis
- Curve - sketching is important in identifying the required region
- Avoid substitution methods of integration.
- Compare approximation of area by; trapezoidal rule, mid-ordinate rule and by integration.
- If a curve is to be drawn **either** it should not exceed the 3^{rd} degree **or** a table of values is given for students to plot and draw.

Suggested Resources

- Square boards
- Graph papers
- Real life situations

Suggested Assessment

Oral and written exercises
Test on 66.00, 67.00, and 68.00

PHYSICS

INTRODUCTION

The Physics Syllabus is designed to offer varied experiences to the learner. The experiences are meant to lead to an all round mental, social and moral development of the learner.

This syllabus presents Physics as a body of knowledge about the physical environment. It employs a systematic scientific methodology of study to arouse learners way of reasoning and create positive attitude. To this end the use of teacher/learner discussion, teacher demonstration and group/class experiments as methods of instruction is encouraged. It emphasises not only the understanding of the fundamental scientific concept and principles, but also the experimental approach of investigation. The experimental approach should prepare the learner to present scientific concepts and ideas in the modern technology. Teachers are encouraged to expand upon suggested projects and teaching methodologies for effective implementation of this syllabus. These projects are designed to enrich the experiments carried out in the laboratory and enhance creativity. The project work approach provides a learner with opportunities in undertaking investigations for purposes of finding solutions to problems. It also helps in the transfer and application of the required scientific knowledge to solving problems encountered in day-to-day experiences. Field visits to resource centre/institutions of higher learning and industries are encouraged to enrich and modernize the teaching/learning process.

The general and specific objectives have been carefully articulated to ensure clarity of the intended learning outcomes. The time allocated for each topic is adequate and will enable the average learner not only acquire knowledge but also discover more about the world around him/her and as such develop interest in the subject.

The syllabus also aims at inculcating in the learner virtues such as diligence and high integrity. Care has also been taken to sensitise the learner on aspects of health and environmental concerns. The syllabus ensures appropriate balance in the development of cognitive, psychomotor and affective skills

The teacher of Physics is therefore challenged to make the subject more appealing through experimental approach and proper planning.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1. select and use appropriate instruments to carry out measurements in the physical environment
2. use the knowledge acquired to discover and explain the order of the physical environment
3. use the acquired knowledge in the conservation and management of the environment
4. apply the principles of Physics and acquired skills to construct appropriate scientific devices from the available resources
5. develop capacity for critical thinking in solving problems in any situation
6. contribute to the technological and industrial development of the nation
7. appreciate and explain the role of Physics in promoting health in society
8. observe general safety precautions in all aspects of life
9. acquire and demonstrate a sense of honesty and high integrity in all aspects of Physics and life in general
10. acquire positive attitude towards Physics
11. acquire adequate knowledge in Physics for further education and/or training.

FORM ONE

1.0.0 INTRODUCTION TO PHYSICS (4 Lessons)

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

(a) explain what the study of physics involves
(b) relate physics to other subjects and to technology
(c) identify career opportunities related to physics
(d) state and explain basic laboratory safety rules.

1.2.0 Content

1.2.1 Physics as a Science(reference to Primary Science Syllabus)
1.2.2 Meaning of Physics
1.2.3 Branches of Physics
1.2.4 Relation between Physics, other subjects and technology
1.2.5 Career opportunities in Physics
1.2.6 Basic laboratory safety rules

2.0.0 MEASUREMENTS 1 (12 Lessons)

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) define length, area, volume, mass, density, time and state the corresponding symbols and SI units
h) convert other metric units to SI units
i) estimate length, mass and time
j) use accurately the following measuring instruments; metre rule, tape measure, beam balance, stop clock/watch, measuring cylinder, pipette and burette
k) determine experimentally the densities of substances
l) solve numerical problems on density.

2.2.0 Content

2.2.1 Definition of length, area, volume, mass, density and time
2.2.2 SI units and symbols
2.2.3 Estimation of quantities
2.2.4 Conversion of units
2.2.5 Measuring instruments
2.2.6 Experiments on density
2.2.7 Problems on density

3.0.0 FORCE (16Lessons)

3.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) define force and state its SI unit
j) describe types of forces
k) describe experiments to illustrate cohesion, adhesion and surface tension
l) state the effects of force
m) state the difference between mass and weight
n) state the relation between mass and weight, W = mg
o) define scalar and vector quantities
p) solve numerical problems involving W = mg.

3.2.0 Content

3.2.1 Definition of force
3.2.2 Types of forces (including cohesive, adhesive and surface tension)
3.2.3 Experiments to demonstrate cohesion, adhesion and surface tension.
3.2.4 Effects of force
3.2.5 Mass, weight and their relationship
3.2.6 Scalar and vector quantities
3.2.7 Problem involving W = mg (take g = 10 N/kg)

4.0.0 PRESSURE (24 Lessons)

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define pressure and state its units
b) determine pressure exerted by solids
c) describe experiments to investigate factors affecting pressure in fluids;
d) derive the formula $P = \rho gh$

e) state the principle of transmission of pressure in fluids (Pascals principle)
f) explain atmospheric pressure and its effect
g) state and explain the applications of pressure
h) solve numerical problems involving pressure.

4.2.0 Content

4.2.1 Definition of pressure
4.2.2 Pressure in solids
4.2.3 Factors affecting pressure in fluid (Experimental treatment required)
4.2.4 Derivation of $P = \rho gh$
4.2.5 Atmospheric pressure
4.2.6 Simple mercury barometer, manometers
4.2.7 Applications of pressure: drinking straw, syringe, siphon, hydraulic press, hydraulic brakes, bicycle pump, force pump, lift pump
4.2.8 Problems on pressure

4.3.0 Project Work

4.3.1 Construct a hydraulic press model.

5.0.0 PARTICULATE NATURE OF MATTER (12 Lessons)

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) show that matter is made up of tiny particles
b) describe experiments to show that particles of matter are at constant random motion
c) explain the states of matter in terms of particles
d) explain diffusion

5.2.0 Content

5.2.1 Experiments to show that matter is made up of tiny particles (e.g. cutting papers into small pieces), dilution experiments
5.2.2 Brownian motion
5.2.3 States of matter
5.2.4 Diffusion (Graham's law not required)

6.0.0 THERMAL EXPANSION (12 Lessons)

6.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define temperature
b) describe the functioning of various thermometers
c) describe thermal expansion in solids, liquids and gases
d) explain expansion in terms of particle behaviour
e) describe the unusual expansion of water and its effects
f) explain the effects and applications of thermal expansion.

6.2.0 Content

6.2.1 Temperature
6.2.2 Thermometers:
- liquid - in - glass,
- clinical,
- six's maximum and minimum

6.2.3 Celsius and Kelvin scales
6.2.4 Expansion of solids, liquids and gases
6.2.5 Effects of expansion and contraction
6.2.6 Unusual expansion of water (Anomolous expansion)
6.2.7 Applications of thermal expansion, include Bimetallic strip

7.0.0 HEAT TRANSFER (12 Lessons)

7.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define heat
b) state the difference between temperature and heat
c) state and explain the modes of heat transfer
d) describe experiments to illustrate factors affecting heat transfer
e) explain applications of heat transfer.

7.2.0 Content

7.2.1 Heat and temperature
7.2.2 Modes of heat transfer
7.2.3 Factors affecting heat transfer (Experimental treatment required)
7.2.4 Applications of heat transfer on:
- Vacuum flask,
- Domestic hot - water system,
- Solar concentrators

8.0.0 RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACE (16 Lessons)

8.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) perform and describe experiments to show that light travels in a straight line
j) describe the formation of shadows and eclipses
k) explain the functioning of a pin-hole camera
l) state the laws of reflection
m) verify experimentally the laws of reflection
n) state the characteristics of images formed by plane mirrors
o) explain the applications of reflection at plane surfaces
p) solve numerical problems involving pin-hole camera and mirrors inclined at an angle.

8.2.0 Content

8.2.1 Rectilinear propagation of light (experimental treatment required)
8.2.2 Formation of shadows and eclipses (umbra and penumbra)
8.2.3 Pin-hole camera image formation and magnification
8.2.4 Laws of reflection
8.2.5 Images formed by plane mirrors, ray diagrams, parallel and inclined mirrors
8.2.6 Devices based on reflection: periscope, kaleidoscope
8.2.7 Problems on pin-hole camera and mirrors inclined at an angle

8.3.0 Project Work

8.3.1 Construct Pin-hole Camera, Periscope and Kaleidoscope.

9.0.0 ELECTROSTATICS I (12 Lessons)

9.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) describe electrostatic charging of objects by rubbing
j) explain the source of electrostatic charges
k) state the two types of charges
l) state the basic law of charges
m) state the unit of charge
n) construct a simple leaf electroscope
o) explain the charging of a leaf electroscope
p) use a charged leaf electroscope to identify conductors, insulators and types of charges.

9.2.0 Content

9.2.1 Electrostatic charging of objects by rubbing (experimental treatment required)
9.2.2 Types of charges and law of charges
9.2.3 The source of charge
9.2.4 The coulomb
9.2.5 Leaf electroscope: features, charging and discharging
9.2.6 Charging by contact and by induction
9.2.7 Identification of charge
9.2.8 Conductors and insulators

10.0.0 CELLS AND SIMPLE CIRCUITS (12 Lessons)

10.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) draw and set-up simple electric circuits
b) identify circuit symbols
c) define electric current
d) explain the working of primary and secondary cells
e) explain the care and maintenance of secondary cells.

10.2.0 Content

10.2.1 Simple electric circuits: cell, ammeter, voltmeter, variable resistor, connecting wires, bulb and switches
10.2.2 Circuit symbols
10.2.3 Electric current and its units
10.2.4 Primary and secondary cells (simple cell, dry Leclanche' cell, Lead acid cell)
10.2.5 Care and maintenance of secondary cells

10.3.0 Project Work

10.3.1 Making a simple cell from locally available materials.

FORM TWO

11.0.0 MAGNETISM (12 Lessons)

11.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

h) describe the properties and uses of magnets
i) identify magnetic and non-magnetic materials
j) state the basic law of magnetism
k) describe patterns of magnetic field
l) describe methods of magnetisation and demagnetization
m) explain magnetisation and demagnetisation using the domain theory
n) construct a simple compass.

11.2.0 Content

11.2.1 Magnets: properties and uses
11.2.2 Magnetic and non-magnetic materials
11.2.3 Basic law of magnetism
11.2.4 Magnetic field patterns
11.2.5 Magnetisation and demagnetization
11.2.6 Domain theory of magnetism
11.2.7 Care of magnets
11.2.8 Construction of a simple compass

12.0.0 MEASUREMENT II (16 Lessons)

12.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) measure length using vernier callipers and micrometer screw gauge
b) express quantities in correct number of decimal places and correct number of significant figures
c) express measurements in standard form
d) estimate the diameter of a molecule of oil
e) solve numerical problems in measurement.

12.2.0 Content

12.2.1 Measurement of length using Vernier callipers and micrometer screw gauge
12.2.2 Decimal places, significant figures and standard form
12.2.3 Estimation of the diameter of the molecule of oil (relate to the size of the HIV virus, mention effects of oil spills on health and environment)
12.2.4 Problems in measurements

12.3.0 Project Work

12.3.1 Construct Vernier Calliper.

13.0.0 TURNING EFFECT OF A FORCE (10 Lessons)

13.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define moment of a force at a point and state its SI unit
b) state and verify the principle of moments
c) solve problems involving the principle of moments.

13.2.0 Content

13.2.1 Moment of a force, unit of moment of a force
13.2.2 Principle of moments
13.2.3 Problems on principle of moments (consider single pivot only)

14.0.0 EQUILIBRIUM AND CENTRE OF GRAVITY (12 Lessons)

14.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define centre of gravity
b) determine experimentally the centre of gravity of lamina objects
c) identify and explain the states of equilibrium
d) state and explain factors affecting stability of an object
e) explain the applications of stability
f) solve numerical problems involving centre of gravity and moments of a force.

14.2.0 Content

14.2.1 Centre of gravity
(Experimental treatment required)
14.2.2 States of equilibrium
14.2.3 Factors affecting stability
14.2.4 Applications of stability
14.2.5 Problems on centre of gravity and moments of a force
(consider single pivot only)

15.0.0 REFLECTION AT CURVED SURFACES(16 Lessons)

15.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) describe concave, convex and parabolic reflectors
h) describe using ray diagram the principal axis, principal focus centre of curvature and related terms
i) locate images formed by curved mirrors by construction
j) determine experimentally the characteristics of images formed by a concave mirror
k) define magnification
l) explain the applications of curved reflecting surfaces.

15.2.0 Content

15.2.1 Concave and convex parabolic reflectors
15.2.2 Principal axis, principal focus, centre of curvature and related terms
15.2.3 Location of Images formed by curved mirrors by construction method
(Experiment on concave mirrors required)
15.2.4 Magnification formula
15.2.5 Applications of curved reflectors

16.0.0 MAGNETIC EFFECT OF ELECTRIC CURRENT (18 Lessons)

16.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) perform and describe experiments to determine the direction of the magnetic field round a current carrying conductor
h) construct a simple electromagnet
i) state the factors affecting the strength of an electromagnet
j) determine experimentally the direction of a force on a conductor carrying current in a magnetic field (motor effect)
k) state the factors affecting force on a current carrying conductor or in a magnetic field
l) explain the working of simple electric motor and electric bell.

16.2.0 Content

16.2.1 Magnetic field due to a current
16.2.2 Oersted's experiment
16.2.3 Magnetic field patterns on straight conductors and solenoid (right hand grip rule)
16.2.4 Simple electromagnets
16.2.5 Factors affecting strength of an electromagnet
16.2.6 Motor effect (Fleming's left hand rule)
16.2.7 Factors affecting force on a current carrying conductor in a magnetic field (Qualitative treatment only)
16.2.8 Applications:
- electric bell,
- simple electric motor

16.3.0 Project Work

16.3.1 Construct an electromagnet and at least one of the following:
- loudspeaker
- telephone receiver
- electric bell
- electric motor

17.0.0 HOOKE'S LAW (8 Lessons)

17.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state and verify experimentally Hooke's law
b) determine the spring constant
c) construct and calibrate a spring balance
d) solve numerical problems involving Hooke's law.

17.2.0 Content

17.2.1 Hooke's law
17.2.2 Spring constant
17.2.3 Spring balance
17.2.4 Problems on Hooke's Law

18.0.0 WAVES I(14 Lessons)

18.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the formation of pulses and waves
b) describe transverse and longitudinal waves
c) define amplitude(a), wavelength (λ), frequency (f) and periodic time(T) of a wave
d) derive the relation $v = f\lambda$
e) solve numerical problems involving $v = f\lambda$

18.2.0 C**ontent**

18.2.1 Pulses and waves
18.2.2 Transverse and longitudinal waves
18.2.3 Amplitude (a), Wavelength (λ), frequency (f), periodic time (T)
18.2.4 $v = f\lambda$
18.2.5 Problems involving $v = f\lambda$

19.0.0 SOUND (12 Lessons)

19.1.0 Specific Objectives

By the end of this topic the learner should be able to:

g) perform and describe simple experiments to show that sound is produced by vibrating bodies
h) perform and describe an experiment to show that sound requires a material medium for propagation
i) explain the nature of sound waves
j) determine the speed of sound in air by the echo method
k) state the factors affecting the speed of sound
l) solve numerical problems involving velocity of sound.

19.2.0 Content

19.2.1 Sound: nature and sources (experimental treatment required)
19.2.2 Propagation of sound: compressions and rarefactions
19.2.3 Speed of sound by echo method
19.2.4 Factors affecting speed of sound
19.2.5 Problems on velocity of sound

20.0.0 FLUID FLOW (14 Lessons)

20.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe streamline flow and turbulent flow
b) derive the equation of continuity
c) describe experiments to illustrate Bernoulli's effects
d) explain the Bernoulli's effect
e) describe the applications of Bernoulli's effect
f) solve numerical problems involving the equation of continuity.

20.2.0 Content

20.2.1 Streamline and turbulent flow
20.2.2 Equation of continuity
20.2.3 Bernoulli's effect (Experimental treatment required)
20.2.4 Applications of Bernoulli's effect: Bunsen burner, spray gun, carburator aerofoil, spinning ball
20.2.5 Problems on equation of continuity

FORM THREE

21.0.0 LINEAR MOTION (20 Lessons)

21.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define distance, displacement, speed, velocity and acceleration
b) describe experiments to determine velocity and acceleration
c) determine acceleration due to gravity
d) plot and explain motion - time graphs
e) applying the equations of uniformly accelerated motion
f) solve numerical problems.

21.2.0 Content

2.1.2.1 Distance, displacement, speed, velocity, acceleration (Experimental treatment required)

21.2.2 Acceleration due to gravity:
- free-fall,
- simple pendulum method

21.2.3 Motion-time graphs:
- Displacement - time graphs,
- Velocity - time graphs

21.2.4 Equations of uniformly accelerated motion

21.2.5 Problems on uniformly accelerated motion

22.0.0 REFRACTION OF LIGHT (20 Lessons)

22.1.0 Specific Objectives

a) By the end of this topic, the
b) learner should be able to:
c) describe simple experiments to illustrate refraction of light
d) state the laws of refraction of light
e) verify Snell's law
f) define refractive index
g) determine experimentally the refractive index
h) describe experiments to illustrate dispersion of white light
i) explain total internal reflection and its effects
j) state the applications of total internal reflection
j) solve numerical problems involving refractive index and critical angle.

22.2.0 **Content**

22.2.1 Refraction of light - laws of refraction (Experimental treatment required)

22.2.2 Determination of refractive index:
- Snell's law,
- real/apparent depth,
- critical angle

22.2.3 Dispersion of white light (Experimental treatment required)

22.2.4 Total internal reflection and its effects: critical angle

22.2.5 Applications of total internal reflection:
- Prism periscope,
- Optical fibre

22.2.6 Problems on refractive index and critical angle

23.0.0 NEWTON'S LAWS OF MOTION (15 Lessons)

23.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Newton's laws of motion
b) describe simple experiments to illustrate inertia
c) state the law of conservation of linear momentum
d) define elastic collision, inelastic collision and impulse
e) derive the equation F = ma
f) describe the application of frictional force
g) define viscosity
h) explain terminal velocity
i) solve numerical problems involving Newton's laws and the law of conservation of linear momentum.

23.2.0 Content

23.2.1 Newton's laws of motion (Experimental treatment on inertia required)

23.2.2 Conservation of linear momentum: elastic collisions, inelastic collisions, recoil velocity, impulse (oblique collisions not required).

23.2.3 F = ma.

23.2.4 Frictional forces:
- advantages and disadvantages,
- viscosity,
- terminal velocity (qualitative treatment).

23.2.5 Problems on Newton's Laws and law of conservation of linear momentum (exclude problems on elastic collisions)

24.0.0 WORK, ENERGY, POWER AND MACHINES (20 Lessons)

24.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

d) describe energy transformations
c) state the law of conservation of energy
d) define work, energy, power and state their SI units
e) define mechanical advantage, velocity ratio and efficiency of machines
f) solve numerical problems involving work, energy, power and machines.

24.20 Content

24.2.1 Forms of energy and energy transformations

24.2.2 Sources of energy:
- renewable,
- non-renewable

24.2.3 Law of conservation of energy

24.2.4 Work, energy and power (work done by resolved force not required)

24.2.5 Kinetic and potential energy

24.2.6 Simple machines

24.2.7 Problems on work, energy, power and machines

24.3.0 Project Work

24.3.1 Construct an energy saving jiko and a solar heater

25.0.0 CURRENT ELECTRICITY (20 Lessons)

25.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) define potential difference and state its units
j) measure potential difference and current in a circuit
k) verify Ohm's law
l) define resistance and state its unit
m) determine experimentally the voltage - current relationships for various conductors
n) define emf and explain internal resistance of a cell
o) derive the formulae for effective resistance of resistors in series and in parallel
h) solve numerical problems involving ohm's law, resistors in series and in parallel.

25.2.0 Content

25.2.1 Scale reading: Ammeter, Voltmeter

25.2.2 Electric circuits: current, potential difference

25.2.3 Ohm's law (experimental treatment required)

25.2.4 Resistance: types of resistors, measurements of resistance units

25.2.5 Electromotive force (emf) and internal resistance of a cell ($E = V + \imath r$)

25.2.6 Resistors in series and in parallel

25.2.7 Problems on Ohm's law, resistors in series and in parallel

26.0.0 WAVES II (10 Lessons)

26.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) describe experiments to illustrate the properties of waves
b) sketch wave fronts to illustrate the properties of waves
c) explain constructive interference and destructive interference

d) describe experiments to illustrate stationary waves.

26.2.0 Content

26.2.1 Properties of waves including sound waves: reflection, refraction, diffraction, interference (Experimental treatment required)

26.2.2 Constructive interference and destructive interference (qualitative treatment only)

26.2.3 Stationary waves (qualitative and experimental treatment required)

26.2.4 Problems involving waves

27.0.0 ELECTROSTATICS II (15 Lessons)

27.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) sketch electric field patterns around charged bodies

h) describe charge distribution on conductors of various shapes

i) define capacitance and state its SI unit

j) describe charging and discharging of a capacitor (calculation involving curves not required)

k) state the factors affecting the capacitance of a parallel plate capacitor

l) state the applications of capacitors

h) solve numerical problems involving capacitors.

27.2.0 Content

27.2.1 Electric field patterns

27.2.2 Charge distribution on conductors: spherical and pear shaped conductors

27.2.3 Action at points: lightning arrestors

27.2.4 Capacitance, unit of capacitance (farad, microfarad), factors affecting capacitance

27.2.5 Applications of capacitors

27.2.6 Problems on capacitors {using $Q=CV$, $C_T = C_1 + C_2$,

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$$ }

28.0.0 HEATING EFFECT OF AN ELECTRIC CURRENT (10 Lessons)

28.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

e) Perform and describe experiments to illustrate heating effect of an electric current

f) state the factors affecting heating by electric current

g) derive the equations for electrical energy and electrical power

h) identify devices in which heating effect of an electric current is applied

f) solve numerical problems involving electrical energy and electrical power.

28.2.0 Content

28.2.1 Simple experiments on heating effect

28.2.2 Factors affecting electrical energy, $W = VIt$, $P = VI$

28.2.3 Heating devices:- electric kettle, electric iron, bulb filament, electric heater

28.2.4 Problems on electrical energy and electrical power

29.0.0 QUANTITY OF HEAT (20 Lessons)

29.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) define heat capacity and specific heat capacity

h) determine experimentally specific heat capacity of solids and liquids

i) define specific latent heat of fusion and specific latent heat of vaporization

j) determine experimentally the specific latent heat of fusion of ice and the specific latent heat of vaporization of steam

k) state the factors affecting melting point and boiling point

l) explain the functioning of a pressure cooker and a refrigerator

g) solve problems involving quantity of heat.

29.2.0 Content

29.2.1 Heat capacity, specific heat capacity, units (Experimental treatment required)

29.2.2 Latent heat of fusion, latent heat of vaporization, units (Experimental treatment necessary)

29.2.3 Boiling and melting

29.2.4 Pressure cooker, refrigerator

29.2.5 Problem on quantity of heat ($Q = MC\Delta\theta$, $Q = M\ell$)

29.3.0 Project Work

29.3.1 Construct a charcoal refrigerator (cooler)

30.0.0 GAS LAWS (15 Lessons)

30.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the gas laws for an ideal gas
b) verify experimentally the gas laws
c) explain how the absolute zero temperature may be obtained from the pressure - temperature and volume - temperature graphs
d) state the basic assumptions of the kinetic theory of gases
e) explain the gas laws using the kinetic theory of gases
f) solve numerical problems involving gas laws.

30.2.0 Content

30.2.1 Boyle's law, Charles' law, pressure law, absolute zero

30.2.2 Gas laws and kinetic theory of gases ($P = \frac{1}{3}\frac{p^2}{C}$ not required)

30.2.3 Problems on gas laws [including $\frac{PV}{T}$ = constant]

FORM FOUR

31.0.0 THIN LENSES(20 Lessons)

31.1.0 Specific objectives

By the end of this topic, the learner should be able to:

j) describe converging lenses and diverging lenses
k) describe using ray diagrams the principal focus, the optical centre and the focal length of a thin lens
l) determine experimentally the focal length of a converging lens
m) locate images formed by thin lenses using ray construction method
n) describe the characteristics of images formed by thin lenses
o) explain image formation in the human eye
p) describe the defects of vision in the human eye and how they can be corrected
q) describe the use of lenses in various optical devices
r) solve numerical problems involving the lens formula and the magnification formula.

31.2.0 Content

31.2.1 Types of lenses
31.2.2 Ray diagrams and terms used
31.2.3 Images formed
- ray construction,
- characteristics,
- magnification.

31.2.4 Determination of Focal length:
(Experimental treatment required)
- estimation method,
- lens formula,
- lens-mirror method

31.2.5 Human eye, defects (short sightedness and long sightedness only)
31.2.6 Optical devices:
- simple microscope,
- compound microscope,
- the camera

31.2.7 Problems involving the lens formula and the magnification formula

31.3.0 Project work

31.3.1 Construct a telescope.

32.0.0 UNIFORM CIRCULAR MOTION (10 Lessons)

32.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define angular displacement and angular velocity
b) describe simple experiments to illustrate centripetal force
c) explain the applications of uniform circular motion
d) solve numerical problems involving uniform circular motion.

32.2.0 Content

32.2.1 The radian, angular displacement, angular velocity
32.2.2 Centripetal force;
$F = \frac{mv^2}{r}$, $F = mr\omega^2$
(derivation of formulae not required)
(experimental treatment is necessary)
32.2.3 Applications of uniform circular motion
32.2.4 Centrifuge, vertical, horizontal circles banked tracks (calculations on banked tracks and conical pendulum not required)
32.2.5 Problem solving
(Apply $F = \frac{mv^2}{r}$, $F = mr\omega^2$)

33.0.0 FLOATING AND SINKING (15 Lessons)

33.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Archimedes' principle
b) verify Archmimedes' principle
c) state the law of flotation
d) define relative density
e) describe the applications of Archimedes' principle and relative density

f) Solve numerical problems involving Archimedes' principle.

33.2.0 Content

33.2.1 Archimedes' principle, (experimental treatment) Law of flotation
33.2.2 Relative density
33.2.3 Applications of Archimedes' principle and relative density
33.2.4 Problems on Archimedes' principle

33.3.0 Project Work

33.3.1 Construct a hydrometer.

34.0.0 ELECTROMAGNETIC SPECTRUM (15 Lessons)

34.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

a) describe the complete electromagnetic spectrum
b) state the properties of electromagnetic waves
c) describe the methods of detecting electromagnetic radiations
d) describe the applications of electromagnetic radiations
e) solve numerical problems involving $c = f\lambda$.

34.2.0 Content

34.2.1 Electromagnetic spectrum
34.2.2 Properties of electromagnetic waves
34.2.3 Detection of electromagnetic (e.m.) radiations
34.2.4 Applications of e.m radiations (include greenhouse effect)
34.2.5 Problems involving $c = f\lambda$

35.0.0 ELECTROMAGNETIC INDUCTION (20 Lessons)

35.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe simple experiments to illustrate electromagnetic induction
b) state the factors affecting the magnitude and the direction of the induced emf
c) state the laws of electromagnetic induction
d) describe simple experiments to illustrate mutual induction
e) explain the working of an alternating current (a.c.) generator and a direct current (d.c.) generator
f) explain the working of a transformer
g) explain the applications of electromagnetic induction
h) solve numerical problems involving transformers.

35.2.0 Content

35.2.1 Simple experiments to illustrate electromagnetic induction
35.2.2 Induced emf:
- Faradays' law,
- Lenz's law

35.2.3 Mutual induction
35.2.4 Alternating current generator, direct current generator
35.2.5 Fleming's right hand-rule
35.2.6 Transformers
35.2.7 Applications of electromagnetic induction:
- induction coil,
- moving coil loudspeaker

35.2.8 Problems on transformers

35.3.0 Project Work

35.3.1 Construct a simple transformer.

36.0.0 MAINS ELECTRICITY (10 Lessons)

36.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the sources of mains electricity
b) describe the transmission of electric power from the generating station
c) explain the domestic wiring system
d) define the Kilowatt hour
e) determine the electrical energy consumption and cost
f) solve numerical problems involving mains electricity.

36.2.0 Content

36.2.1 Sources of mains electricity
36.2.2 Power transmission (include dangers of high voltage transmission)
36.2.3 Domestic wiring system
36.2.4 Kw-hr, consumption and cost of electrical energy
36.2.5 Problems on mains electricity

36.3.0 Excursion

36.3.1 Field trip to a power station is recommended.

37.0.0 CATHODE RAYS AND CATHODE RAY TUBE (10 Lessons)

37.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

f) describe the production of cathode rays
g) state the properties of cathode rays
h) explain the functioning of a Cathode Ray Oscilloscope (C.R.O.) and of a Television tube (T.V. tube)
i) explain the uses of a Cathode Ray Oscilloscope
j) solve problems involving Cathode Ray Oscilloscope.

37.2.0 Content

37.2.1 Production of cathode rays, cathode ray tube
37.2.2 Properties of cathode rays
37.2.3 C.R.O. and T.V. tubes
37.2.4 Uses of C.R.O.
37.2.5 Problems on C.R.O.

Note: Demonstration with a CRO is suggested.

38.0.0 X-RAYS (8 Lessons)

38.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

f) explain the production of X-rays
g) state the properties of X-rays
h) state the dangers of X-rays
i) explain the uses of X-rays
j) solve numerical problems involving X-rays.

38.2.0 Content

38.2.1 Production of X-rays, X-ray tube
38.2.2 Energy changes in an X-ray tube
38.2.3 Properties of X-rays, soft X-rays and hard X-rays
38.2.4 Dangers of X-rays and precautions
38.2.5 Uses of X-rays(Bragg's law not required)
38.2.6 Problems on x-rays

39.0.0 PHOTOELECTRIC EFFECT (15 Lessons)

39.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:

f) perform and describe simple experiments to illustrate the photoelectric effect
g) explain the factors affecting photoelectric emission
h) apply the equation $E = hf$ to calculate the energy of photons
i) define threshold frequency, work function and the electron volt
j) explain photoelectric emission using Einstein equation ($hf = hf_0 + \frac{1}{2} mv^2$)
f) explain the applications of photoelectric effect
g) solve numerical problems involving photoelectric emissions.

39.2.0 Content

39.2.1 Photoelectric effect, photons, threshold frequency; work function, Planck's constant, and electron-volt
39.2.2 Factors affecting photoelectric emission
39.2.3 Energy of Photons
39.2.4 Einsteins equation $hf = hf_o + \frac{1}{2}mv^2$
39.2.4 Applications of photoelectric effect:
- photo emissive,
- photo conductive,
- photovoltaic cells

39.2.5 Problems on photoelectric emissions

39.3.0 Project Work

39.3.1 Construct a burglar alarm.

40.0.0 RADIO ACTIVITY
(15 Lessons)

40.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) define radioactive decay and half-life
j) describe the three types of radiations emitted in natural radioactivity
k) explain the detection of radioactive emissions
l) define nuclear fission and fusion
m) write balanced nuclear equations
n) explain the dangers of radioactive emissions
o) state the applications of radioactivity
p) solve numerical problems involving half-life.

40.2.0 **Content**

40.2.1 Radioactive decay
40.2.2 Half-life
40.2.3 Types of radiations, properties of radiations
40.2.4 Detectors of radiation,
40.2.5 Nuclear fission, nuclear fusion
40.2.6 Nuclear equations
40.2.7 Hazards of radioactivity, precautions
40.2.8 Applications
40.2.9 Problems on half-life (integration not required)

41.0.0 ELECTRONICS (10 Lessons)

41.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) state the differences between conductors and insulators
h) define intrinsic and extrinsic semi-conductors
i) explain doping in semi-conductors
j) explain the working of a p-n junction diode
k) sketch current-voltage characteristics for a diode
l) explain the application of diodes in rectification.

41.2.0 Content

41.2.1 Conductors, semi-conductors, insulators
41.2.2 Intrinsic and extrinsic semi-conductors
41.2.3 Doping
41.2.4 p-n junction diode
41.2.5 Applications of diodes: half wave rectification and full-wave rectification

41.3.0 Project Work

41.3.1 Construct a simple radio receiver

SUGGESTED ASSESSMENT METHODS

1. Practical work.
2. Project work.
3. Field trips.
4. Oral questions.
5. Quizes.
6. Written tests and examination.

CHEMISTRY

INTRODUCTION

Chemistry as a subject is introduced to the learners for the first time at secondary school level. The knowledge of chemistry is necessary in the understanding of the composition, properties and behaviour changes of matter that form the environment around us.

This syllabus presents chemistry as a practical subject where scientific concepts, principles and skills are developed through experimental investigations. The learning of scientific knowledge by discovery method is encouraged.

The topics and content have been carefully selected and logically organised to facilitate step by step realization of the expected behavioral changes. The specific objectives in every topic will guide the teacher and the learner on the depth of treatment of content. The learning/teaching experiences have been appropriately chosen to ensure proper development of the cognitive, psychomotor and affective skills.
The syllabus emphasises the use of International Units for Physical and Applied Chemistry (IUPAC) system of nomenclature, correct use of chemical terminologies and equations.

There are applications and projects at the end of most of the topics to enable the learners link the subject with the physical environment around them. The learners would use the opportunities to interact with the physical and chemical processes, which take place within the local environment. The projects are meant to enhance creativity, critical thinking and ability to make logical decisions. The projects also make the learners aware of the effect of scientific knowledge in everyday life and thus able to appreciate their responsibility to the society.

The projects given are only examples. Teachers can come up with their own. The learners are also encouraged to initiate their own projects based on the scientific principles so far learnt. This creates interest, curiosity and fun in the learning of the subject.

Most of the apparatus, chemicals and equipment required for carrying out experiments are basic and affordable by most schools. Improvisation and use of local materials is encouraged where necessary to cut down on costs.

The suggested time is only a guide on how long each topic is expected to take.

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

1 select and handle appropriate apparatus for use in experimental work

2 make accurate measurements, observations and draw logical conclusions from experiments

3 observe and appreciate the need for safety precautions during experimental investigations

4 understand and appreciate the use of chemical symbols and formulae in writing equations

5 use appropriate chemical terms in describing physical and chemical processes

6 identify patterns in the physical and chemical behaviour of substances

7 apply the knowledge acquired to promote positive environmental and health practices

8 use the knowledge and skills acquired to solve problems in everyday life

9 apply principles and skills acquired in technological and industrial development

10 acquire adequate knowledge in chemistry for further education and for training.

FORM ONE

1.0.0 INTRODUCTION TO CHEMISTRY (12 Lessons)

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

f) recall the topics related to chemistry taught at primary school level
g) explain what the study of chemistry is about
h) name and state the uses of common apparatus in the laboratory
i) describe a Bunsen burner and its flame
j) state laboratory safety rules.

1.2.2 Content

1.2.3 Review the following topics

- properties of matter
- states of matter
- mixtures and their separations
- conductors and non-conductors of electricity
- Mention of drugs (prescription, dosage and abuse)

1.2.2 Chemistry and the Society

- Definition of chemistry and its role in the society

1.2.4 Chemistry laboratory

- heating apparatus (Bunsen burner, spirit lamp, candle, gas or kerosene stove and electric heater)
- parts of a Bunsen burner and its flame
- measuring apparatus (volume, temperature, mass, time)
- other apparatus (glass ware, spatula, deflagrating spoon, crucible, wire gauze etc)
- laboratory safety rules.

2.1.0 SIMPLE CLASSIFICATION OF SUBSTANCES (32 Lessons)

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

l) carry out simple experiments to obtain pure substances from mixtures
m) state the criteria for identifying a pure substance
n) define and determine the melting point and boiling point of a substance
o) explain the three states of matter (solid, liquid, gas) in terms of a simplified form of the kinetic theory
p) state the effect of heat on a variety of substances
q) distinguish between permanent and non-permanent changes
r) define an element, a compound, an atom and a molecule
s) name and write the chemical symbols of common elements
t) recognize the constituents of matter from given examples
u) distinguish between mixtures and compounds
v) apply separation techniques to extract various substances from natural sources.

2.2.0 Content

2.2.5 Separation of Mixtures

- Filtration, evaporation and condensation
- Distillation (simple and fractional), chromatography, solvent extraction as a method of extracting oil from nut seeds, crystallization, separation by using separating funnel, sublimation and decantation.
- Simple criteria for purity; melting point and boiling point.

2.2.6 Effect of heat on substances

- States of matter (solid, liquid, gases); The Kinetic theory
- Melting and boiling, condensation and evaporation of liquids in terms of kinetic theory
- Permanent and non-permanent changes (illustrate using iodine, wax, copper (II) sulphate crystals, potassium manganate (VII), zinc (II) oxide etc)

2.2.7 Constituents of matter

- Elements, atoms, molecules and compounds
- Names and symbols of common elements
- Simple word equations

2.2.8 Applications

- Fractional distillation of crude oil (e.g. Changamwe oil refinery) and liquid air, salt extraction e.g. Magadi Soda Company and Ngomeni; removal of stains from fabrics (dry cleaning); obtaining cream from milk.

2.4.0 Projects

- extraction of natural dyes, medicines and oils from plants
- construction and use of a fractionating column

3.1.0 ACIDS, BASES AND INDICATORS (16 Lessons)

3.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

f) prepare and use plant extracts as acid-base indicators
g) use indicators to identify acids and bases
h) state simple properties of acids and bases
i) name uses of acids and bases
j) state effects of acids on substances.

3.2.4 Content

3.2.5 Acid/Base indicators

- Plant - extracts as simple acid -base indicators
- Common acid-base indicators, universal indicator and pH scale
- Acidic, neutral and basic/alkaline solutions illustrated by the use of the following examples; water, aqueous solution/suspension; lemon juice, soap, wood ash, baking powder, anti-acid tablets and powders, toothpaste, sour milk, ammonia, ammonium sulphate, sodium chloride, sodium hydroxide, carbon (IV) oxide, sulphur (IV) oxide, sulphuric acid, hydrochloric acid, nitric acid, calcium hydroxide and magnesium oxide.

3.2.6 Simple properties of acids and bases:

- Reaction of dilute acids with metals, metal oxides, hydroxides, carbonates and hydrogen carbonates
- Effects of acids on substances

3.2.7 Applications

- Uses of acids and bases

3.3.0 Projects

- Investigate various plants extracts and use them as acid/base indicators

4.1.0 AIR AND COMBUSTION (24 Lessons)

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

m) state the percentage composition of air by volume
n) carry out simple experiments to show that oxygen is the active part of air
o) determine the percentage of oxygen in air using suitable methods
p) describe the combustion of specified elements in air and oxygen and name the products

q) explain how liquefied air can be separated into its components by fractional distillation
r) carry out experiments to investigate the conditions for rusting, and state the composition of rust
s) state methods of preventing rusting
t) prepare oxygen, investigate its properties and state its uses
u) arrange some elements in order of their reactivity with oxygen using experimental data
v) classify the products of burning elements in oxygen either as acidic or basic
w) state pollution effects due to burning of substances in air
x) state the uses of reactivity series.

4.2.6 Content

4.2.7 Composition of air

- Approximate percentage of nitrogen and oxygen in air by volume (mention of carbon dioxide and noble gases as other constituents of air)
- Quantitative determination of oxygen in air using copper, iron fillings and burning candle.
- Burning of substances in air; carbon, sulphur, phosphorus (CARE), sodium and copper
- Oxygen as an active part of air (mass changes involved)
- Fractional distillation of liquefied air
- Rusting: conditions, composition and prevention

4.2.8 Oxygen

- Laboratory preparation of oxygen using 20 volume by volume (v/v) hydrogen peroxide with manganese (IV) oxide or reaction of sodium peroxide with water (relate methods of collection to the properties of the gas)
- Properties; physical and chemical
- Combustion of elements in oxygen (metals and non-metals)
- competition for combined oxygen illustrated by the reaction of magnesium with carbon dioxide, lead (II) oxide) and copper (II) oxide
- Mention atmospheric pollution due to burning in oxygen

4.2.9 Reactivity Series

- order of reactivity of elements from reaction with oxygen: potassium, sodium, calcium, magnesium, aluminium, carbon, zinc, iron, lead and copper.
  (It is not possible to establish full series practically)
- Uses: oxy -acetylene in welding; life support functions

4.2.10 Application

Extraction of metals (use the concept of reactivity series only)

4.4.0 Projects

Determination of oxygen in water from different sources. Investigate industrial processes of large scale oxygen production (e.g. the British Oxygen Company (BOC) Kenya Limited).

5.1.0 WATER AND HYDROGEN
(20 Lessons)

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) state sources of water
j) describe an experiment to show water is a product of burning organic matter
k) describe an experiment to show that water contains hydrogen
l) state the products of reactions of cold water and steam with different metals
m) list the order of reactivity of metals as obtained from metal-water reactions
n) prepare hydrogen, investigate its properties and state its uses.
o) define oxidation as oxygen gain and reduction as removal of oxygen
p) explain metal oxide reactions with hydrogen in terms of reduction and oxidation.

5.2.3 Content

5.2.4 Water

- Sources of water: Burning of organic matter e.g. burning candle in air (test for carbon dioxide and water vapour using lime water and cobalt chloride paper or anhydrous copper (II) sulphate respectively)
- Water as an oxide of hydrogen.
- Reaction of sodium, calcium, magnesium with cold water and reaction of magnesium, zinc, iron with steam.

5.2.5 Hydrogen

- Laboratory preparation of hydrogen by reacting a metal with a dilute acid. (relate methods of collection to properties of the gas). Test for hydrogen
- Properties; physical and chemical
- Oxidation and reduction (oxygen gain and removal only) e.g. in metal oxide - hydrogen reaction. (Caution: experiments involving the burning of hydrogen gas are explosive).
- Uses (manufacture of margarine, rocket fuels, ammonia, hydrochloric acid, Oxyhydrogen flame for welding and weather balloons

5.4.0 Project

- Identification of common pollutants of water from local sources and suggesting their control

FORM TWO

6.1.0 STRUCTURE OF THE ATOM AND THE PERIODIC TABLE
(24 Lessons)

6.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

l) name and write the chemical symbols of the first twenty elements of the periodic table
m) describe the structure of the atom and write the electron arrangement of the first twenty elements of the periodic table
n) explain the electron arrangement of the atom in terms of energy levels
o) define atomic number, mass number, isotopes and relative atomic mass
p) calculate the relative atomic masses from isotopic composition
q) explain the position of an element in the periodic table in terms of the electron arrangement
r) define valency and oxidation number of an element
s) predict the type of ion formed from a given electron arrangement of an atom
t) predict the valencies and oxidation numbers from position of elements in the periodic table
u) derive the formulae of some simple compounds from valencies of elements and radicals
v) write simple balanced chemical equations.

6.3.1 Content

6.2.1 The Structure of the Atom

- Names and symbols of the first twenty elements of the periodic table.
- Simple structure of the atom; protons, electrons and neutrons; electron energy levels in atoms.

6.2.3 Atomic characteristics

- Definitions of atomic number, mass number, isotopes and relative atomic mass (reference C-12); examples of isotopes
- Calculations of relative atomic mass from relative abundance of isotopes of an element

6.2.3 The periodic table

- Build up of the periodic table for the first twenty elements on the basis of energy levels
  - rows (periods)
  - columns (groups)

6.2.5 Ion formation

- Formation of simple ions (cations and anions): qualitative treatment of the ionisation energy and electron affinity.
- Writing of the electron arrangement of ions formed from atoms; lithium, sodium, fluorine, chlorine, aluminium, magnesium and Sulphur; definition of valency and oxidation numbers.
- Derive valency and oxidation number of an element from atoms; its position in the periodic table
- Names and formulae of common radicals
- Use of valencies in determining the chemical formulae of some common compounds
- Writing simple balanced chemical equations

6.4.0 Project

- Atomic model construction

Note: The use of chemical equations with state symbols should be emphasised henceforth

7.1.0 CHEMICAL FAMILIES; PATTERNS IN PROPERTIES
(28 Lessons)

7.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

j) identify alkali metals, alkaline-earth metals, halogens and noble gases in the periodic table and write their electron arrangement
k) state and explain trends in physical properties of alkali metals, alkaline-earth metals, halogens and noble gases

l) state and explain the trends in reactivity of the alkali metals, alkaline-earth metals and halogens
m) explain the similarities in formulae of compounds formed by alkali metals, alkaline-earth metals and halogens
n) state the uses of alkali metals, alkaline-earth metals, halogens and noble gases
o) explain the unreactive nature of the noble gases in terms of their electron arrangement
p) identify the elements in a given period and write their electron arrangement
q) state and explain the trends in physical properties of elements in a period
r) state and explain the trends in chemical behaviour of elements in a given period.

7.2.6 Content

7.2.7 **Alkali metals (Group 1);**
(lithium, sodium, and potassium).

- Electron arrangement, gradation in size of the atom, ion and trends in ionisation energy.
- Physical properties; appearance, melting point, boiling point, thermal and electrical conductivity
- Reaction with air, water and chlorine.
- Similarity of ions and formulae of hydroxides, oxides and chlorides of alkali metals
- Uses of alkali metals (sodium only).

7.2.8 Alkaline - earth metals (Group 2)
(Beryllium, magnesium, and calcium)

- Electron arrangement, gradation in size of atom, ion and trends of ionisation energy
- Physical properties; appearance, melting point, boiling point, thermal and electrical conductivity
- Reaction with air, water, chlorine and dilute acids.

(Caution: Reaction between calcium and acid is violent. Use very dilute acid)

- Similarity of ions and formulae of oxides, hydroxides and chlorides
- Importance of alkaline-earth metals

7.2.9 **Halogens (Group 7);**
(Fluorine, chlorine, bromine and iodine);

- Electron configuration of fluorine and chlorine, gradation in size of atoms and ions
- Physical properties (appearance, melting point, boiling point, thermal and electrical conductivity)
- Reaction with metals, sodium, zinc, iron and water
- Similarity of ions and formulae of compounds
- Importance of fluorine, chlorine, bromine and iodine

7.2.10 **Noble gases (group 8)**;
(Helium, neon, argon)

- Electron arrangement and gradation in size of atoms
- Electron arrangement - the basis of low reactivity of helium, neon and argon
- Importance of noble gases

7.2.11 Properties and trends across a period

- Period three elements (sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine and argon)
- Electron arrangement of the elements
- Physical properties of period three elements (atomic size, ionisation energy, melting point, boiling point, thermal and electrical conductivity)
- Reaction of period three elements with oxygen, water and dilute acids

(Caution: Reaction of sodium with acids is explosive. Give theoretical treatment only)

7.4.0 Project

- Construction of models of the periodic table

8.1.0 STRUCTURE AND BONDING (20 Lessons)

8.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) describe the role of the outer electrons in determining chemical bonding
j) explain qualitatively the formation of covalent and ionic bonds
k) illustrate the covalent and ionic bonds using diagrams
l) explain the unique nature of the metallic bonding
m) state the effect of intermolecular forces of attraction on physical properties of substances
n) distinguish between bond types on the basis of physical properties of substances
o) compare and explain the changes in bond type across a period
p) select appropriate materials for use based on bond type.

8.3.0 Content

8.2.1 The role of outer electrons in chemical bonding

- significance of the outer electrons in chemical bonding.
- the noble gas electron arrangement
- electron transfer and ionic bonding
- electron sharing and covalent bonding
- use dot (.) and cross (x) diagrams to illustrate bonding, electrostatic forces of attraction in the following: molecular (iodine), giant covalent (diamond, graphite and silicon (IV) oxide), giant ionic (sodium chloride) and giant metallic (copper)
- other types of bonds: coordinate, hydrogen bond, Van der waals forces of attraction (simple explanation only)
- the influence of hydrogen bonds and Van der waals forces on physical properties (melting point, boiling point, solubility, electrical and thermal conductivity)

8.2.3 Types of bonds across a period (period 3)

- Changes in types of chemical bonds in oxides and chlorides of sodium, magnesium, aluminium, silicon, phosphorous, Sulphur and chlorine.

Note: Use of models to illustrate bonding should be encouraged.

8.2.3 Applications

Selection of materials for various uses; e.g. diamond, graphite and aluminium

8.2.6 Project

Investigation of materials in terms of their structure and bonding.

9.1.0 SALTS (20 Lessons)

9.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

h) select and use appropriate methods of preparing particular salts
i) explain the terms saturated solution, crystallisation, neutralisation and precipitation
j) write ionic equations for the preparation of salts
k) state types of salts
l) identify soluble and insoluble salts
m) describe and explain from experimental observations the action of heat on various salts
n) state uses of some salts.

9.2.5 Content

9.2.6 Methods of preparing salts

- preparation of soluble salts by reaction of acids with; metals, metal hydroxides, metal oxides, metal carbonates and metal hydrogen carbonates
- preparation of insoluble salts by precipitation (ionic equations required)
- direct combination reaction (e.g. sodium with chlorine, iron with sulphur)
- Types of salts; normal, acid and double salts.

9.2.7 Solubility of salts

- Solubility of sulphates, chlorides, nitrates and carbonates in water
- Relationship between method of preparation and solubility
  Note: The solubility of hydroxides and oxides should be considered along with others

9.2.8 Action of heat on salts

- Effects of heat on the following salts; carbonates, nitrates, sulphates and hydrated salts (include ammonium salts)
- Applications
  - use of lime to change soil pH
  - use of salts as anti - acids
  - use of salts as inorganic fertilizers

9.2.9 Project

Analysing anti-acid drugs.

10.1.0 EFFECT OF AN ELECTRIC CURRENT ON SUBSTANCES (16 Lessons)

10.1.0 Specific objectives

By the end of this topic, the learner should be able to:

g) define the terms conductor and non-conductor; electrolyte and non - electrolyte
h) classify solutions and molten substances as electrolytes and non-electrolytes
i) distinguish between electrolytes and non-electrolytes in terms of the particles they contain
j) explain the process of electrolysis and define the terms anode and cathode
k) state the products of electrolysis of a binary electrolyte
l) state some applications of electrolysis.

10.2.3 Content

10.2.4 Conduction of electricity

- Conductors and non-conductors
- Test for conduction of electricity by;
  - Solids, metals and non metals; (wood, aluminium foil, sodium chloride, sugar and lead (II) bromide)
  - aqueous solutions of: sugar, urea, copper (II) chloride, sodium chloride and mineral acids.
  - melts: Sulphur, lead (II) bromide or lead (II) iodide and sugar
- Electrolytes and non-electrolytes
- Ions as the particles in electrolyte solutions and melts
- Molecules as the particles in non-electrolyte solutions and melts

10.2.5 Electrolysis

- Passage of a direct electric current through an electrolyte (electrolysis of molten lead (II) bromide or lead (II) iodide)
- Anode and cathode
- Applications of electrolysis
  - electroplating
  - production and purification of metals

Note: details of the processes not required at this level

11.1.0 CARBON AND SOME OF ITS COMPOUNDS (20 Lessons)

11.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

k) define allotropy and allotropes
l) explain the physical properties of the carbon allotropes in terms of bonding and how the properties are related to the uses of the allotropes
m) describe some chemical properties of carbon
n) describe laboratory preparation and properties of carbon (IV) dioxide (Carbon dioxide)

o) state and explain the physical and chemical properties of carbon (IV) dioxide (Carbon dioxide)
p) describe laboratory preparation and some properties of Carbon (II) oxide (Carbon monoxide)
q) describe the chemical reactions of carbonates and hydrogen carbonates
r) describe the manufacture of sodium carbonate
s) explain the advantages and disadvantages of Carbon (IV) dioxide and carbon (II) oxide gases in the atmosphere
t) explain the importance of carbon compounds in the natural environment and industry.

11.2.2 Content

11.2.3 Forms of carbon

- Diamond, graphite and charcoal: structure, physical properties and uses (relate uses to structure and physical properties)

11.2.2 Chemical properties of carbon

- Consider combustion, reaction with acids and reducing action

11.2.3 Preparation and properties of Carbon (IV) oxide (carbon dioxide)

(Relate methods of collection to the properties of the gas)

- Reactions of the gas with water, lime water and alkalis.
- Uses of carbon (IV) oxide (carbon dioxide)

11.2.4 Preparation and properties of carbon (II) oxide (carbon monoxide)

- Preparation of carbon (II) oxide (carbon monoxide). Physical properties
- Chemical properties; combustion, reducing action, poisonous nature such as car exhausts fumes and charcoal fire

(Note: only theoretical treatment required because of its poisonous nature)

11.2.5 Carbonates and hydrogen carbonates

- Action of heat and dilute acids on some carbonates and hydrogen carbonates
- Production and manufacture of sodium carbonate (Magadi Soda Company and solvay process)
  Note: Use simple schematic diagrams to illustrate solvay process.

11.2.7 Importance of carbon and its oxides

- Carbon cycle
- Soft drinks manufacture
- Fire extinguishers
- The effects of Carbon (IV) oxide (carbon dioxide) and carbon (II) oxide (carbon monoxide) on the environment

11.3.0 Projects

- construction and use of simple fire extinguishers
- construction of carbon cycle chart.

FORM THREE

12.1.0 GAS LAWS (15 lessons)

12.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

g) state Boyle's and Charles' laws
h) carry out calculations involving the gas laws
i) use combined gas law in calculations
j) state Graham's law of diffusion
k) explain diffusion in liquids and gases in terms of kinetic theory
l) relate the rate of diffusion to the relative molecular mass of a gas.

12.2.0 Content

12.2.3 Boyle's law and Charles' law

- Boyle's law, Charles' law and combined gas laws
- Explanation of the laws (use graphs to illustrate)
- Calculations involving gas laws

Note: Use of SI units should be emphasised

12.2.4 Grahams' law of diffusion

- Graham's law of diffusion; experiments illustrating diffusion of bromine gas, dissolving of copper (II) sulphate crystals or potassium manganate (VII) crystals in water. Explain diffusion in terms of kinetic theory.
- Relationship between rate of diffusion and density or relative molecular mass of a gas (illustrate with ammonia and hydrogen chloride)
- Calculations on diffusion

13.1.0 THE MOLE: FORMULAE AND CHEMICAL EQUATIONS (40 Lessons)

13.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

l) define the mole
m) relate the mole to the relative atomic mass
n) convert mass into moles and vice versa
o) determine the empirical and molecular formulae of compounds from experimental results and given data
p) explain the terms concentration, molarity and dilution of a solution
q) define and prepare molar solution
r) prepare molar solutions
s) carry out titrations and calculations involving molar solutions
t) write correct full formulae and ionic equations of reactions with state symbols
u) define molar gas volume and atomicity of gases
v) state Avogadro's and Gay - Lussac's laws and carry out related calculations.

13.2.4 Content

13.2.5 The mole as a basic unit

- The mole as a basic unit. Molar mass
- Relative atomic mass (reference to carbon - 12) the mole as a number of particles (illustrated using 'counting by weighing' experiments)
- Conversion of mass in grammes to moles and vice versa (consider atoms, molecules and compounds)

13.2.6 Determination of formulae:

- Empirical and molecular formulae; quantitative determination of composition of magnesium oxide and copper (II) oxide

13.2.7 Molar solutions

- Preparations of molar solutions. Molarity of a solution.
- Concentration and dilution
- Stoichiometry of chemical reactions. (Use of ionic and full formulae equations in calculation of reacting quantities). Reactions that may be considered;

- Ba^{2+} (aq) + CO_3^{2-}(aq) **6** $BaCO_3$ (s) (precipitation)
- Pb^{2+} (aq) + $2I^-$(aq) **6** PbI_2 (s) (precipitation)
- Cu^{2+} (aq) + Fe (s) **6** Cu (s) + Fe^{2+} (aq) (displacement)
- Evolution of gas by action of an acid on solids e.g.

- Na_2CO_3 (s) + 2HCl (aq) 6 2NaCl (aq) + CO_2 (g) + H_2O (I)
- Acid/base titrations (use of pippete fillers recommended) (Use balanced ionic and full formulae equations in calculation of reacting quantities.)
- Redox titration involving acidified MnO^-_4/Fe^{2+} and $Cr_2O_7^{2-}/Fe^{2+}$ (writing of redox equations not required)

13.2.4 Molar gas volume

- Molar gas volume and atomicity of gases
- Avogadro's and Gay-Lussac's laws and related calculations

13.4.0 Project

Carrying out Counting by weighing experiments

14.0.0 ORGANIC CHEMISTRY I (HYDROCARBONS) (25 Lessons)

14.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) Define a hydrocarbon
b) name and draw the structures of simple hydrocarbons (alkanes, alkenes and alkynes).
c) state the features of a homologous series
d) draw and name isomers of simple hydrocarbons containing not more than five carbon atoms
e) describe the general methods of preparing alkanes, alkenes and alkynes
f) explain the physical and chemical properties of alkanes, alkenes and alkynes
g) state the uses of alkanes, alkenes and alkynes.

14.3.0 Content

14.2.1 Alkanes

- Definition of a hydrocarbon
- General formula: occurrence, nomenclature (consider straight chain alkanes of up to ten carbon atoms); fractional distillation of crude oil.
- Isomerism (butane and pentane)
- Preparation of methane and ethane
- Trends in physical properties (melting point, boiling point, density and solubility in water and in organic solvents)
- Chemical properties: burning and substitution reactions with chlorine or bromine (details of reaction mechanism not required)
- Uses of alkanes

14.2.4 Alkenes

- General formula, nomenclature (consider straight chain alkenes of up to six carbon atoms)
- Isomerism (butene and pentene)
- Preparation of ethane; trends in physical properties (melting point, boiling point, solubility in water and non-polar solvent)
- chemical properties (combustion, addition of chlorine, bromine, hydrogen, hydrogen halides, and ethene). (details of mechanism not required)
- Test for unsaturation (use acidified potassium manganate (VII) or bromine water)
- Uses of alkenes

14.2.5 Alkynes

- General formula, nomenclature (consider straight chain alkynes of up to six carbon atoms)
- Isomerism (butyne)
- Preparation of ethyne; trends in physical properties (melting point, boiling point, density solubility in water and non-polar solvents)
- chemical properties (combustion and addition reactions with chlorine, hydrogen, bromine, hydrogen halides).
- Uses of alkynes

15.0.0 NITROGEN AND ITS COMPOUNDS (30 lessons)

15.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

m) describe the isolation of nitrogen from air
n) describe the laboratory preparation of nitrogen and state its properties and uses
o) describe the laboratory preparation, and state the properties and uses of the oxides of nitrogen
p) describe the laboratory preparation of ammonia and state its properties and uses
q) explain the difference in chemical reactions of ammonia gas and its aqueous solution
r) describe the industrial manufacture of ammonia
s) calculate the percentage of nitrogen in nitrogen containing fertilizers
t) describe the preparation and manufacture of nitric acid
u) describe and explain the reactions of both dilute and concentrated nitric acid
v) state the uses of nitric acid
w) identify the products formed when different nitrates are heated
x) explain the pollution effects of nitrogen compounds in the environment.

15.4.0 Content

15.4.1 Isolation of nitrogen gas from air

- Isolation of nitrogen gas from air; laboratory and in industry.

15.4.2 Laboratory preparation of nitrogen gas

- Laboratory preparation of nitrogen gas
- Properties
  - inert character
  - burning magnesium and sulphur in nitrogen gas
- uses of nitrogen gas

15.4.3 Oxides of nitrogen (nitrogen (I) oxide, nitrogen (II) oxide, nitrogen (IV) oxide)

- Laboratory preparations
- Properties and uses of the oxides.

15.4.4 Ammonia

- Laboratory preparation and properties of ammonia gas (relate method of collection to the properties of the gas):
- Solubility in water
  - reaction of aqueous ammonia (NH_4OH) with cations.
  - reaction with air/oxygen (catalysed and uncatalysed), copper (II) oxide and hydrogen chloride,
- manufacture of ammonia by Haber process.
  (state optimum conditions only)
- uses of ammonia
- Fertilizers: mention of various nitrogen containing fertilizers, (sulphates, nitrates and phosphate), amount of nitrogen in various fertilizers.

15.4.5 Nitric acid

- Laboratory preparation and manufacture of nitric acid
- Reaction of dilute nitric acid with; metals, carbonates, hydroxides and oxides
- Reaction of concentrated nitric acid as an oxidizing agent; iron (II) solution, Sulphur and copper metal
- Uses of nitric acid

15.4.6 Action of heat on nitrates

- Effects of heat on nitrates of sodium, potassium, copper, lead and silver (silver nitrate may be considered theoretically due to its cost)
- Test for nitrates

15.2.8 Pollution effects of nitrogen compounds in the environment

16.0.0 SULPHUR AND ITS COMPOUNDS (25 lessons)

16.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) describe the allotropes of sulphur
j) describe the extraction and state the properties and uses of sulphur
k) describe the preparation and state the properties and uses of sulphur (IV) oxide (sulphur dioxide) and sulphur (VI) oxide (sulphur trioxide)
l) carry out tests to distinguish between sulphite and sulphate ions
m) explain the preparation and manufacture of sulphuric acid and state its uses
n) distinguish between the reactions of dilute and concentrated sulphuric acid
o) describe the preparation and state properties of hydrogen sulphide
p) explain environmental pollution caused by sulphur containing compounds.

16.3.0 Content

16.3.1 Occurrence and extraction of Sulphur

- Extraction by Frasch process
- Allotropes of sulphur
- Physical and chemical properties of sulphur
- Uses of sulphur

16.3.2 Sulphur (IV) oxide (sulphur dioxide)

- Preparation (relate method of collection to properties of the gas)
- Properties (acid character, bleaching action, reducing action e.g. test with potassium chromate (VI) and combination with oxygen to form sulphur (VI) oxide (Sulphur trioxide). oxidizing action e.g. with magnesium and hydrogen sulphide
- Test for sulphate and sulphite ions
- Uses of sulphur (IV) oxide

16.3.3 Manufacture of Sulphuric acid

- Contact process (state optimum conditions only) e.g. Kel Chemical Ltd in Thika, and East Africa Heavy Chemicals, Webuye
- Pollution control in contact process

16.3.4 Properties of Sulphuric acid

- Reaction of concentrated sulphuric acid as;
  - dehydrating agent (sucrose, ethanol, hydrated copper (II) sulphate)
  - oxidizing agent (copper, zinc, sulphur and carbon)
  - displacement reaction (sodium chloride solid, potassium nitrate solid)
- Reactions of dilute sulphuric acid with:
  - metals
  - carbonates
  - metal hydroxides
  - metal oxides

16.3.5 Hydrogen sulphide

- Preparation and physical properties
- Chemical properties (reducing action)

Note: Only theoretical treatment is required

16.3.6 Pollution of atmosphere by compounds of sulphur (hydrogen sulphide and oxides of sulphur)

17.0.0 CHLORINE AND ITS COMPOUNDS (20 Lessons)

17.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

h) describe and explain the laboratory preparation of chlorine
i) state and explain the properties and uses of chlorine
j) describe and explain the preparation of hydrogen chloride gas
k) state and explain the properties and uses of hydrogen chloride gas
l) explain the effect of a solvent on the properties of hydrogen chloride
m) describe the industrial manufacture of hydrochloric acid
n) explain environmental pollution caused by chlorine and chlorine containing compounds.

17.2.4 Content

17.2.5 Chlorine

- Preparation of chlorine by reaction of concentrated hydrochloric acid with manganese (IV) oxide or any other suitable oxidizing agent (relate method of collection to its properties)
- Physical properties
- Chemical properties
  Reactions of chlorine with;
  - hydrogen
  - metals (magnesium and iron)
  - non-metals phosphorous (caution!)
  - Reducing agents (hydrogen sulphide, sulphites and ammonia)
  - Water and alkali solutions (both dilute and concentrated)
  - Bromides and iodides (displacement reactions)
  - Bleaching action
- Test for chlorides in dry solids and aqueous solution
- Uses of chlorine

17.2.6 Hydrogen Chloride

- Preparation of hydrogen chloride gas by reaction of sodium chloride with concentrated sulphuric acid (relate method of collection to properties of the gas)
- Properties (physical and chemical)

17.2.7 Effect of solvent on the properties of hydrogen chloride

- Reactions of aqueous hydrogen chloride
  Compare the properties of aqueous hydrogen chloride and a solution of hydrogen chloride in methylbenzene
  - acid nature; litmus, reaction with metals, bases, carbonates and hydrogen carbonates
  - redox reaction with potassium manganate (VII) to produce chlorine
- Test for hydrogen chloride gas with ammonia

17.2.4 Uses of hydrogen chloride gas

- Industrial manufacture of hydrochloric acid (e.g. Pan Paper, Webuye)
- Uses of hydrochloric acid

17.2.6 Pollution of environment by chlorine and its compounds e.g. CFC, DDT etc

17.4.0 Projects

- determination of chlorine content of various bleaching powders and liquids
- investigation of water purification and treatment.

FORM FOUR

18.0.0 ACIDS, BASES AND SALTS (25 Lessons)

18.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

j) define acids, bases and salts
k) explain the differences between aqueous solutions of weak and strong acids; weak and strong bases; based on the degree to which they dissociate into ions
l) write formulae and ionic equations for specified acid-base and precipitation reactions
m) explain the effect of solvent in acid-base character
n) test for the presence of specified cations and anions
o) identify the precipitates and complex ions produced by specified cation-anion reactions
p) explain the use of solubility curves in salt extraction
q) state the types and causes of hardness of water
r) state the effects and explain the methods of removal of water hardness.

18.3.0 Content

18.3.1 Acids and Bases

- Acids as substances which dissociate in water to give hydrogen ions
- Bases as substances which dissociate in water to give hydroxide ions
- Weak and strong acids and bases; pH scale and electrical conductivity, (use aqueous solutions of; hydrochloric acid, ethanoic acid, sodium hydroxide and ammonia of the same concentration to illustrate)

18.3.2 Characteristics of Amphoteric oxides and hydroxides

- Reaction with acids and alkalis (aluminium oxide, zinc (II) oxide, zinc hydroxide lead hydroxide, and aluminium hydroxide).

18.3.3 Effect of solvent.

- Characteristics of hydrogen chloride in methyl benzene and aqueous solution, (illustrate with dry litmus, magnesium and marble chips)
- Reactions of dry and aqueous ammonia

18.3.4 Salts

- Salts as ionic compounds formed when cations derived from bases combine with anions derived from acids
- Precipitation reactions (use ionic equations)
- Reactions involving the following cations in aqueous solutions: magnesium, calcium, iron (II), iron (III), Barium (II), Zinc (II), Aluminium (III), Copper (II) with; sodium hydroxide, ammonia solution, Chloride, Carbonate, sulphite and sulphate ions

18.2.5 Complex ions

Dissolving of specific metal hydroxides in excess aqueous ammonia and sodium hydroxide solution

Formulae of the following required,
$[Cu(NH_3)_4]^{2+}$
$[Zn(NH_3)_4]^{2+}$, $[Al(OH)_4]^-$
$[Pb(OH)_4]^{2-}$ and $[Zn(OH)_4]^{2-}$
Equations not required

- Solubility; definition and relationship with temperature
- Solubility curves for sodium chloride, potassium nitrate, potassium chlorate (V), calcium sulphate and sodium carbonate.
- Fractional crystallization of salts
- Extraction of sodium carbonate from Lake Magadi and sodium chloride at Ngomeni

18.2.7 Water hardness

- Types of water hardness: causes and effects
- Methods of removal of water hardness; boiling, distillation, precipitation and use of ion exchange

18.3.0 Projects

d) Salt extraction from ash or soil.
e) Investigation of water hardness and its removal

19.0.0 ENERGY CHANGES IN CHEMICAL AND PHYSICAL PROCESSES (25 Lessons)

19.4.0 Specific Objectives

By the end of this topic, the learner should be able to:

k) define exothermic and endothermic reactions using $\in H$ notation
l) draw energy level diagrams
m) explain fusion and vaporisation as evidence of inter-particle forces
n) explain that energy changes in chemical reactions are due to bond formation and bond breaking
o) define and explain various types of heat changes
p) carry out experiments to determine enthalpy changes for some reactions
q) write correct simple thermochemical equations
r) state Hess' Law and carry out related calculations
s) state and explain the factors that influence the choice of fuel
t) explain the environmental effects of fuels.

19.5.0 Content

19.5.1 Endothermic and Exothermic reactions

- Enthalpy notation ($\in H$) for exothermic reactions and endothermic reactions

19.5.2 Latent heat

- Molar heat of fusion and vaporisation as evidence of overcoming forces of attraction between particles.

19.5.3 Quantitative determination of enthalpies

- Formation of hydrogen chloride gas from hydrogen gas and chlorine gas; formation of chloromethane from methane and chlorine gas
- Quantitative determination of enthalpies of:
  - Solution (e.g. ammonium nitrate, sodium hydroxide and conc. sulphuric acid)
  - combustion (e.g. methanol/ethanol)
  - displacement (e.g. copper from copper (II) ions by iron or zinc)
  - neutralization (e.g. sodium hydroxide and dilute hydrochloric acid).

19.5.4 Simple energy level diagrams

- Hess' Law (energy level diagrams and thermo chemical cycles) (use molar enthalpy of formation for illustration)
- Relate heat of solution to hydration and lattice energy

19.5.5 Common fuels; Energy contents of:

- Charcoal, fuel oil, ethanol (methylated spirit), liquid petroleum gas (LPG), petroleum, kerosene and diesel
- Choice of fuel;
- Precautions necessary when using fuels

19.5.6 Pollution by common fuels e.g. internal combustion engine

19.6.0 Projects

Comparison of heat energy values of fuels

20.0.0 REACTION RATES AND REVERSIBLE REACTIONS (15 Lessons)

20.1.1 Specific objectives

By the end of this topic, the learner should be able to:

d) define rate of reaction
e) explain the term activation energy
f) describe some methods used to measure rates of reaction
d) explain the effects of different factors on reaction rates
e) illustrate reaction rates graphically and interpret experimental data
f) state examples of simple reversible reactions

g) explain chemical equilibrium as a state of 'balance'
h) explain the effect of different factors on the position of equilibrium.

20.2.0 Content

20.2.1 Reaction rates

- Definition of rate of reaction
- Collision theory and activation energy (qualitative treatment only)
- Qualitative treatment of the effects of concentration, pressure, temperature, surface area, light and catalysts on rates of reactions. (No reaction mechanisms required).
- Experiments involving the following reactions:
  - calcium carbonate (marble chips) with dilute acid (hydrochloric or nitric acid).
  - sodium thiosulphate with dilute hydrochloric acid
  - metal with dilute acid (e.g. magnesium with hydrochloric acid).
  - hydrogen peroxide with various catalysts e.g. manganese (IV) oxide

  (Graphical presentation of results required)

20.2.2 Reversible reactions

- Equilibrium as the state of balance (example acid/alkali plus indicator, chromate/dichromate, hydrated and anhydrous copper (II) sulphate)
- The effect of changing concentration, pressure and temperature on position of equilibrium. Le Chatelier's Principle
- Uses in industrial processes (Contact and Haber processes).

21.0.0 ELECTROCHEMISTRY
(25 Lessons)

21.1.0 Specific objectives

By the end of this topic, the learner should be able to:

l) explain redox reactions in terms of gain and loss of electrons
m) identify changes in oxidation numbers during redox reactions
n) write balanced redox equations
o) explain an electrochemical cell in terms of electron transfer process
p) draw cell diagrams and write the cell notations
q) explain the construction and working of an electrochemical cell such as zinc - copper cell
r) compare oxidizing and reducing power of ions from displacement reactions
s) Calculate Electromotive Force of a cell given the standard electrode potentials
t) state and explain the factors that affect preferential discharge of ions during electrolysis
u) relate the quantity of electricity passed to amount of substances liberated at the electrodes
v) describe some applications of electrolysis.

21.2.0 Content

21.2.1 Redox reactions

- Electron transfer (gain and loss of electrons)
- Determination of oxidation numbers
- Use an illustration of iron (II) (acidified with dilute sulphuric acid) to iron (III) with hydrogen peroxide.
- Identify reactant - Iron (II) (aq), and product Iron (III) (aq), with hydroxide ion.

  Other examples; sodium/water magnesium/dilute acid (hydrochloric acid/sulphuric acid)

21.2.2 Displacement reactions; (as redox reactions)

- Reducing power
  - Reaction of metal/metal - cation ($M*M^{2+}$). Calcium, magnesium, zinc, iron, lead, copper.
- Oxidizing power of halogens: chlorine, bromine and iodine only.

21.2.3 Electrochemical cell

- Qualitative treatment of the electron flow in:
  Zn (s) $*Zn^{2+}$ (aq) $**Cu^{2+}$ (aq) $*$Cu (s) cell
  Note: Conventions, vertical line (*) represents a phase boundary where a potential difference develops e.g. Zn (s) $*Zn^{2+}$ (aq); two vertical parallel lines (**) represent a salt bridge.
- Standard electrode potentials (simple calculations involving E^{θ} values required)

21.2.4 Electrolysis

- The role of water in electrolysis.
- Preferential discharge in electrolysis of the following solutions:
  - Sodium chloride
  - Dilute sulphuric acid (acidified water).
  - Magnesium sulphate
  - Electrolysis of copper (II) sulphate using graphite and copper electrodes. (product changes in electrolytes)
- Factors affecting preferential discharge
  - Quantitative treatment of electrolysis
    (Note: First Faraday's law only).

21.2.5 Applications

- Extraction of metals
- Manufacture of sodium hydroxide, chlorine, hydrogen (electrolysis of brine).
- Copper refining, electroplating
- Investigating further electroplating processes, prevention of rusting (cathodic protection), investigate various types of cells.

21.3.0 Projects

22.0.0 METALS (20 Lessons)

22.1.0 Specific objectives

By the end of this topic, the learner should be able to:

g) name the chief ores of some metals
h) describe and explain general methods used in the extraction of metals from their ores
i) select and describe suitable methods for the extraction of some metals from their ores
j) describe and explain physical and chemical properties of some metals
k) state and explain various uses of these metals and their alloys
l) describe the effects of the industrial production processes of metals on the environment.

22.2.0 Content

22.2.1 Metals; methods of extraction:

- Chief metal ores of: sodium, aluminium, zinc, iron, copper and lead
- General methods of extraction (electrolysis and reduction)
- The electrolytic production of sodium and aluminium
- Extraction of iron, copper, and zinc from their ores.

22.2.5 Properties of Metals (sodium, aluminium, iron, copper and zinc):

- Physical properties (melting point, boiling point, thermal and electrical conductivity, density, malleability and ductility)
- Chemical properties (reaction with air, water, chlorine, dilute hydrochloric acid and oxidizing acids (concentrated nitric and sulphuric acid)

(Note: the reaction of sodium and dilute acid is explosive)

22.2.6 Uses of metals and their alloys
(alloys: brass, bronze, steel, duralumin)
- construction (air craft, bridges etc.), electrical materials (copper)

22.2.7 Pollution effect of the industrial production of metals on the environment

22.3.0 Projects
- Analysis of ores
- Construction of a mini-blast furnace
- Carrying out iron - smithing

23.0.0 ORGANIC CHEMISTRY II (ALKANOLS AND ALKANOIC ACIDS) (20 Lessons)

23.1.0 Specific Objectives
By the end of this topic, the learner should be able to:

k) name and draw the structures of simple alkanols and alkanoic acids
l) describe the preparation and explain the physical and chemical properties of alkanols and alkanoic acids
m) state the main features of the homologous series
n) state and explain the uses of some alkanols and alkanoic acids
o) describe the preparation, properties and uses of detergents
p) explain the effect of hard water on detergents
q) list some natural, synthetic polymers, fibres and state their uses
r) describe the preparation, properties and uses of some synthetic polymers
s) identify the structure of a polymer given the monomer
t) state the advantages and disadvantages of synthetic materials compared to those of natural origin in terms of both structure and properties.

23.4.0 Content

23.2.1 Alkanols
- General formula (ROH) Nomenclature (primary alcohols upto 10 carbon atoms)
- Preparation of alkanols from:
  - Hydrolysis of alkenes
  - Fermentation of carbohydrates
- Physical properties
  - Gradual changes in physical properties of primary alkanols (mention hydrogen bonding)
- Chemical properties
  - reactions with oxygen (burning), sodium, concentrated sulphuric acid (to give alkenes), ester formation and oxidation to give alkanoic acids
- Uses - solvents, fuels and pharmaceuticals.

23.2.4 Alkanoic acids
- General formula - RCOOH
- Nomenclature (primary alkanoic acids up to 10 carbon atoms)
- Preparation by oxidation of primary alkanols
- Physical properties
  - gradual change in physical properties of alkanoic acids (mention hydrogen bonding)
- Chemical properties
  - acid properties; salt and ester (alkanoates) formation [up to 2 carbons only]

Note: equations involving these reactions are required (state symbols are not required)

23.2.5 Detergents
- Soapy detergents (soaps)
  - laboratory preparation by hydrolysis of fats or oils with alkalis
  - mode of action
  - water hardness
  - pollution effects
- Soapless detergents
  - manufacture
  - mode of action
  - pollution effect
- Polymers
- Names of some natural polymers and fibres
  - cellulose materials (cotton, wood, paper;silk)
  - hydrocarbons (rubber and its vulcanisation)

- Names of some synthetic polymers and fibres
  - Polythene, polychloroethene (pvc)
  - polyphenylethene (polystyrene)
  - terylene, nylon, and Perspex.
- Synthetic rubber
  - Preparation properties and uses of synthetic polymers
  - Equations to show addition polymerisation for example formation of polythene, polychloroethene and polyphenylethene
- Advantages and disadvantages of synthetic polymers and fibres over those of natural origin should be mentioned. (include biological degradability of the materials).
- Uses of polymers and fibres. (manufacture of beer, spirits, soaps and detergents, drugs, textiles, packaging materials, pipes, tyres).

23.5.0 Projects

- fermentation of various carbohydrates to produce ethanol
- soap preparation
- investigate effects of soap and detergents on aquatic life
- investigate methods of recycling and disposal of plastics
- investigation of strength of polymers and fibres

24.0.0 RADIOACTIVITY (10 Lessons)

24.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

i) define radioactivity, half-life, radioisotope and nuclides
j) state types of radioactivity
k) name the particles emitted during radioactive decay and state their properties
l) carry out simple calculations involving half-life ($t^1/_2$)
m) write balanced nuclear equations
n) distinguish between nuclear fission and fusion
o) state uses of some radioisotopes
p) state dangers associated with radioactivity.

24.2.0 Content

24.2.2 Stability of isotopes of elements

- Stability of isotopes of elements
- Radioactivity, types of radiation, (alpha (α), beta (β) particles and gamma (γ) rays; characteristics and properties
- Radioactive decay as measured by half-life ($t_{½}$), calculations involving half -life ($t_{1/2}$)
- Nuclear equations: changes in nuclei resulting from radioactive decay by alpha (α), beta (β) particles and gamma (γ) rays
- Qualitative treatment of fission and fusion
  - mention nuclear reactions as source of energy

NB: Nuclear reactions are different from chemical reactions.

24.2.2 Applications

Uses and importance of radioisotopes in chemistry, medicine, carbon dating and agriculture.

24.2.3 Pollution effects of radioactivity

Dangers of radio isotopes
Environmental pollution e.g. the chernobyl disaster, titanium mining in Kwale

SUGGESTED ASSESSMENT METHODS

- Oral Questions
- Observation of individual/group activities
- Short answer questions
- Practical test/assignments
- Written assignments
- Project work
- Field trips

BIOLOGY

INTRODUCTION

The study of Biology aims at equipping the learner with the knowledge, attitudes and skills necessary for controlling and preserving the environment. The subject enables the learner to appreciate humans as part of the broader community of living organisms. This subject is important in fields such as health, agriculture,

environment and education. Biology is the precursor of biotechnology which is a tool for industrial and technological development

The content has been carefully reorganized to ensure that the required concepts and skills are realized. Sufficient practical activities have been suggested. These should be taught alongside the respective content rather than being treated as a separate entity. It is recommended that the teachers use discovery method in achieving the objectives of this subject. Most of the apparatus, chemicals and equipment required for practical activities are affordable. However, the teacher is highly encouraged to improvise using locally available materials to reduce costs.

Contemporary issues such as HIV/AIDS, S.T.Is, drug abuse and environmental pollution which have an impact on the learners lives have been incorporated for study.

The current system of using five kingdoms in classification has been adapted instead of the traditional two kingdom system

It is envisaged that this syllabus should be adequately covered within the allocated time. A suggested guideline on time allocation per topic has been provided to help the teacher in lesson planning. This however, can be adjusted to meet the requirements of the individual class.

SUBJECT OBJECTIVES

By the end of the course, the learner should be able to:

11. communicate biological information in a precise, clear and logical manner

12. develop an understanding of interrelationships between plants and animals and between humans and their environment

13. apply the knowledge gained to improve and maintain the health of the individual, family and the community

14. relate and apply relevant biological knowledge and understanding to social and economic situations in rural and urban settings

15. observe and identify features of familiar and unfamiliar organisms, record the observation and make deductions about the functions of parts of organisms

16. develop positive attitudes and interest towards biology and the relevant practical skills

17. demonstrate resourcefulness, relevant technical skills and scientific thinking necessary for economic development

18. design and carry out experiments and projects that will enable them understand biological concepts

19. create awareness of the value of cooperation in solving problems

20. acquire a firm foundation of relevant knowledge, skills and attitudes for further education and for training in related scientific fields.

FORM ONE

1.0.0 INTRODUCTION TO BIOLOGY (5 lessons)

1.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) define biology
b) list branches of biology
c) explain the importance of biology
d) state the characteristics of living organisms
e) state the main differences between plants and animals.

1.2.0 Content

1.2.6 Definition of biology
1.2.7 Branches of biology
1.2.8 Importance of biology
1.2.9 Characteristics of living organisms
1.2.10 Comparison between plants and animals

1.3.0 Practical Activities

1.3.1 Collecting, observing and recording external features of plants and animals

2.0.0 CLASSIFICATION 1 (12 lessons)

2.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

f) use the magnifying lens to observe the external features of plants and animals
g) record observations of the main external characteristics of living organisms, preserved specimens and photographs
h) state the necessity and significance of classification
i) name the major units of classification
j) state the application of Binomial nomenclature in naming organisms.

2.2.0 Content

2.2.1 Review the use of magnifying lens
2.2.2 External features of plants and animals
2.2.6 Necessity and significance of classification
2.2.7 Major units of classification: (naming)

- Kingdoms
  - Monera
  - protoctista
  - fungi
  - plantae
  - animalia

  (At least one example of each)
- For kingdom plantae and animalia, cover phylum/division, class, order,family,genus and species. Show relationship between the taxonomic units (Give at least one example of each taxon)

2.2.8 Discussion on Binomial nomenclature

2.3.0 Practical activities

2.3.1

- Use of collecting nets, cutting instruments and handlens
- Collection and detailed observation of:
  - Small animals e.g. insects
  - Plants - rhizoids, root systems (taproot, fibrous and adventitious), stems and leaves

3.0.0 THE CELL (20 lessons)

3.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

k) define the cell
l) state the purpose of a light microscope
m) identify the parts of a light microscope and state their functions
n) use and care for the light microscope and state the magnification
o) identify the components of a cell as seen under the light and electron microscopes and relate their structure to functions
p) compare plant and animal cells
q) mount and stain temporary slides of plant cells
r) describe animal cells as observed from permanent slides
s) estimate cell size
t) state the differences between cells, tissues, organs and organ systems.

3.3.0 Content

3.3.1 Definition of the cell

3.3.2 Structure and functions of parts of a light microscope

3.3.3 Use and care of the light microscope

3.3.4 Cell structure and functions as seen under
- a light microscope
- an electron microscope

3.3.5 Preparation of temporary slides of plant cells

3.3.6 Estimation of cell size

3.3.7 Cell specialization, tissues, organs and organ systems

3.3.0 Practical activities

3.3.6 Observe, identify, draw and state the functions of parts of the light microscope

3.3.7 Prepare and observe temporary slides of plant cells

3.3.8 Observe permanent slides of animal cells

3.3.9 Comparison between plant and animal cells

3.3.10 Observe, estimate size and calculate magnification of plant cells

4.0.0 CELL PHYSIOLOGY (20 lessons)

4.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) define cell physiology

i) correlate the membrane structure with cell physiology in relation to permeability

j) differentiate between diffusion, osmosis and active transport

k) state and describe factors affecting diffusion, osmosis and active transport

l) carry out experiments on diffusion and osmosis

m) explain the roles of diffusion, osmosis and active transport in living organisms

n) explain turgor and plasmolysis in terms of osmotic pressure.

4.2.0 Content

4.2.7 Meaning of cell physiology

4.2.8 Structure and properties of cell membrane (Theories of membrane structure not required)

4.2.9 Physiological processes - diffusion, osmosis and active transport

4.2.10 Factors affecting diffusion, osmosis and active transport

4.2.11 Role of diffusion, osmosis and active transport in living organisms

4.2.12 Water relations in plant and animal cells: turgor, plasmolysis, wilting and haemolysis

4.3.0 Practical Activities

4.3.1 Diffusion as demonstrated with potassium permanganate or potassium iodide/flower dyes/coloured plant extracts/smoke

4.3.2 Experiments with visking tubing and living tissues: fresh arrow roots/cassava/sweet potatoes/leaf petioles/irish potatoes/carrots

4.3.3 Plasmolysis can be demonstrated by using any of the following: spirogyra, epidermal cells of onion or raw egg that has been put in dilute hydrochloric acid overnight

5.0.0 NUTRITION IN PLANTS AND ANIMALS (59 lessons)

5.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

n) define nutrition and state its importance in living organisms

o) differentiate various modes of feeding

p) describe photosynthesis and show its importance in nature

q) explain how the leaf is adapted to photosynthesis

r) explain the factors affecting photosynthesis

s) distinguish between carbohydrates, proteins and lipids

t) state the importance of various chemical compounds in plants and animals

u) explain the properties and functions of enzymes

v) relate various types of teeth in mammals to their feeding habits

w) differentiate between omnivorous, carnivorous and herbivorous modes of feeding
x) relate the structures of the mammalian (human) alimentary canal to their functions
y) explain the role of enzymes in digestion in a mammal (human)
z) explain the factors that determine energy requirements in humans.

5.2.0 Content

5.2.1 Meaning, importance and types of nutrition

5.2.2 Nutrition in plants (autotrophism)
- Definition of photosynthesis and its importance in nature
- Adaptations of leaf to photosynthesis
- Structure and function of chloroplast
- Process of photosynthesis - light and dark stages (omit details of electron transport system and chemical details of carbondioxide fixation)
- Factors influencing photosynthesis
  - light intensity
  - carbon dioxide concentration
  - water
  - temperature

5.2.3 Chemical Compounds which Constitute Living Organisms
- Chemical composition and functions of carbohydrates, proteins and lipids (omit details of chemical structure of these compounds and mineral salts in plant nutrition).
- Properties and functions of enzymes (omit lock and key hypothesis)

5.2.4 Nutrition in Animals (heterotrophism)
Meaning and types of heterotrophism
- Modes of feeding in animals
- Dentition of a named carnivorous, herbivorous and omnivorous mammal
- Adaptation of the three types of dentition to feeding
- Internal structure of mammalian teeth
- Common dental diseases, their causes and treatment

5.2.5 Digestive system and digestion in a mammal (human)
- Digestive system, regions, glands and organs associated with digestion
- Ingestion, digestion, absorption, assimilation and egestion

5.2.6 Importance of vitamins, mineral salts, roughage and water in human nutrition

5.2.7 Factors determining energy requirements in humans

5.3.0 Practical activities

5.3.8 Carry out experiments on factors affecting photosynthesis

5.3.9 Observe stomata distribution

5.3.10 Carry out food test experiments

5.3.11 Carry out experiments on factors affecting enzymatic activities

5.3.12 Investigate presence of enzymes in living tissues (plants and animals)

5.3.13 Observe, identify, draw and label different types of mammalian teeth

5.3.14 Carry out dissection of a small mammal to observe digestive system and associated organs (demonstration)

FORM TWO

6.0.0 TRANSPORT IN PLANTS AND ANIMALS (52 lessons)

6.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

p) define transport and explain the necessity of transport in plants and animals
q) relate the structure of the root, root hair, xylem and phloem to their functions
r) relate the internal structure of the leaf to transpiration
s) explain possible forces involved in the movement of water and mineral salts through the plant
t) explain the significance of and factors affecting transpiration
u) demonstrate simple experiments on transpiration
v) distinguish between closed and open circulatory systems
w) relate the structure of the heart and the blood vessels to their functions
x) trace the path taken by blood from the heart to all parts of the body, and back to the heart
y) name the common diseases of the circulatory system in humans and suggest methods of control / prevention
z) relate the structure of the components of blood to their functions
aa) explain how oxygen and carbon dioxide are transported in the blood
bb) describe the mechanism of blood clotting and its importance
cc) describe the human blood groups and their importance in blood transfusion
dd) explain immunity and describe immune responses.

6.2.0 Content

6.2.1 Meaning and importance of transport systems

6.2.2 Absorption of Water and Mineral Salts
- Internal structure of root and root hairs
- Absorption of water
- Active uptake of mineral salts

6.2.3 Transpiration
- Definition of transpiration
- Review of the structure of the leaf
- Structure and function of xylem
- Factors affecting transpiration
- Forces involved in water movement in plants
  - Transpiration pull
  - Cohesion and adhesion
  - Capillarity
  - Root pressure

6.2.4 Translocation
- Structure and function of phloem
- Materials translocated (omit mechanisms of translocation)

6.2.5 Comparison between open and closed circulatory system

6.2.6 Mammalian Circulatory System
- Structure and function of the heart, arteries, veins, and capillaries
- Diseases and defects of the circulatory system (Thrombosis, Varicose veins, Arterio-sclerosis) and how to control them.

6.2.7 The Structure and Functions of Blood
- Composition of blood
- Functions of blood plasma
- The structure and functions of red blood cells and white blood cells
- Mechanism of blood clotting and its importance

6.2.8 Blood groups (ABO system and the Rhesus factor)

6.2.9 Immune responses
- Natural and artificial immunity
- Allergic reactions
- Importance of vaccinations against diseases (Tuberculosis, Poliomyletis, Measles, Diphtheria, Whooping cough)

6.3.0 Practical Activities

6.3.7 Observe permanent slides of sections of stems and roots

6.3.8 Carry out experiments to compare transpiration on lower and upper leaf surfaces

6.3.9 Observe wall charts/models
6.3.10 Analyse data on transpiration rate under different environmental conditions in Plants
6.3.11 Dissect a small mammal and observe its transport system (demonstration)
6.3.12 Make a longitudinal section of the mammalian heart to display the chambers and associated blood vessels
6.3.7 Record pulse rate at the wrist before and after vigorous activities and analyse the results
6.3.8 Demonstrate the unidirectional flow of blood in the cutaneous veins of the fore arm

7.0.0 GASEOUS EXCHANGE (36 lessons)

7.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

i) explain the need for gaseous exchange in living organisms
j) explain the mechanism of gaseous exchange in plants
k) compare the internal structures of aquatic and terrestrial roots, stems and leaves
l) examine various types of respiratory structures in animals and relate them to their functions
m) state the characteristics of respiratory surfaces
n) describe the mechanisms of gaseous exchange in protozoa, insects, fish, frog and mammal
o) describe the factors which control the rate of breathing in humans
p) state the causes, symptoms and prevention of respiratory diseases.

7.2.0 Content

7.2.3 Gaseous exchange in living organisms (necessity)
7.2.4 Gaseous Exchange in Plants
- Mechanisms of opening and closing of stomata
- The process of gaseous exchange in root, stem and leaves of both aquatic (floating) and terrestrial plants

7.2.3 Gaseous Exchange in Animals
- Types and Characteristics of Respiratory Surfaces - cell membrane, gills, buccal cavity, skin and lungs
- Mechanism of gaseous exchange in
  - Protozoa - amoeba
  - Insect - grasshopper
  - Fish - bonyfish
  - Amphibia - frog
  - Mammal - human

7.2.4 Factors affecting rate of breathing in humans

7.2.5 Respiratory diseases: Asthma, Bronchitis, Pulmonary tuberculosis, Pneumonia and Whooping cough

7.4.0 Practical Activities

7.4.1 Observe permanent slides of cross-sections of aerial and aquatic leaves and stems
7.4.2 Examine the distribution of spiracles on grasshopper or locust
7.4.3 Examine the gills of a bony fish
7.4.4 Dissect a small mammal and identify the structures of the respiratory system (demonstration)
7.4.5 Construct and use models to demonstrate breathing mechanisms in a mammal (human)
7.4.6 Demonstrate the effect of exercise on the rate of breathing

8.0.0 RESPIRATION (18 lessons)

8.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

e) explain the significance of respiration in living organisms
f) distinguish between aerobic and anaerobic respiration
g) describe the economic importance of anaerobic respiration in industry and at home
h) describe experiments to show that respiration takes place in plants and animals.

8.2.0 Content

8.2.3 Meaning and significance of respiration

8.2.4 Tissue respiration

- Mitochondrion - structure and function
- Aerobic respiration (Details of kreb's cycle not required)
- Anaerobic respiration in plants and animals, the products and by-products
- Application of anaerobic respiration in industry and at home
- Compare the energy output of aerobic and anaerobic respiration

8.3.0 Practical Activities

8.3.1 Carry out experiments to Investigate

- The gas produced when food is burnt
- The gas produced during fermentation
- Heat production by germinating seeds

9.0.0 EXCRETION AND HOMEOSTASIS (42 lessons)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

n) distinguish between excretion and egestion
o) explain the necessity for excretion in plants and animals
p) state the uses of excretory products of plants
q) describe the methods of excretion in a named unicellular organism
r) relate the structures of the human skin, lungs, liver and kidney to their functions
s) name common kidney diseases
t) explain the concept of internal environment and homeostasis
u) compare responses to changes in temperature by behavioural and physiological methods in animals
v) relate heat loss to body size in mammals
w) describe methods by which mammals gain and lose heat
x) explain how the functions of the following relate to homeostasis - skin, hypothalamus, liver and kidney
y) discuss the role of antidiuretic hormone, insulin and glucagons
z) describe simple symptoms of *Diabetes mellitus* and *Diabetes insipidus.*

9.2.0 Content

9.2.1 Excretion in Plants

- Methods of excretion in plants
- Useful and harmful excretory products of plants and their economic importance e.g. caffeine in tea and coffee, quinine, tannins, colchicine, cocaine, rubber, gum, papain (from pawpaw) and products of cannabis sativa (bhang) and khat (miraa)

9.2.2 Excretion and Homeostasis in Animals

- Distinction between excretion, homeostasis and egestion
- Excretion in a named uni-cellular organism (protozoa)
- Structure and functions of skin and kidney
- Neuro-endocrine system and homeostasis
  - Water balance (blood osmotic pressure)
  - Blood sugar level (control)
  - Temperature regulation (mention the role of hypothalamus)

9.2.3 Common kidney diseases, their symptoms and possible methods of prevention and control.

9.2.4 The role of the skin in thermoregulation, salt and water balance

9.2.7 Major functions of the liver and their contributions to homeostasis

9.2.8 Common diseases of the liver, their symptoms and possible methods of prevention/control

9.3.0 Practical Activities

9.3.5 Examine and draw the mammalian kidney

9.3.6 Make vertical sections of the kidney to identify cortex and medulla

9.3.7 Observe permanent slides of mammalian skin

9.3.8 Investigate effect of catalase enzyme on hydrogen peroxide

FORM THREE

10.0.0 CLASSIFICATION II (35 lessons)

10.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) state briefly the general principles of classification of living organisms
i) state general characteristics of each of the five kingdoms
j) state the main characteristics of arthropoda, chordata and major divisions of plantae
k) name classes of spermatophyta
l) describe the main characteristics of classes of phyla arthropoda and chordata
m) use observable external features to construct simple dichotomous keys of plants and animals
n) use already constructed dichotomous keys to identify organisms.

10.2.4 Content

10.2.5 Review of binomial nomenclature
10.2.6 General principles of classification
10.2.7 General characteristics of kingdoms

- Monera
- Protoctista
- Fungi
- Plantae
- Animalia

10.2.4 Main characterisitics of major divisions of plantae

- Bryophyta
- Pteridophyta
- Spermatophyta (cover only up to class level)

10.2.5 Main Characteristics of the Phyla Arthropoda and Chordata (cover up to classes as shown)

- Arthropoda
  - diplopoda
  - chilopoda
  - insecta
  - crustacea
  - arachnida
- Chordata
  - pisces
  - amphibia
  - reptilia
  - aves
  - mammalia

10.2.6 Construction and use of simple dichotomous keys based on observable features of plants and animals

10.3.0 Practical activities

10.3.1 Examine live/preserved specimens or photographs of representatives of major divisions of plantae and phyla arthropoda and chordata
10.3.2 Construct simple dichotomous keys using leaves/parts of common plants/arthropods/ common chordates in the local environment
10.3.3 Use dichotomous keys to identify organisms

11.0.0 ECOLOGY (55 lessons)

11.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

p) define the terms ecology, habitat, biomass, ecosystem and carrying capacity
q) identify the physical (abiotic) and biological (biotic) factors in a given ecosystem
r) describe the inter-relationships of organisms in the ecosystem
s) differentiate between saprophytism, parasitism and symbiosis
t) explain the importance of fungi and bacteria as decomposers
u) relate the mode of transmission to prevention/control of named parasites
v) describe the adaptive characteristics of named parasites to hosts
w) explain the importance of symbiotic bacteria in leguminous plants
x) describe the nitrogen cycle
y) explain the flow of energy in the

ecosystem

z) identify and construct food chains and food webs, pyramid of numbers and pyramid of biomass

aa) explain the use of various methods of estimating population

bb) relate adaptations of plants to various habitats

cc) describe the effects of pollutants in air, water and soil on humans and other living organisms

dd) identify symptoms of different types of human diseases, methods of transmission and control.

11.2.0 Content

11.2.1 Concepts of Ecology

- Ecology
- Habitat
- Niche
- Population
- Community
- Ecosystem
- Biomass
- Carrying capacity

11.2.8 Factors in an ecosystem

- Abiotic factors (environmental factors) - light, temperature, atmospheric pressure, salinity, humidity, pH and wind
- Biotic factors
- Inter-relationships - competition, predation, saprophytism, parasitism and symbiosis
- Nitrogen cycle

11.2.9 Energy flow in an ecosystem
Food chains, food webs, decomposers, pyramid of numbers and pyramid of biomass

11.2.10 Population estimation methods

- Quadrat method
- Line transect
- Belt transect
- Capture - recapture method

11.2.11 Adaptations of plants to various habitats

- Xerophytes
- Mesophytes (common terrestrial plants)
- Hydrophytes - Nymphea, Salvinia spp
- Halophytes – mangrove

11.2.12 Effect of pollution on human beings and other organisms
Causes, effects and control of pollutants in air, water and soil

11.2.13 Human diseases

- Bacterial diseases - Cholera and Typhoid
- Protozoa - Malaria and Amoebic dysentry (Amoebiasis)
- *Ascaris lumbricoides* and Schistosoma
  - Mode of transmission
  - Effects of the parasites on the hosts
  - Adaptive characteristics of the parasites
  - Control/prevention of diseases associated with the parasites

11.3.0 Practical activities

11.3.5 Collect, record, analyse and interpret data from ecological studies (examples of food chains should be used to join up to make food webs. Calculate ratios of consumers to producers from data provided)

11.3.6 Examine specimens of hydrophytes, mesophytes and xerophytes, and identify the features that adapt them to their habitats

11.3.7 Examine roots of legumes taken from fertile and poor soils to compare the number of root nodules

11.3.8 Estimate populations using sampling methods (for quadrat and line/belt transect, measure pH, temperature, wind direction and humidity)

12.0.0 REPRODUCTION IN PLANTS AND

ANIMALS (50 lessons)

12.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

l) describe location and appearance of chromosomes and chromosome movement during mitosis and meiosis

m) differentiate between mitosis and meiosis stating their significance in reproduction

n) describe and state the importance of asexual reproduction, binary fission, spore formation and budding

o) compare adaptations of wind and insect pollinated flowers

p) describe the process of fertilization in flowering plants

q) describe and explain how different fruits and seeds are formed and dispersed

r) differentiate between internal and external fertilization as exhibited by amphibians and mammals (humans)

s) relate structure of the human reproductive system to functions

t) describe the role of hormones in human reproduction

u) identify the symptoms and explain the method of transmission and prevention of sexually transmitted infections (S.T.Is)

v) explain the advantages and disadvantages of sexual and a sexual reproduction.

12.2.0 Content

12.2.1 Concept of reproduction
- Importance of reproduction

12.2.4 Chromosomes, mitosis and meiosis (mention gamete formation)

12.2.5 A sexual reproduction
- Binary fission in amoeba
- Spore formation/reproduction in mucor/Rhizopus
- Budding in yeast

12.2.4 Sexual reproduction in plants
- Structure and functions of parts of named insect and wind pollinated flowers
- Pollination and agents of pollination
- Features and mechanisms that hinder self-pollination and self fertilization
- The process of fertilization
- Fruit and seed formation and dispersal

12.2.5 Sexual reproduction in animals
- External fertilization in amphibians
- Structure of the reproductive system of a named mammal (human)
- Functions of the parts of reproductive system
- Fertilization, implantation and the role of placenta
- Gestation period
- Role of hormones in reproduction in humans (secondary sexual characteristics, menstrual cycle)

12.2.6 Sexually transmitted infections (S.T.Is)
- Gonorrhoea
- Herpes simplex
- Syphilis, Trichomoniasis, Hepatitis, Candidiasis
- HIV/AIDS (Acquired Immune Deficiency Syndrome) - emphasize preventive measures especially change of behaviour

12.2.7 Advantages and disadvantages of asexual and sexual reproduction

12.3.0 Practical Activities

12.3.8 Examine stages of mitosis using squashed young onion tip/charts/electron micrographs

12.3.9 Examine stages of meiosis using anthers of a flower

12.3.10 Grow bread mould and examine using a handlens

12.3.11 Examine spores in sori of a fern

12.3.12 Examine various types of insect and wind pollinated flowers and relate structure to function

12.3.13 Collect, classify and dissect fruits and seeds and relate their structure to mode of dispersal

12.3.14 Dissect a small mammal to show organs associated with reproduction (demonstration)

13.0.0 GROWTH AND DEVELOPMENT

(20 lessons)

13.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

j) differentiate growth from development
k) analyse experimental data on growth rates
l) identify parts of a named seed and factors affecting viability and dormancy in seeds
m) investigate conditions necessary for germination and distinguish the types of germination
n) measure one aspect of growth in a given seedling
o) determine the region of growth in seedlings
p) explain apical dominance
q) distinguish between complete and incomplete metamorphosis in insects
r) explain the role of hormones in regulating growth and development.

13.2.3 Content

13.2.4 Concepts of growth and development
13.2.5 Growth and development in plants
- Dormancy and ways of breaking it
- Conditions necessary for germination
- Epigeal and hypogeal germination
- Measurement of one aspect of growth in a named seedling e.g. region of growth
- Primary and secondary growth
- Role of growth hormones in plants
- Apical dominance

13.2.3 Growth and development in animals
- Complete and incomplete metamorphosis in insects
- Role of growth hormones in insects

13.3.0 Practical activities

13.3.1 Examine, draw and differentiate seeds
13.3.2 Determine the region of growth in shoots and roots
13.3.3 Investigate hypogeal and epigeal germination
13.3.4 Carry out experiments to demonstrate apical dominance
13.3.5 Observe stages of complete and incomplete metamorphosis in insects

13.4.0 Project work:

Measure either length of internodes/ breadth of leaves/height/dry weight of seedlings over a known period of time, analyse and present the data obtained in form of graphs, charts or histograms

FORM FOUR

14.0.0 GENETICS (34 lessons)

14.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

j) distinguish between continuous and discontinuous variations
k) describe the structure and properties of chromosomes
l) state the first law of inheritance and describe Mendel's work
m) construct and use punnet square/checker board
n) distinguish between F_1 and F_2 generations, genotype and phenotype, haploidy and diploidy, homozygosity and heterozygosity, dominance and recessiveness, linkage and sex linkage, mutations and mutagens
o) predict and explain the inheritance of the ABO blood groups and Rhesus (Rh) factor
p) state examples of genetically inherited disorders
q) explain causes of chromosomal mutations
r) explain the practical application of genetics.

14.2.0 Content

14.2.1 Concepts of genetics
- Variation within plant and animal species
- Review of chromosomes
- Brief mention of genes and DNA (without details of the molecular structure of genes and DNA)

14.2.2 First law of heredity
- Mendel's experiments - monohybrid inheritance (3:1 ratio)
- Complete and incomplete dominance, backcross/testcross
- Inheritance of ABO blood groups and Rh factor

14.2.3 Sex determination in humans

14.2.4 Linkage
Sex linked genes, sex linked characteristics e.g. Colour blindness, Haemophilia, Hairy ears and Nose

14.2.5 Mutations
- Types of mutations
- Causes and consequences of chromosomal mutations
- Gene mutations(only cover the following examples of genetic disorders: Albinism, Sickle cell Anaemia, Haemophilia, Colour blindness)

14.2.6 Practical applications of genetics
- Blood transfusion
- Plant and animal breeding using artificial selection
- Genetic counselling
- Genetic engineering

14.3.0 Practical Activities

14.3.4 Measure and record heights of class members and plot the data on graphs

14.3.5 Demonstrate chromosome behaviour in mitosis and meiosis by using clay/plasticine/insulated coloured wires/coloured thread

14.3.6 Carry out investigations on finger prints and tongue rolling

15.0.0 EVOLUTION (19 lessons)

15.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) explain the meaning of evolution and the current concepts of evolution
b) describe the struggle for existence and survival for the fittest
c) describe the evidences for organic evolution
d) explain resistance to antibiotics, fungicides and pesticides.

15.2.0 Content

15.2.1 Meaning of evolution

15.2.2 The origin of life
- Special creation
- Chemical evolution
(Brief explanation required)

15.2.3 Evidences for organic evolution
- Fossil records - brief mention of human evolution
- Geographical distribution - continental drift
- Comparative embryology
- Comparative anatomy
(Convergent and divergent evolution based on homology and analogy)
- Cell biology - occurrence of cell organelles and blood pigments

15.2.4 Mechanisms of evolution
- Lamarcks theory (Brief mention)
- Evolution by natural selection
- Natural selection in action e.g. peppered moth (industrial melanism)
- Resistance to drugs, pesticides and antibiotics

15.5.0 Practical activities

15.3.1 Compare vertebrate limbs
15.3.4 Compare wings of birds and insects
15.3.5 Education tour to an archeological site/local museum

16.0.0 RECEPTION, RESPONSE AND COORDINATION IN PLANTS AND ANIMALS (43 lessons)

16.1.0 Specific Objectives
By the end of the topic, the learner should be able to:
j) define irritability, stimulus and response
k) explain differences between tactic and tropic responses and their survival values
l) explain the production of plant hormones and their effects on tropisms (growth responses)
m) relate the structure of the mammalian nervous system to its functions
n) distinguish between simple and conditioned reflex actions
o) explain the role of endocrine system in humans
p) state the effects of drug abuse on the human health
q) relate structure to function of the human ear and eye
r) explain defects of the eye and ear and their corrections.

16.2.0 Content

16.2.1 Meaning of stimulus, response and irritability

16.2.2 Reception, response and coordination in plants
- Response to a variety of external stimuli
- Tropisms and tactic movements and their survival values
- Production of auxins and their effects on plant growth

16.2.3 Reception, responses and coordination in animals
- Components of the nervous system in a mammal
- Structure and functions of the neurones
- Functions of major parts of human brain
- Simple and conditioned reflex actions

16.2.4 The role of hormones in coordination in a mammal
- Effects of over secretion and under secretion of adrenaline and thyroxine in humans
- Functional differences and similarities between endocrine and nervous systems

16.2.5 Effects of drug abuse on the human health

16.2.6 Structure and functions of parts of the mammalian eye (human)
- Accommodation, image formation and interpretations
- Common eye defects and their corrections

16.2.7 Structure and functions of parts of the mammalian ear (human)
- Hearing (omit details of cochlea)
- Balance and posture (mention only parts involved)

16.3.5 Practical activities

16.3.6 Carry out experiments to investigate

tactic responses e.g. chemotaxis - use any of the following organisms: worker termites/fly maggots/earth worms/honey bee/grasshoppers/ woodlice

16.3.7 Carry out experiments on tropisms and etiolation

16.3.8 Determine the distance of blind spot

16.3.9 Carry out knee jerk experiment

17.0.0 SUPPORT AND MOVEMENT IN PLANTS AND ANIMALS (39 LESSONS)

17.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

h) explain the necessity of support and movement in animals and plants

i) describe the arrangement and the role of supporting tissues in young and old plants

j) list functions of the exo and endo-skeletons

k) describe locomotion in a named finned fish

l) identify the bones of the axial and appendicular skeleton in a mammal

m) describe the structure and functions of different types of joints in a mammal and explain how muscles bring about movement

n) distinguish between the different types of muscles, their locations and functions.

17.2.0 Content

17.2.1 Plants

- Necessity for support and movement in plants
- Review of tissue distribution in monocotyledonous and dicotyledonous plants (Histological details of tissues are not required)

17.2.2 Animals

- Necessity for support and movement in animals
- Types and functions of the skeleton
  - exoskeleton in arthropods
  - endoskeleton in vertebrates

17.2.7 Locomotion in a finned fish

17.2.8 Identification of the bones of axial and appendicular skeletons (names of individual bones of coccyx not required)

17.2.9 Types and functions of movable joints (ball and socket, hinge joint)

17.2.10 Structure, function and location of cardiac, smooth and skeletal muscles (Details of fine structure not required) Role of muscles in movement of the arm in humans

17.3.0 Practical activities

17.3.1 Observe permanent slides of transverse sections of the stems of herbacious and woody plants

17.3.6 Observe wilting in young herbacious plants

17.3.7 Examine the exoskeleton in arthropods

17.3.8 Observe and identify external features of a finned fish

17.3.9 Examine and draw different types of bones in mammals

SUGGESTED ASSESSMENT METHODS

7. Practical Work
8. Project work
9. Field trips
10. Oral questions
11. Quizzes
12. Written tests and examinations

AGRICULTURE

INTRODUCTION

This syllabus has been compiled with a view to accomplishing two fundamental objectives. First, the learners should develop basic principles of agricultural production relevant to Kenya in general, and specifically to their own environments. Secondly, learners should be involved in practicals which aim at assisting them to acquire useful agricultural skills. Therefore, it is highly recommended that learners be involved in practical work for actual agricultural production.

Affective domain objectives in agriculture are as important as those in cognitive and psychomotor domains. However, they must not be seen as achievable at the end of each single topic. They are long term objectives and are set out in the general rather than specific objectives. The teacher must not forget them in teaching and in assessment.

The syllabus covers crop production, livestock production, farm power and machinery, farm structures, agricultural economics and agroforestry. These are distributed throughout the four-year course.

An attempt has been made to arrange the topics in a logical sequence. However, due to different ecological zones and weather patterns in the country, teachers are advised to take into account these differences when developing their schemes of work. They should also endeavour to cover the syllabus within the allocated time. In topics on crop and livestock production, teachers should select examples which are most suited to their ecological zones. It is highly recommended that a crop museum be established in each school. Students should also be encouraged to plant suitable trees in their schools and label them using common and botanical names for each tree.

Each school is encouraged to harvest its rain water from the roof catchment, hold it in reservoirs and use it for irrigation and for livestock, among other uses. Rain water harvesting does not only avail cheap water to the school, but also prevents soil erosion and undermining of building foundations. Agricultural and other related activities must not be used as punishment for wrong doers.

At the end of this syllabus are appendices on lists of tools, weeds, pests and diseases to be studied. However, teachers are encouraged to innovate and to use local resources in teaching. A guide on learner/assessment and self evaluation is given in appendix II.

GENERAL OBJECTIVES

The Secondary Agriculture course aims to:

1. develop an understanding of agriculture and its importance to the family and the nation

2. promote interest in agriculture as an industry and create awareness of opportunities existing in agriculture and related sectors.

3. demonstrate that farming is a dignified and profitable occupation

4. enhance skills needed in carrying out agricultural practices

5. provide a background for further studies in agriculture

6. develop self-reliance, resourcefulness and problem solving abilities in agriculture

7. develop occupational outlook in agriculture

8. enable schools to take an active part in national development through agricultural activities

9. create awareness of the role of agriculture in industrial and technological development

10. enhance understanding of the role of technology and industrialization in agricultural development

11. promote agricultural activities which enhance environmental conservation

12. promote consciousness of health promoting activities in agricultural production.

FORM ONE

1.0.0 INTRODUCTION TO AGRICULTURE (8 lessons)

1.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define agriculture
b) state the main branches of agriculture
c) describe farming systems
d) explain the role of agriculture in the economy and demonstrate an appreciation of its importance to the country
e) demonstrate an appreciation for the wide and varied opportunities in agriculture.

1.2.0 Content

1.2.1 Definition of agriculture

1.2.2 Branches of agriculture

- Crop-farming (Arable farming)
  - i) Field crops
  - ii) Horticulture
    - Floriculture (flower farming)
    - Olericulture (vegetable farming)
    - Pomoculture (fruit farming)
- Livestock farming
  - i) Pastoralism - mammalian livestock farming
  - ii) Fish farming
  - iii) Apiculture (Bee keeping)
  - iv) Poultry keeping
- Agricultural economics
- Agricultural engineering

1.2.3 Systems of farming

- Extensive
- Intensive
- Large scale farming
- Small scale farming

Note:- Study each of the above systems under:

- Meaning
- Advantages
- Disadvantages

1.2.4 Methods of farming

- Mixed farming
- Nomadic pastoralism
- Shifting cultivation
- Organic farming
- Agroforestry

Note: Learners should be reminded that any of the above methods can be subsistence or commercial

1.2.5 Roles of agriculture in the economy

- Food supply
- Source of employment
- Foreign exchange earner
- Source of raw materials for industries
- Provision of market for industrial goods
- Source of capital

2.0.0 FACTORS INFLUENCING AGRICULTURE (24 lessons)

2.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain the human factors influencing agriculture
b) explain biotic factors influencing agriculture
c) explain how climatic factors influence agriculture
d) define soil
e) describe the process of soil formation
f) describe soil profile
g) determine soil constituents
h) classify soils by physical characteristics
i) explain chemical properties of soils
j) relate crop and livestock distribution to soils in different regions.

2.2.0 Content

2.2.1 Human factors

- Levels of education and technology
- Health - HIV/AIDs and health in general
- Economy (include liberalization)
- Transport and communication
- Market forces (local and international)
- Government policy
- Cultural and religious beliefs

2.2.2 Biotic Factors
- Pests
- Parasites
- Decomposers
- Pathogens
- Predators
- Pollinators
- Nitrogen fixing bacteria

2.2.3 Climatic Factors
- Rainfall
  - intensity
  - reliability
  - quantity
  - distribution
- Temperature
  - How topography and altitude affect temperature
  - How temperature influences crop and livestock production
- Wind
  - Evapotranspiraton
  - Lodging
  - Pollination
  - Seed dispersal
  - Soil erosion (note section 21.11)
- Light
  - Intensity
  - Duration - long, neutral and short day plants
  - Wavelength

Note: Each factor to be discussed with respect to the following:
- Land potentiality
- Crop production
- Livestock production
- Crop and livestock distribution in Kenya

2.2.4 Edaphic factors
- Definition of soil
- Soil formation
- Soil profile
  - Definition
  - Characteristics of different soil layers
  - Difference between soil formed in situ and depositions
  - Soil depth and its influence on crop production
- Soil constituents
  - Constituents (demonstrate presence of each)
  - importance of each constituent
- Physical properties of soil
  i) Soil structure
    - Definition
    - Types
    - Influence on crop production
  ii) Soil texture
    - definition
    - soil textural classification
    - influences on crop growth and production, porosity, capillarity, drainage and water retention capacity.
  iii) Soil colour
- Chemical properties of soil
  - Soil pH
  - pH influence on crop growth and production
  - Effects of pH on mineral availability

3.0.0 FARM TOOLS AND EQUIPMENT (7 lessons)

3.1.0 Specific objectives

By the end of the topic, the learner should be able to:
a) identify various farm tools and equipment
b) name parts of various farm tools and equipment
c) describe the use of various tools and equipment
d) carry out maintenance practices on tools and equipment
e) demonstrate an appreciation for care and maintenance of tools.

3.2.0 Content

3.2.1 Garden tools and equipment
3.2.2 Workshop tools and equipment
- Woodwork tools and equipment
- Metalwork tools and equipment

3.2.3 Livestock production tools and equipment
3.2.4 Plumbing tools and equipment
3.2.5 Masonry tools and equipment

Note: Study the above tools under the following headings:
- Name and uses
- Parts and uses
- Maintenance practices

Note: (see Appendix I for list of

tools and equipment to be studied)

4.0.0 CROP PRODUCTION I (LAND PREPARATION) (7 lessons)

4.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain the importance of land preparation
b) describe the various types of cultivation
c) relate cultivation operation to correct tools and or implements
d) prepare a piece of land ready for crop production.

4.2.0 Content

4.2.1 Land preparation
- Definition
- Importance

4.2.2 Operations in land preparation
- Clearing land before cultivation
  - Importance(include clearing as a method of land reclamation)
  - Methods and equipment
- Primary cultivation
  - Definition and importance
  - Timing
  - Choice of tools and implements
- Secondary cultivation
  - Definition and importance
  - Number of operations
  - Correct tools and implements for different operations
  - Relating final tilth to the intended planting material
- Tertiary operations
  - Ridging
  - Rolling
  - Levelling

Note: for each type:
- give reasons
- explain how it is carried out

- Sub-soiling
  - Meaning
  - Importance
  - Equipment used

4.2.3 Minimum tillage
- Definition
- Importance
- Practices

5.0.0 WATER SUPPLY, IRRIGATION AND DRAINAGE (10 lessons)

5.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the sources of water for the farm
b) describe collection, storage, pumping, and conveyance of water;
c) describe water treatment and explain its importance
d) define irrigation
e) explain the importance of irrigation
f) describe methods of irrigating land
g) list the equipment used in irrigation
h) grow a crop through irrigation
i) carry out maintenance on irrigation equipment and facilities
j) define drainage
k) explain the importance of drainage
l) describe the methods of drainage
m) explain how agricultural activities pollute water and how this can be prevented
n) demonstrate an appreciation for clean water in farming and life in general.

5.2.0 Content

5.2.1 Water supply
- Sources of water
- Collection and storage of water
- Pumps and pumping
- Conveyance of water
  - Piping: - types of pipes
  - Choice of pipes
  - Canals
  - Transportation in containers
- Water treatment
  - Meaning
  - Methods
  - Importance
- Uses of water on the farm

5.2.2 Irrigation
- Definition
- Importance (include irrigation as a method of land reclamation)
- Methods
  - surface
  - sub-surface
  - overhead
  - drip

  Note: advantages and disadvantages of each
- Maintenance practices of each irrigation system

5.2.3 Project on crop production through any method of irrigation

5.2.4 Drainage
- Definition
- Importance (include as a method of land reclamation)
- Methods of drainage
  - Surface
  - Sub-surface
  - Pumping
  - Planting of appropriate trees

5.2.5 Water Pollution
- Meaning
- Agricultural practices that pollute water
- Methods of pollution prevention and control

SOIL FERTILITY I (ORGANIC MANURES) (6 lessons)

6.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define soil fertility
b) explain how soil fertility can be maintained
c) describe how soil loses fertility
d) define and distinguish organic matter, manure and humus
e) explain the importance of organic matter in the soil
f) describe the different organic manures
g) prepare compost manure;
h) demonstrate a caring attitude towards soil.

6.2.0 Content

6.2.1 Soil fertility
- Definition
- How soil loses fertility
- Maintenance of soil fertility

6.2.2 Organic Manures
- organic matter and humus
- importance of organic matter in the soil
- types of organic manures
  - Green manure
  - Farm-yard manure
  - Compost manure

Note: For each type, describe its preparation, advantages and disadvantages and use

6.2.3 Compost manure:
- Meaning
- Materials used and materials to avoid
- Preparation methods and procedure
  - Heap
  - Pit

7.0.0 LIVESTOCK PRODUCTION I (COMMON BREEDS) (7 lessons)

7.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) name various livestock species
b) define the terms livestock, breed and type
c) describe the various breed characteristics
d) state the origin of various livestock breeds
e) classify the various breeds into types
f) name the external parts of the various livestock species
g) demonstrate an appreciation of the socio-economic value of livestock.

7.2.0 Content

7.2.1 Importance of livestock

72.2 Livestock species
- Cattle
  - Exotic
  - Indigenous
- Goats
- Sheep
- Pigs
- Poultry (chicken)
- Rabbits
- Camels

Discuss each under the following:
- Breed origin and characteristics
- Type of each breed
- External parts of each livestock species
- Typical conformation

7.2.3 Terms used to describe livestock in different species by age, sex and use.

8.0.0 AGRICULTURAL ECONOMICS I (BASIC CONCEPTS AND FARM RECORDS) (7 lessons)

8.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define economics and agricultural economics
b) explain basic concepts of economics
c) describe the importance of agricultural economics
d) explain the importance of farm records
e) describe the different types of farm records
f) keep farm records.

8.2.0 Content

8.2.1 Definition
- Economics
- Agricultural Economics

8.2.2 Basic concepts of economics
- Scarcity
- Preferences and choice
- Opportunity cost

8.2.3 Uses of farm records

8.2.4 Types of farm records
- Breeding
- Feeding
- Production
- Health
- Field operations
- Inventory
- Labour
- Marketing

FORM TWO

9.0.0 SOIL FERTILITY II (INORGANIC FERTILIZERS) (12 lessons)

9.1.0 Specific Objectives

By the end of the topic, the learner should be able to:

a) list the essential elements
b) classify the essential elements
c) state the role of each macro-nutrient
d) describe the deficiency symptoms of the macro-nutrients
e) identify and classify fertilizers
f) describe the properties of various fertilizers
g) describe soil sampling and testing procedures
h) use appropriate methods of fertilizer application
i) calculate fertilizer application rates
j) explain how soil acidity and alkalinity affect crop production.

9.2.0 Content

9.2.1 Essential elements

- Macro-nutrients
  - carbon hydrogen and oxygen
  - fertilizer elements(N.P.K)
  - liming elements (Ca, Mg, S)
- Role of macro-nutrients in plant growth
- Deficiency symptoms of macro-nutrients in crops
- Micronutrients

9.2.2 Inorganic fertilizers

- Classification of fertilizers
- Identification of fertilizers
- Properties of fertilizers
- Methods of fertilizer application
- Determination of fertilizer rates

9.2.3 Soil sampling

- Meaning
- Soil sampling methods and procedures
- Sites to avoid
- Preparation and Procedure of sending soil for testing

9.2.4 Soil testing

- Meaning
- Importance
- Testing for pH
- How soil pH affects crop production

Note: Learners to make a table showing optimum pH range for various crops with the help of the teacher.

10.0.0 CROP PRODUCTION II (PLANTING)

10.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the correct planting materials for various crops
b) select and prepare planting materials
c) determine the optimum time of planting
d) state the factors which determine the depth of planting
e) describe the planting procedures for different crops
f) state the factors that determine seed rate, spacing and plant population
g) calculate plant population
h) demonstrate an appreciation for economical use of land.

10.2.0 Content

10.2.1 Types of planting materials

- Seeds
  - Description
  - Advantages
  - Disadvantages
- Vegetative materials
  - Description
  - Advantages
  - Disadvantages
- Plant parts used for vegetative propagation
  - Slips
  - Splits
  - Bulbils
  - Crowns
  - Suckers
  - Tubers
  - Vines
  - Cuttings and setts

10.2.2 Selection of planting materials

- Suitability to ecological conditions (use maize hybrids and coffee varieties as examples)
- Purity
- Germination percentage
- Certified seeds

10.2.3 Preparation of planting materials
- Breaking dormancy
- Disease and pest control/seed dressing
- Seed innoculation
- Chitting

Note: Give appropriate crop for each Practice

10.2.4 Planting
- Timing
  - Factors to consider
  - Advantages of timely planting
- Methods of planting
  - Broadcasting
  - Row planting
  - Oversowing (refer to pastures)
  - Undersowing

Note: Give appropriate crop for each method

10.2.5 Plant population
- spacing
  - factors to consider
- seedrates
  - factors to consider
- calculation of plant population per unit area.

10.2.6 Depth of planting
- factors to consider

Note: Learners should:
- carry out the above practices
- develop a table showing spacing for different local crops

11.0.0 CROP PRODUCTION III (NURSERY PRACTICES) (16 lessons)

11.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe a nursery bed
b) distinguish between a nursery bed, a seedling bed and a seed bed
c) state the importance of a nursery bed
d) select a suitable site for a nursery
e) prepare a nursery bed
f) manage a nursery bed
g) transplant crops from a nursery
h) bud a seedling
i) graft a seedling
j) explain the importance of budding, grafting, layering and tissue culture
k) describe damage caused by animals on tree seedlings and how to prevent it.

11.2.0 Content

11.2.1 Nursery bed
- Definition
- Difference between a nursery bed, seedling bed and a seed bed
- Importance
- Site selection
- Nursery establishment
  i) Vegetable nursery
  ii) Tree nursery
  iii) Vegetative propagation nursery (tea as an example)
    - use of sleeves and other innovations for growing young plants
    - making and using seedling boxes for growing young plants
    - preparation of rooting medium
    - preparation of cuttings

11.2.2 Routine management in raising
- seedlings
- Seed drilling
- Mulching
- Watering
- Shading
- Pricking out
- Hardening off
- Weed control
- Pest control

- Disease control

11.2.3 Budding
- Meaning
- Methods and procedure
- Appropriate plants
- Appropriate tools and materials

Note: Learners to practice budding of orange scions on lemon root-stocks or other appropriate plants.

11.2.4 Grafting
- Meaning
- Methods and procedure
- Appropriate plants
- Appropriate tools and materials

Note: Learners to practice grafting on appropriate fruit trees

11.2.5 Importance of budding and grafting

11.2.6 Layering
- Methods
- Importance
- Appropriate crops/plants for layering
- Materials used in layering

11.2.7 Tissue culture for crop propagation

11.2.8 Transplanting of vegetable seedlings from nursery to seedbed
- Timing
- Procedure and precautions

11.2.9 Transplanting of tree seedlings
- Timing
- Digging appropriate holes
- Planting including firming and watering
- Protecting the seedlings after transplanting
  - Shading
  - Damage caused by animals on tree seedlings and how to prevent it.

12.0.0 CROP PRODUCTION IV (FIELD PRACTICES) (14 lessons)

12.0.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define crop rotation
b) state the importance of crop rotation
c) draw a crop rotation programme
d) distinguish terms used in crop farming
e) state the importance of mulching in crop production
f) describe the importance of various field practices in crop production
g) carry out various field practices
h) state the correct stage for harvesting various crops
i) describe harvesting practices for various crops.

12.2.0 Content

12.2.1 Crop rotation
- Definition
- Importance
- Factors influencing crop rotation
- Rotational programmes

12.2.2 Terms used in crop production
- Monocropping
- Intercropping
- Mixed cropping

12.2.3 Mulching
- Meaning
- Importance
- Types of mulching materials
  - organic
  - inorganic
- Advantages and disadvantages of mulching materials

12.2.4 Routine field practices
- Thinning
- Rogueing
- Gapping
- Training/staking/propping
- Pruning:
  i) Tea - table formation and maintenance
  ii) Coffee
  - single and multiple stem.
  - capping
  - de-suckering

- changing cycles

(iii) Banana stool management.
(iv) Pyrethrum
- cutting back

- Earthing up
- Crop protection:
  - Weed control
  - Pests and disease control (see unit 22 and 23)

Note: Study each of the above under
- Importance
- Timing
- Appropriate crops

12.2.5 Harvesting
- Stage and timing of harvesting
- Methods of harvesting
- Precautions during harvesting

12.2.6 Post - harvest practices:
- Threshing/shelling
- Drying
- Cleaning
- Sorting and grading
- Dusting
- Packaging

12.2.7 Storage
- Importance
- Types of storage
- Preparation of store

13.0.0 CROP PRODUCTION V (VEGETABLES) (16 lessons)

13.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) grow a vegetable crop from nursery establishment to harvesting
b) keep crop production records
c) market farm produce
d) demonstrate an appreciation of agriculture as an economically lucrative activity.

13.2.0 Content

13.2.1 Vegetable crops
- Tomatoes - use varieties that require pruning and staking.
- Carrots
- Onions
- Cabbages/kales

Note:
- Each student should grow at least one of the above crops keeping all the necessary records
- The teacher should organise the class in such a way that there are students growing each of the crops
- Class discussions should be organised so that students tell and demonstrate to each other their work in the different vegetable crops. Discussion may be held at the crop plots for students to observe.
- The teacher may organise common nurseries for students growing tomatoes, cabbages/kales and onions. However, all students should actively participate in all nursery establishment and management practices.
- Topics 12.00 and 13.00 may be carried out concurrently as theory and practical

14.0.0 LIVESTOCK HEALTH I (INTRODUCTION TO LIVESTOCK HEALTH) (8 lessons)

14.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define health and disease
b) describe signs of sickness in animals
c) state the predisposing factors of livestock diseases
d) categorize animal diseases;
e) carry out disease control practices
f) state the importance of maintaining livestock healthy
g) demonstrate a caring attitude towards livestock.

14.2.0 Content

14.2.1 Health and disease
- Definitions
- Importance of keeping livestock healthy
- Pre-disposing factors of livestock diseases
- Signs of ill -health in livestock

14.2.2 Classification of livestock diseases by cause
14.2.3 General methods of disease control
14.2.4 Appropriate methods of handling livestock

15.0.0 LIVESTOCK HEALTH II (PARASITES) (16 Lessons)

15.1.0 Specific objectives

By the end of the topic, the learner should be able to:

e) describe host-parasite relationship
f) identify different parasites
g) describe the life-cycle of parasites
h) explain methods of parasite control in livestock.

15.2.0 Content

15.2.1 Host - parasite relationship
- effects of parasites on hosts

15.2.2 External parasites
- Ticks
- Tsetseflies
- Mites
- Lice
- Fleas
- Keds

15.2.3 Internal parasites
- Roundworms (Ascaris spp)
- Tapeworms (Taenia spp)
- Flukes (Fasciola spp)

Note:
- The parasites in 15.2.2 and 15.2.3 should be studied under the following:-
  i) Identification
  ii) Livestock species attacked
  iii) Part(s) of livestock attacked or inhabited and mode of feeding
  iv) Signs and symptoms of attack

- Describe the life cycles of the following:
  i) Roundworm (ascaris spp.)
  ii) Tapeworm (Taenia spp.)
  iii) Liver Fluke (Fasciola spp.)
  iv) Ticks, appropriate examples of:
    - one - host
    - two - host
    - three - host

Note: Indicate whether soft or hard tick

- State methods of parasite control giving appropriate example of a parasite for each method.

16.0.0 LIVESTOCK PRODUCTION II (NUTRITION) (12 Lessons)

16.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) identify and classify livestock feeds
b) describe digestion and digestive systems of cattle, pig and poultry
c) define terms used to express feed values
d) compute a livestock ration
e) prepare balanced ration for various livestock
f) demonstrate a caring attitude towards livestock.

16.2.0 Content

16.2.1 Livestock nutrition
- Feeds and Feeding
  - Identification
  - classification of feeds
  - Terms used in expressing feed values
  - Computation of livestock rations
  - Preparation of livestock rations

- Digestive systems.
  - Ruminant cattle
  - Non-ruminant (pig and poultry)

- Digestion in cattle, pig and poultry

16.2.2 Appropriate livestock handling techniques while feeding

FORM THREE

17.0.0 LIVESTOCK PRODUCTION III (SELECTION AND BREEDING) (12 lessons)

17.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) describe reproduction
b) describe reproductive systems,
c) select breeding stock
d) describe breeding systems
e) identify signs of heat in livestock
f) describe methods used in serving livestock
g) demonstrate a caring attitude towards livestock

17.2.0 Content

17.2.1 Reproduction and reproductive systems.
- Cattle
- Poultry

17.2.2 Selection:
- meaning
- Factors to consider in selecting a breeding stock
  - Catttle
  - Sheep
  - Goats
  - Pigs
  - Camels
- Methods of selection
  - mass selection
  - contemporary comparison
  - progeny testing

17.2.3 Breeding
- Meaning
- Terms used in breeding
  - Dorminant and recessive genes
  - Heterosis(hybrid vigour)
  - Epistasis
- Breeding systems
  - Cross-breeding
  - Up-grading
  - Inbreeding
  - Line breeding
  - Out-crossing

Note: Discuss under the headings:
- Definition
- Advantages
- Disadvantages

17.2.4 Signs of heat in:
- Cattle
- Pigs
- Rabbits

Note: Study the oestrus cycle of each of the above

17.2.5 Methods of service in livestock
- Natural mating
- Artificial insemination
- Embryo transplant

Note: Discuss advantages and disadvantages of each.

17.1.6 Signs of parturition
- Cattle
- Pigs
- Rabbits

Note: Learners to handle livestock in appropriate caring manner.

18.0.0 LIVESTOCK PRODUCTION IV (LIVESTOCK REARING PRACTICES) (10 lessons)

18.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) describe livestock rearing practices
b) carry out livestock rearing practices
c) demonstrate a caring attitude towards livestock.

18.2.0 Content

18.2.1 Routine livestock rearing practices
- Feeding practices
  - Flushing
  - Steaming up
  - Creep feeding
- Parasites and Disease control practices
  - Vaccination
  - Deworming
  - Hoof trimming
  - Docking
  - Dipping/spraying
  - Dusting

- Breeding practices
  - Crutching
  - Tupping and serving
  - Raddling
  - Ringing
- Identification
- Debeaking
- Tooth clipping
- Culling: Describe general methods and carry out practicals on:
  - Cattle
  - Poultry
- Dehorning
- Shearing
- Castration
  - open
  - closed
  - caponization
- Management during paturation:-
  - Pigs
  - Cattle
  - Sheep
  - Goats
  - Rabbits

18.2.2 Bee Keeping (Apiculture)
- Importance
- Colony
- Siting of the apiary and hive
- Stocking the bee hive
- Management:
  - Feeding
  - Predator and pest control
- Honey harvesting and processing

18.2.3 Fish Farming (aquaculture)
- Importance
- Types of fish kept in farm ponds
- Management
- Harvesting
- Processing and preservation

18.2.4 Appropriate handling of livestock during routine management

19.0.0 FARM STRUCTURES (18 Lessons)

19.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe parts of a building
b) identify materials for construction
e) describe various farm structures and their uses
f) describe sitting of various structures
f) construct and maintain farm structures.

19.2.0 Content

19.2.1 Farm buildings and structures
- Siting
- Parts of a building
  - Foundation
  - Wall
  - Roof

19.2.2 Livestock buildings and structures
- Crushes
- Dips
- Spray race
- Dairy shed/parlour
- Calf pens
- Poultry houses and structures
  - Deep litter
  - Coops
  - Folds/Arks
  - Runs
  - Battery cages
- Rabbit hutches/Rabbitry
- Piggery/pig sty
- Fish ponds
- Silos (for silage)
- Zero grazing unit
- Bee hives

19.2.3 Farm stores
- Feed
- Farm produce
- Chemical
- Machinery
- Tools

19.2.4 Green house
- Meaning
- Construction materials
- uses

19.2.5 Fences in the farm
- Types of fences and materials used
- Uses - advantages and disadvantages
- Gates and passes in fences
- Fence reinforcements

Note
- Construct either of the following structures:
  i) a crush
  ii) a beehive
  iii) a hutch
- Visit nearby construction sites for observation.

20.0.0 AGRICULTURAL ECONOMICS II (LAND TENURE AND LAND REFORM) (8 Lessons)

20.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define the term tenure
b) describe tenure systems
c) describe land reforms.

20.2.0 Content

20.2.1 Land tenure

- definition
- tenure systems
  - (i) individual
    - Types
    - Advantages and disadvantages
  - (ii) collective
    - Description
    - Advantages
    - Disadvantages

20.2.2 Land reforms

- Definition
- Types of reform and reasons for each
  - Fragmentation
  - Consolidation
  - Adjudication
  - Registration (Emphasise the importance of a title deed)
  - Settlement and resettlement

21.0.0 SOIL AND WATER CONSERVATION (19 Lessons)

21.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define soil erosion
b) explain the various factors that influence erosion
c) list the agents of erosion
d) describe the various types of erosion
e) describe various methods of erosion control
f) demonstrate a caring attitude towards soil and water
g) carry out soil erosion control measures
h) describe water harvesting and conservation techniques
i) describe micro-catchments and their uses.
j) design and construct a micro-catchment .

21.2.0 Content

21.2.1 Soil erosion

- Definition
- Factors influencing erosion -
  - Land use and ground cover
  - Topography - gradient and length of slope (horizontal and vertical intervals)
  - Soil type and condition (Erodability)
  - Rainfall intensity (Erosivity)
- Agents of erosion
  - Water
  - Wind
  - Human beings
  - Animals
- Types of erosion
  - i) Splash/rain drop
  - ii) Sheet
  - iii) Rill
  - iv) Gully
    - gully formation
    - types of gullies
  - v) River bank
  - vi) Solifluction
  - vii) Landslides
- Soil erosion control
  - (i) Biological/cultural control
    - Grass strips
    - Cover crops
    - Grassed waterways
    - Contour farming and strip cropping
    - Mulching
    - Afforestation/forestation
  - (ii) Physical/structural controls
    - Stone lines
    - Filters /strip
    - Trashlines
    - Terraces - level, graded, broad based narrow-based. bench, fanya juu, fanya chini.
    - Bunds
    - Cut-off - drains/Diversion ditches
    - Gabions/porous dams
    - Ridging

21.2.2 Water harvesting
- Roof catchment
- Rock catchment
- Weirs and dams
- Ponds
- Retention ditches/Level terraces

21.2.3 Micro-catchments
- Types
- Laying out and construction methods
- Uses

Note
- A local soil conservation officer to be contacted for necessary tools and demonstration of skills in establishing level and graded terraces
- Learners to practice using leveling boards, line and spirit level to develop conservation structures.
- Learners to carry out soil and water conservation work in and or out of school wherever appropriate

22.0.0 WEEDS AND WEED CONTROL (15 lessons)

22.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define a weed
b) identify weeds
c) classify weeds
d) explain the characteristics which make the weeds competitive
e) describe ways of controlling weeds
f) state harmful effects of weeds
g) control weeds
h) exercise safety measures to oneself, to crops and to the environment while controlling weeds.

22.2.0 Contents

22.2.1 Weeds
- Definition of weed
- Weed identification and classification
- Competitive ability of weeds (Appropriate examples for each ability)
- Harmful effects of weeds (appropriate examples for each effect) (See Appendix II for weeds to be studied)

22.2.2 Weed control methods
- Chemical weed control:
  - Classes of herbicides
  - Methods of application
  - Safety measures in use of chemicals
- Mechanical weed control
- Cultural weed control
- Biological weed control
- Legislative control

23.0.0 CROP PESTS AND DISEASES (14 lessons)

23.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define pest and disease
b) state the main causes of crop diseases
c) describe the harmful effects of crop pests and diseases
d) identify and classify some of the common pests and diseases
e) carry out general disease and pest control measures
f) demonstrate a caring attitude towards the environment while controlling pests and diseases.

23.2.0 Content

23.2.1 Pests
- Definition
- Classification of pests:
  - Mode of feeding
  - Crops attacked
  - Stage of growth of crop attacked
  - Field and storage pests
- Identification of common pests
- Harmful effects of pests
- Pest control measures.

23.2.2 Diseases:
- Definition
- Classification of diseases according to cause
- Identification of common diseases
- Disease control
- Harmful effects of diseases
- Disease control measures (see appendices III and IV for pests and diseases to be studied)

Note: Remind learners of safety in mixing, using and storing of chemicals including container disposal as in unit 22.00)

24.0.0 CROP PRODUCTION VI (FIELD PRACTICES II) (17 Lessons)

24.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe management practices in crop production
b) carry out management practices for a given crop
c) demonstrate an appreciation of agriculture as an economically lucrative activity.

24.2.0 Content

24.2.1 Production of :

- Maize/millet/sorghum
- Beans

Discuss under the following:-

- Meaning of hybrids, composites and cultivars
- Selecting best hybrids, composites or cultivars for a given climatic region.
- Raising of a maize/sorghum/millet and bean crop from seed bed preparation to harvesting
- Keeping records in production of maize/sorghum/millet and beans

24.2.2 Rice production

- Land preparation
- Water control
- Use of flooding in rice field
- Fertilizer application
- Weed control

24.2.3 Harvesting of the following crops

- Cotton
- Pyrethrum
- Sugarcane
- Tea
- Coffee

Under the following

- Stage of harvesting
- Method and procedure of harvesting
- Precautions in harvesting

Note:
Compare cost of production with value of product for maize/sorghum/millet and beans

Discuss why there is a loss or a profit and improvement needed.

25.0.0 FORAGE CROPS (9 Lessons)

25.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) define and classify pastures
b) identify forage crops
c) describe the ecological requirements of forage crops
d) describe the establishment and management of pastures and fodder
e) describe forage utilization and conservation.

25.2.0 Content

25.2.1 Pastures

- Definition
- Classification
- Establishment
- Management

25.2.2 Utilization

- Grazing systems
  - Rotational
  - Herding
- Zero grazing

25.2.3 Fodder crops

- Napier/bana grass
- Guatemala grass
- Sorghum
- Kale
- Edible cana
- Lucerne
- Clovers
- Desmodium
- Manigolds
- Agroforestry trees/bushes used as fodder

Under the following:

- Ecological requirements
- Establishment and management
- Production per unit area
- Utilization

25.2.4 Forage conservation
- Hay making
- Silage making
- Standing hay

26.0.0 LIVESTOCK HEALTH III (DISEASES) (20 Lessons)

26.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) describe causes and vectors of main livestock diseases
b) state the incubation period of the livestock diseases
c) describe the signs of each disease
d) state the predisposing factors where applicable
e) carry out simple control measures of livestock diseases
f) demonstrate a caring attitude towards livestock.

26.2.0 Content

26.2.1 Protozoan diseases
- East coast fever
- Anaplasmosis
- Coccidiosis
- Trypanosomiasis(Nagana)

26.2.2 Bacterial diseases
- Fowl typhoid
- Foot rot
- Contagious abortion(Brucellosis)
- Scours
- Black quarter
- Mastitis
- Anthrax
- Pneumonia

26.2.3 Viral diseases
- Rinderpest
- Foot and mouth
- Newcastle
- Fowl pox
- Gumboro
- African Swine fever

26.2.4 Nutritional diseases
- Milk fever
- Bloat

The above diseases should be studied under the following:
- Animal species attacked
- Cause/causal organism/agent and or vector
- Predisposing factors(where applicable)
- Incubation period (where applicable)
- Signs and symptoms of disease
- Simple control measures of the diseases

Note

- Learners to exercise care and use appropriate livestock handling practices

- Exercise care not to pollute the environment with chemicals

FORM FOUR

27.0.0 LIVESTOCK PRODUCTION V (POULTRY) (25 Lessons)

27.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) identify parts of an egg
b) select eggs for incubation
c) identify suitable sources of chicks
d) describe broodiness and natural brooding
e) describe brooder and brooder management
f) describe conditions necessary for artificial incubation
g) describe rearing systems
h) describe the feeding for each age and category of poultry
i) identify stress and vices
j) state the causes of stress and vices in poultry
k) state the effects of vices and stress in poultry
l) state control measures of vices and stress
m) describe marketing of eggs and poultry meat
n) select sort and grade eggs for marketing
o) demonstrate an appreciation of poultry production as an economically lucrative activity.

27.2.0 Content

27.2.1 Parts of an egg

27.2.2 Incubation
- Meaning
- Selection of eggs for incubation
- Natural incubation
  - Signs of broodiness in poultry
  - Preparation and management of natural incubation
- Artificial incubation
  - Management of the incubator

27.2.3 Sources of chicks

27.2.4 Brooding
- Meaning
- Natural brooding
- Artificial brooding
  - Brooder and brooder management
  - Conditions
  - Equipment
  - Management of:-
    i) layers
    ii) broilers

27.2.5 Rearing systems
- Extensive
  - Free range
- Semi - intensive
  - Fold system
- Intensive
  - Deep litter
  - Battery cage system

  Note: Include advantages and disadvantages of each system.

27.2.6 Chicken feeding
- Broilers
- Layers

27.2.7 Stress and vices in chicken.
- Identification
- Causes
- Control

27.2.8 Marketing
- eggs - include, grading of eggs for marketing
- meat

Note: Learners to exercise care and use appropriate methods while handling poultry

28.0.0 LIVESTOCK PRODUCTION VI (CATTLE) (16 Lessons)

28.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) raise young stock
b) demonstrate a caring attitude towards livestock
c) describe milk by its components
d) describe milk secretion and let - down
e) milk using correct procedure and technique
f) describe marketing of beef cattle and milk
g) Demonstrate an appreciation of cattle production as an economically lucrative activity.

28.2.0 Content

28.2.1 Raising young stock

- Feeding
- Weaning
- Housing
- Routine practices (see unit 18)

28.2.2 Milk and Milking

- Milk composition
- Milk secretion and let down
- Clean milk production
  - Equipment and materials (include milking machine)
  - Cleanliness of the milkman / milkwoman
  - Milking procedure (by hand and by machine
  - Milking techniques
- Dry cow therapy

28.2.3 Marketing of milk

28.2.4 Marketing beef cattle

Note: Learners to exercise care and use appropriate methods in handling livestock

29.0.0 FARM POWER AND MACHINERY (18 Lessons)

29.1.0 Specific objectives

By the end of the topic the learner should be able to:

f) describe various sources of power in the farm
g) describe various systems of a tractor
h) describe the various tractor implements, their uses and maintenance
i) describe the various animal drawn implements, their uses and maintenance
j) describe tractor service and maintenance practices.

29.2.0 Content

29.2.1 Sources of power in the farm

- Human
- Animal
- Wind
- Water
- Biomas
  - Wood/charcoal
  - Biogas
- Fossil fuel
  - Coal
  - Petroleum
  - Natural gas
- Electrical
  - Hydro
  - Geothermal
  - Nuclear
  - Storage battery
- Solar

29.2.2 Tractor Engine

- Four stroke cycle engine
  - diesel
  - petrol
- Two stroke cycle engine

29.2.3 Systems of the tractor

- Fuel system
- Electrical
- Ignition
- Cooling
- Lubrication
- Transmission
  - Clutch
  - Gears
  - Differential
  - Final Drive

29.2.4 Tractor service maintenance

29.2.5 Tractor drawn implements, their uses and maintenance.

- Attachment methods
  - i) One point hitch
    - draw bar
  - ii) Three point hitch
    - hydraulic
  - iii) Power take off (P.T.O)
- Implements
  - i) Trailer
  - ii) Disc plough
  - iii) Mouldboard plough
  - iv) Harrows
    - disc
      - plain
      - notched
        - spike tooth
        - spring tined
  - v) Sub - soilers
  - vi) Ridgers
- Rotary tillers
- Mowers
  - Gyro
  - Reciprocating
- Planters and seeders
- Cultivators/weeders
- Sprayers
- Harvesting machines
  - grain
  - root crops
  - forage
- Shellers

29.2.6 Animal drawn implements, uses and maintenance

- Ploughs
- Carts
- Ridgers

Note : Teacher should use local resources and diagrams. The school does not need to have tractor, tractor drawn implements, animals and animal drawn implements.

30.0.0 AGRICULTURAL ECONOMICS III (PRODUCTION ECONOMICS) (20 Lessons)

30.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) explain various parameters of national development
b) relate national development to agricultural production
c) state the factors of production and explain how each affects production
d) describe how the law of diminishing returns relates to agricultural production
e) describe agricultural planning and budgeting in a farm business
f) state sources of agricultural support services
g) describe risks and uncertainities in farming
h) explain ways of adjusting to risks and uncertainities.

30.2.0 Content

30.2.1 National income

- Household - firm relationship
- Gross Domestic product (GDP)
- Gross National Product (GNP)
- Per Capita Income
- Contribution of agriculture to national development

30.2.2 Factors of production

- Land
  - Definition
  - Methods of acquisition
- Labour
  - Definition
  - Types
  - Measures of labour
  - Ways of increasing labour efficiency
- Capital
  - Definition
  - Types
  - Sources
- Management
  - Definition
  - Role of a farm manager

Note: Emphasize that by law, a Kenyan can acquire land, settle, invest capital or work anywhere within the country.

30.2.3 Production function.
- Increasing returns
- Constant returns
- Decreasing returns

30.2.4 Economic laws and principle
- The law of diminishing returns
- The law of substitution
- The law of equimarginal returns
- Principle of profit maximization

30.2.5 Farm planning
- meaning
- factors to consider
- steps

30.2.6 Farm budgeting
- Definition
- Importance
- Types
  - Partial
  - Complete

30.2.7 Agricultural services available to the farmer

30.2.8 Risks and uncertainties in farming
- Meaning
- Common risks and uncertainties
- Ways of adjusting

31.0.0 AGRICULTURAL ECONOMICS IV (FARM ACCOUNTS) (10 Lessons)

31.1.0 Specific objectives

By the end of the topic, the learner should be able to:

a) state the importance of farm accounts
b) distinguish and describe the various financial documents and their uses
c) prepare and analyse financial statements
d) identify various books of accounts and their uses.

31.2.0 Content

31.2.1 Financial documents and books of accounts
- Financial documents
  - Invoices
  - Statements
  - Receipts
  - Delivery notes
  - Purchase orders
- Books of Accounts
  - Ledger
  - Journal
  - Inventory
  - Cash book

31.2.2 Financial statements
- Cash analysis
- Balance sheet
- Profit and loss account

32.0.0 AGRICULTURAL ECONOMICS V (AGRICULTURAL MARKETING AND ORGANISATIONS) (10 Lessons)

32.1.0 Specific objectives

By the end of the topic, the learner should be able to:

define market and marketing
describe the various types of markets
describe how the law of supply and demand affects the prices of agricultural products
state various marketing functions, agents and institutions
identify problems in marketing of agricultural products
list various agricultural organizations
describe the role of each of the agricultural organizations.

32.2.0 Content

32.2.1 Market and marketing
32.2.2 Types of markets
32.2.3 Demand, supply and price theory
32.2.4 Marketing functions
32.2.5 Problems of marketing agricultural products and possible solutions
32.2.6 Marketing boards, agents and institutions
32.2.7 Co-operatives
- Formation
- Functions

32.2.8 Associations and unions
- Agricultural society of Kenya (ASK)
- Young Farmers Clubs (YFC)
- Kenya National Farmers Union (KNFU)
- Agricultural based Women groups.

33.0.0 AGROFORESTRY (10 Lessons)

33.1.0 Specific objectives

By the end of the topic, the learner should be able to:

j) define agroforestry
k) state the importance of agroforestry
l) describe various forms of agroforestry
m) explain the importance of trees
n) select appropriate trees for different uses
o) describe tree nursery management and transplanting
p) explain routine tree management
q) select appropriate sites for trees in the farm and other areas
r) describe various methods of tree harvesting.

33.2.0 Content

33.2.1 Definition of agroforestry
- forms of agroforestry

33.2.2 Importance of agroforestry

33.2.3 Importance of trees and shrubs
- important trees and shrubs for particular purposes
- Trees and shrubs to avoid at certain sites and reasons

33.2.4 Tree nursery
- types of nurseries
- seed collection and preparation
- nursery management
- transplanting

Note: Refer to 11.00 nursery practices

33.2.5 Care and management of trees
- Protection
- Pruning and training
- Grafting old trees

33.2.6 Agroforestry practices
- Alley cropping
- Multistory cropping
- Woodlots in farms

33.2.7 Sites for agroforestry trees
- Boundaries
- River banks
- Terraces
- Slopes
- Homestead

33.2.8 Tree harvesting methods

APPENDIX I - RESOURCES

A TOOLS AND EQUIPMENT TO BE STUDIED

1. GARDEN TOOLS AND EQUIPMENT TO BE STUIED

panga
axe
mattock/pick axe
jembe/hoe
fork jembe
spade
wheelbarrow
watering can
spring balance
rake
tape measure
soil auger
knap -sack sprayer
sprinkler
hose pipe
garden shear
pruning saw
pruning knife
meter rule
secateurs
garden trowel
garden fork
pruning - hook
levelling boards

2. LIVESTOCK PRODUCTION TOOLS AND EQUIPMENT

elastrator
burdizzo
syringes and needles
thermometer
halter
hoof trimmer
strip cup
trochar and canular
hard broom
wool shears
ear notcher
bull ring and lead stick
bucket
stir-up pump
milk churn
strainer/sieve
rope
milking stool
weighing balance
hot iron
teeth clipper
drenching gun
dosing gun
bolus gun
dehorning wire
chaff cutter

3. WORKSHOP TOOLS AND EQUIPMENT

cross cut saw
tenon/back saw
coping saw
compass saw/key hole saw
rip saw
bow saw
hack saw
wood chisel
cold chisel
files and rasps
wire brush
marking gauge
divider
centre punch
spoke shave
screw drivers
spanners
jack plane
scrapper
try square
wood clamp
sash clamp
G-clamp
mallet
soldering gun
tin -snip
claw hammer
paint brush
ball -pein hammer
sledge hammer
wire strainer
pliers
brace and bits
hand drills and bits

pipe wrench	riveting machine
pipe cutter	crow bar
levelling rod	masons square
spirit level	plumb bob
mason	trowel
wood float	metal float
meter rule	shovel

B. WEEDS TO BE STUDIED

COMMON NAME	**BOTANICAL NAME**
1. Black Jack	*Bidens pilosa*
2. Mexican marigold	*Tagetes minuta*
3. Oxalis/sorrel	Oxalis species
4. Double thorn	*Oxygonum sinuatum*
5. Thorn apple	*Datura stramonium*
6. Couch grass	*Digitaria scalarum*
7. Nut grass	*Cyperus rotundas*
8. Wandering Jew	*Commelina bengalensis*
9. Sow thistle	*Sonchus oleraceus*
10. Devil's horsewhip	*Achranthes aspera*
11. Macdonaldi/gallant soldier	*Gallinsoga parviflora*
12. Sodom apple	*Solanum incanum*
13. Black nightshade	*Solanuim nigrum*
14. Chinese lantern	*Nicandra physalodes*
15. Bracken fern	*Pteridium aquillinum*
16. Love grass/Bristly foxtail	*Seteria verticillata*
17. Cleavers	*Gallium spurium*
18. Stinging nettle	*Utica massaica*
19. Fat hen/Goosefoot	Chenopodium species
20. Rape Weed	*Brassica napus*
21. Wild Oats	*Avena fatua*
22. Lantana/Tick berry	*Lantana camara*
23. Water hyacinth	*Eichhornial crassipes*
24. Witchweed	*Striga hermonthica*
25. Creeping indigo	*Indigofera spicata*

C. CROP PESTS TO BE STUDIED

1. Armyworm
2. Cut worm
3. Locust
4. Moths
5. Fruitfly
6. Mealybug
7. Thrips
8. Beetles
9. Weavils - field and store
10. Birds - Weaver, Sudan dioch, Mouse bird
11. Rodents - Squirrels, Moles and Rats
12. Boll worms
13. Stainers
14. Nematodes
15. Leaf miners
16. Aphids
17. Stalk borers
18. Loopers
19. Scales

D. CROP DISEASE TO BE STUDIED

1. Maize streak
2. Smuts
3. Blasts
4. Leaf blight
5. Anthracnose
6. Rusts – in cereals and leaf rust in coffee
7. Leaf spot
8. Blight –hallow, early and late
9 Panama disease
10. Cigar end rot
11. Mildew
12. Mosaic
13. Die back
14. Greening
15. Tristeza
16. Wilts –Fusarium and Bacterial
17. Black arm
18. Damping off
19. Coffee Berry Disease
20. Rosette
21. Ratoon stunting disease
22. Armilaria root-rot

APPENDIX II

EVALUATION

It is important for the teacher to evaluate his teaching and to assess learners performance. Both of these measurements can be carried out by determining the extent to which the intended objectives have achieved by the end of each topic.

At the beginning of each topic, a list of specific objectives is given. Note that, the stem of each list of objectives says;

"By the end of the topic, the learner should be able to:" perform a certain task. Each specific objective then starts with a verb which gives the task that the learner should be able to perform by the end of the topic.

Such verbs include:

- State
- Explain
- Describe
- Relate
- Distinguish
- Prepare
- Carry out

A good assessment therefore will attempt to determine whether the learner is able to perform the task expressed by the verb.

The objectives are meant to serve certain purposes:-

1) They guide the teacher to determine what the learner is expected to do. In some cases when the objectives are very specific they may demand the determination of extent to which the learner is able to perform a task eg the learner should be able to complete milking a cow within seven minutes from the beginning is different from the learner "the learner will be able to milk a cow"

   In the first objective, assessment will not only be on the ability to milk but also within what time. Grades may then be allocated for performance of the task and for the time it takes.

2. They guide the teacher on the methodology for example, if the task is that the learner be able to **explain** something, then the teacher may use lecture or discussion method.

   If the task is to **prepare** e.g. a nursery bed, then the methodology will be a demonstration followed by a practical.

3 They guide on the method of assessment i.e. if the task was to **state**, then the learner should be asked to **state** but not to **explain**.

   If on the other hand, the objective required learners to **describe**, the question should read, **describe** but not **demonstrate**

   The teacher must therefore always get the **verb** in the objective to ask the question.

4 They guide on the depth of coverage e.g. **name** the tick that carries ECF is shallower than **describe** the tick that carries ECF.

   Therefore if the objective states that the learner should be able to name, then description is not called for.

5. The teacher is able to evaluate his/her teaching through assessment of learners. The number of learners able to perform the task(s) set out in the objective(s) to a certain extent by the end of the specified time that is end of topic, shows how effective the teaching has been. The results of such an evaluation can help the teacher to determine what changes are required in future teaching such as, changes in:-
   - Teaching methods
   - Teaching resources
   - Time given per content area

METHODS OF ASSESSMENT

It is recommended that the teacher carries out continuous assessment. Since, the specific objectives state that learners will be able to perform certain task(s) **by the end of the topic**. Therefore, through the teacher may need to test certain contents before the end of the topic, it is important that a test is done at the end of each topic. Mid-term, term and end year examinations are also encouraged. Some methods of testing are:

i) Oral for example for brainstorming on a topic, exploring learners knowledge of a new topic or as an indication to the teacher whether the learners are following the lesson.
ii) Short/written quizzes at the end of the lesson or topic/short answer questions.
iii) Written assignments/long answer questions/essays
iv) Practical work - in class or field
v) Observation - this is used mostly of assessing of psychomotor and affective domain objectives

Observation will therefore include:

a) Degree of exactness in performance of a task.
b) Creativity
c) Timeliness in completing a task and reporting
d) Enthusiasism/keenness
e) Care in handling materials and tools
f) Care of the environment
g) Co-operation/teamwork spirit
h) Leadership/planning/organizational abilities/responsibility/command/respect

vi) Practical projects for individuals or groups

It is important for the teacher to understand that **how a task is performed** tells not only the competence gained but also the **attitude** with which it is done.

HOME SCIENCE

INTRODUCTION

Home science is an applied and integrated science which aims at improving the quality of life for the individual, the family and the community.

This Home science syllabus incorporates subject areas such as health education foods, nutrition, textiles, clothing, home care, maternal health-care and consumer education. Issues such as HIV/AIDS, STIs, drug misuse, sanitation have been dealt with under health education. Gender responsiveness has also been addressed to encourage both male and female learners to take the subject.

The syllabus has been formatted for uniform interpretation by teachers. In view of this, teachers are advised to use it as a guide and to integrate content areas appropriately during lesson planning. Teachers are called upon to be creative and improvise materials and equipment appropriately. Use of locally available resources and incorporation of the electronic media are encouraged in the enhancement of the learning and teaching of Home Science. Information update in all areas incorporated in this subject is essential.

Emphasis should be laid on economical use of resources through group practicals and, where possible, field visits within the locality. Practical and written assignments should be given regularly so that the teacher can assess the learners' mastery of content and acquisition of relevant skills.

The content has been reorganized and can be covered within the suggested number of lessons, however, flexibility is acceptable. Teachers are advised to make use of the teachers guide in lesson preparation.

It is expected that this syllabus will adequately prepare learners for further education and training in a wide variety of careers.

GENERAL OBJECTIVES

By the end of the course the learner should be able to:

1 adapt to environmental, social and economic changes

2 practice principles of good health with respect to self, others and the environment

3 manage and improvise resources

4 practice preventive and promotive health care strategies

5 develop artistic values in the selection, preparation and serving of food

6 preserve and store foods

7 appreciate foods from different communities

8 develop artistic values in clothing and interior design

9 select, use and care for different fabrics

10 develop skills in garment construction and soft furnishings

11 acquire knowledge in maternal child health care

12 acquire awareness of consumer education and be able to utilize it wisely

13 form a foundation for further education and training in various fields.

FORM ONE

1.0.0 INTRODUCTION TO HOME SCIENCE (2 Lessons)

1.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define Home Science
b) explain the importance of Home Science
c) relate Home Science to various career opportunities.

1.2.0 Content

1.2.1 Definition of Home Science

1.2.2 Importance of Home Science to:

- individual
- family
- nation

1.2.3 Home Science as a basis for various careers

2.0.0 PERSONAL HYGIENE (11 Lessons)

2.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) practice principles of good grooming
b) choose and use cosmetics appropriately
c) state changes in adolescence and relate them to personal hygiene
d) make correct choice, use and care for clothes and shoes.

2.2.0 Content

2.2.1 Good grooming:

- care of the body
- ways of enhancing personal appearance
- care of personal items - handkerchiefs, combs, hair brushes, towels, tooth brushes, underwear

2.2.2 Choice, use and misuse of cosmetics

2.2.3 Changes in adolescence

- physical
  - personal hygiene
- emotional
- social

2.2.4 Choice, use and care of clothes and shoes - leather and canvas shoes

3.0.0 SAFETY IN THE HOME AND FIRST AID (9 Lessons)

3.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify causes of common accidents in the home
b) take appropriate measures to prevent and manage common accidents
c) prepare and assemble items in a First Aid kit
d) use medicine correctly
e) differentiate between misuse and abuse of medicine.

3.2.0 Content

3.2.1 Common accidents in the home, their causes, prevention and management

- burns and scalds
- cuts and bruises
- fractures and sprains
- suffocation and choking
- foreign bodies in the eyes, ears and nose
- shock
- fainting
- nose bleeding
- drowning
- insect stings and bites
- snake bites
- poisoning

3.2.2 Assembling a First Aid kit

3.2.3 Medicine

- basic instruction on using medicine
- misuse and abuse

4.0.0 HOUSING THE FAMILY(6 Lessons)

4.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) compare house designs in different communities
b) identify and relate locations of different areas in a house to their functions
c) explain different ways of providing family shelter
d) state and discuss factors to consider when providing family shelter.

4.2.0 Content

4.2.1 Types of houses
- traditional houses
- modern houses

4.2.2 Essential areas and their placement in a house

4.2.3 Relationship between locations of different areas in a house and their functions

4.2.4 Methods of providing family shelter

4.2.11 Factors to consider when providing family shelter.

5.0.0 CARE OF THE HOME
(12 Lessons)

5.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify different types of dirt found in the home
b) choose, use and care for different types of cleaning materials and equipment
c) improvise cleaning materials and equipment
d) practice methods of removing dirt from different surfaces
e) practice cleaning different areas in the home.

5.2.0 Content

5.2.1 Classification of dirt:
- loose dirt
- fixed dirt

5.2.2 Choice, use and care of different types of cleaning materials and equipment

5.2.3 Improvisation of cleaning materials and equipment

5.2.4 Reasons for cleaning a house

5.2.5 Removing dirt from surfaces
- sweeping
- dusting
- scrubbing
- suction

5.2.6 Daily, weekly and special cleaning of different areas in a house:
- sitting/living area
- sleeping area
- sanitation area
- storage area
- dining area
- cooking area

6.0.0 KITCHEN EQUIPMENT
(8 Lessons)

6.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify, use and care for kitchen equipment
b) exercise safety precautions when handling kitchen equipment
c) improvise kitchen equipment where necessary.

6.2.0 Content

6.2.1 Types of kitchen equipment and their use

6.2.2 Care of kitchen equipment
- plastics
- metals
  - stainless steel
  - aluminium
  - iron
  - enamel
- wood
- glass
- earthenware
- calabashes

6.2.3 Safety precautions when handling kitchen equipment

6.2.4 Improvisation of kitchen equipment.

7.0.0 FOOD HYGIENE (9 Lessons)

7.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) practice rules of food hygiene
b) explain the causes and prevention of food spoilage and poisoning
c) state the signs and symptoms of food poisoning
d) store perishable and dry food appropriately
e) treat water for drinking.

7.2.0 Content

7.2.1 Kitchen and food hygiene

7.2.2 Food spoilage and poisoning

7.2.3 Signs and symptoms of food poisoning

72.4 Storage of perishable and dry foods

7.2.5 Water treatment at home
- sedimentation
- filtration
- boiling
- storage

8.0.0 METHODS OF COOKING (12 Lessons)

8.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss reasons for cooking food
b) state general rules for different methods of cooking
c) state the advantages and disadvantages of different methods of cooking
d) practice different methods of cooking.

8.2.0 **Content**

8.2.1 Reasons for cooking food

8.2.2 Methods of cooking

- General rules
- Advantages and disadvantages for each method:
  - i) Moist Methods
    - boiling
    - steaming
    - frying
    - stewing
  - ii) Dry Methods
    - roasting
    - baking

9.0.0 TEXTILE FIBRES (9 Lessons)

9.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify textile fibres
b) state properties of textile fibres
c) identify types of textile fibres.

9.2.0. Content

9.2.1 Classification of fibres

- i) Natural fibres
  - animal (wool, silk)
  - plant (cotton, linen)
  - mineral (asbestos)
- ii) Man-made fibres
  - regenerated
    - viscose rayon
    - acetate rayon
  - synthetic
    - polyamides (nylon)
    - acrylonitrile (acrylic)
    - polyester (terylene)
  - elastofibres (lycra)

9.2.2 Properties of common textile fibres

- cotton
- linen
- wool
- silk
- viscose rayon
- nylon
- acrylic
- polyester

9.2.3 Physical identification of textile fibres.

10.0.0 SEWING TOOLS AND EQUIPMENT (9 Lessons)

10.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) choose, use and care for basic sewing tools and equipment
b) use and care for a sewing machine.

10.2.0 Content

10.2.1 Choice, use and care for basic sewing tools and equipment

10.2.2 Parts of a sewing machine and their functions

11.0.0 STITCHES (12 Lessons)

11.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify stitches
b) work out different types of stitches.

11.2.0 Content

11.2.1 Classification of stitches

- temporary
- permanent (joining, neatening and decorative)

11.2.2 Different types of stitches

- temporary
  - i) tacking
    - even tacks
    - long and short
    - basting/diagonal tacks
    - tailor tacks
- permanent
  - joining
  - neatening
  - decorative

FORM TWO

12.0.0 ENVIRONMENTAL HYGIENE (9 Lessons)

12.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define environmental hygiene
b) dispose refuse appropriately
c) describe the types of drainage and care for them appropriately
d) explain dangers of poor sanitation
e) discuss causes, signs, symptoms and prevention of common communicable diseases.

12.2.0 Content

12.2.1 Definition of environmental hygiene

12.2.2 Disposal of household refuse
- organic refuse
- inorganic refuse
- recycling

12.2.3 Drainage
- types of drainage
- care

12.2.4 Sanitation
- causes of poor sanitation
- dangers of poor sanitation
- common communicable diseases
  - typhoid
  - cholera
  - dysentery
  - malaria
  - bilharzia
  - scabies
  - ringworms
  - T.B. (Tuberculosis)
  - worm infestation

13.0.0 LAUNDRY EQUIPMENT (3 Lessons)

13.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify laundry equipment
b) choose, use and care for different laundry equipment

13.2.0 Content

13.2.1 Types of laundry equipment used for washing, drying, finishing and storage

13.2.2 Choice, use and care for different laundry equipment.

14.0.0 DETERGENTS AND LAUNDRY AGENTS (6 Lessons)

14.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) distinguish between soap and soapless detergents and their suitability to various fabrics
b) explain the difference between hard and soft water
c) soften hard water for laundry work
d) identify laundry agents.

14.2.0 Content

14.2.1 Soap and soapless detergents

14.2.2 Suitability of different detergents to various fabrics

14.2.3 Hard and soft water

14.2.4 Soften hard water

14.2.5 Other laundry agents
- bleaches
- starch
- laundry blue
- fabric conditioner
- salt

15.0.0 LAUNDRY PROCESSES (1 Lesson)

15.1.0 Specific Objective

By the end of the topic the learner should able to identify different laundry processes.

15.2.0 Content

15.2.1 Laundry processes
- repairing
- sorting
- soaking/steeping
- washing
- rinsing
- drying
- finishing
- storage

16.0.0 REPAIR OF CLOTHES AND HOUSEHOLD ARTICLES (6 Lessons)

16.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the importance of repairing clothes and household articles
b) differentiate wear and tear in clothes and household articles
c) repair wear and tear in clothes and household articles.

16.2.0 Content

16.2.1 Importance of timely repair of clothes and household articles
16.2.2 Wear and tear
16.2.3 Repair of clothes and household articles
- darning (holes, thin areas)
- hanging hems
- gaping seams
- replacement of buttons
- buttonhole repairs
- repair of belt loops
- patches (plain, print)

17.0.0 LAUNDERING DIFFERENT FABRICS (9 Lessons)

17.1.0 Specific Objective

By the end of the topic, the learner should be able to launder different fabrics appropriately.

17.2.0 Content

17.2.1 Laundering different fabrics
- white and coloured cottons and linens
  - knitted
  - woven
- woollens
- silks
- nylons
- acrylics
- viscose rayon's
- polyesters

17.2.2 Care labels

18.0.0 SPECIAL TREATMENT IN LAUNDRYWORK (9 Lessons)

18.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identity and remove stains
b) carry out special treatment in laundrywork.

18.2.0 Content

18.2.1 Stain Removal
- blood
- tea
- grass
- oil
- ink
- banana sap
- chewing gum
- perspiration

18.2.2 Other Special treatment in laundry work
- disinfecting
- fixing colour
- starching
- blueing
- valeting
- dry cleaning
- spotting and sponging
- fabric conditioning

19.0.0 STORAGE OF CLOTHES AND HOUSEHOLD ARTICLES (3 Lessons)

19.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) store clothes and household articles;
b) improvise storage facilities for clothes and household articles.

19.2.0 Content

19.2.1 Storage facilities
19.2.2 Methods of storing clothes and household articles
- folding
- hanging

19.2.3 Improvisation of storage facilities

20.0.0 FOOD NUTRIENTS AND NUTRITIONAL DISORDERS (18 Lessons)

20.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) classify food nutrients and their sources
b) explain the functions of food nutrients
c) discuss the common nutritional disorders, their signs, symptoms and management
d) discuss causes of malnutrition
e) explain principles of nutrient conservation
f) state reason for food fortification.

20.2.0 Content

20.2.1 Definitions of food, food nutrient, nutrition, balanced diet and malnutrition

20.2.2 Classification of nutrients and their sources

20.2.3 Functions of nutrients in the body

20.2.4 Causes of malnutrition

20.2.5 Common nutritional disorders, their signs, symptoms and management

- kwashiorkor
- marasmus
- anaemia
- scurvy
- goiter
- rickets/osteomalacia
- beriberi
- keratomalacia
- pellagra

20.2.6 Nutritional disorders associated with lifestyles

- diabetes
- gout
- hypertension
- obesity
- anorexia nervosa

20.2.7 Principles of nutrient conservation during

- preparation of food
- cooking
- storage

20.2.8 Food fortification

21.0.0 SEAMS (9 Lessons)

21.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) list commonly used seams
b) make samples of commonly used seams
c) choose appropriate seams.

21.2.0 Content

21.2.1 Definition of a seam

21.2.2 Commonly used seams

- inconspicuous
  - open seam
  - French seam
- conspicuous
  - overlaid seam
  - double stitched seams

21.2.3 Procedures of working commonly used seams

21.2.4 Choice of seams

22.0.0 PATTERNS AND GARMENT CONSTRUCTION (24 Lessons)

22.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) take body measurements
b) identify pattern symbols and markings and their use
c) draft and develop pattern pieces for an apron
d) lay out and transfer pattern symbols and markings on to the fabric correctly
e) cut out and make the apron.

22.2.0 Content

22.2.1 Body measurements

22.2.2 Pattern symbols and markings

22.2.3 Drafting and developing patterns for an apron

- double bib
- waistband
- skirt
- pocket
- neckband
- frills (optional)

22.2.4 Making the apron

23.0.0 CONSUMER AWARENESS (2 Lessons)

23.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of consumer education
b) state sources of consumer information.

23.2.0 Content

23.2.1 Definitions of consumer, consumer education, goods, services
23.2.2 Importance of consumer education
23.2.3 Sources of consumer information

24.0.0 ADVERTISEMENT (3 Lessons)

24.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) discuss types of advertisements
b) state forms of advertisement
c) interpret and use advertisements wisely.

24.2.0 Content

24.2.1 Types of advertisements
- informative
- persuasive
- competitive

24.2.2 Forms of advertisement
- electronic media
- print media
- person to person

24.2.3 Effects of advertisements on the consumer
- negative
- positive

FORM THREE

25.0.0 MEAL PLANNING AND MANAGEMENT (24 Lessons)

25.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) state the importance of meal planning
b) discuss factors to consider when planning meals
c) plan and prepare meals to meet individuals needs
d) present meals attractively
e) plan and prepare packed meals.

25.2.0 Content

25.2.1 Importance of meal planning

25.2.2 Factors to consider when planning meals

25.2.3 Plan, prepare and present meals for the family and special groups

- young children
- adolescents
- manual workers
- invalids
- convalescents
- elderly

25.2.4 Packed meals

26.0.0 MATERNAL CHILD HEALTH CARE (12 Lessons)

26.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the importance of safe parenthood
b) state the signs of pregnancy
c) explain common problems in pregnancy
d) discuss the needs of a pregnant woman
e) explain the importance of ante-natal and post-natal care.

26.2.0 Content

26.2.1 Safe parenthood

- nutritional needs
- social preparation
- psychological preparation
- voluntary counselling and testing (VCT) in HIV
- age of the parents

26.2.2 Pregnancy

- signs of pregnancy
- common problems during pregnancy

26.2.3 Needs of a pregnant woman

- nutritional needs
- physical needs
- emotional needs
- social needs
  - role of the family

26.2.4 Ante-natal care

- definition
- factors that affect normal foetal development
  - STIs
  - H.I.V/AIDS
  - alcohol
  - smoking
  - drugs
  - trauma
  - german measles
  - nutrient deficiency
- activities at the antenatal clinics
- role of Traditional Birth Attendants (TBA)

26.2.5 Post-natal care

- definition
- importance of post-natal care
- activities at the post-natal clinic
- care of the lactating mother
- growth monitoring and promotion

27.0.0 CHILD IMMUNIZATION (2 Lessons)

27.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define immunization
b) discuss the importance of immunization
c) explain the immunization schedule.

27.2.0 Content

27.2.1 Definition of immunization
27.2.2 Importance of immunization
27.2.3 Immunization schedule for young children
- BCG
- diptheria, whooping cough (pertussis), tetanus, hepatitis B, H. influenza type B
- polio
- measles
- yellow fever
- supplementation - vitamin A

28.0.0 BREAST FEEDING (6 Lessons)

28.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) explain how to care for a lactating mother
b) explain the importance of breastfeeding
c) state the problems related to breastfeeding
d) state advantages and disadvantages of supplementary/complementary feeding
e) practice proper care of feeding equipment.

28.2.0 Content

28.2.1 Care of a lactating mother
28.2.2 Importance of breastfeeding
28.2.3 Problems related to breastfeeding and how to overcome them
28.2.4 Advantages and disadvantages of supplementary/complementary feeding
28.2.5 Care of feeding equipment
- handling
- cleaning
- storage

29.0.0 WEANING THE BABY (4 Lessons)

29.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) define weaning;
b) state factors to consider when weaning a baby
c) choose and prepare suitable weaning foods
d) discuss problems related to weaning and their management.

29.2.0 Content

29.2.1 Definition of weaning
29.2.2 Factors to consider when weaning a baby
29.2.3 Choice and preparation of weaning foods
29.2.4 Problems related to weaning and how to deal with them

30.0.0 HABIT TRAINING (6 Lessons)

30.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) explain the importance of habit training
b) discuss the role of play in child development
c) choose, make and care of play items.

30.2.0 Content

30.2.1 Importance of habit training
30.2.2 Role of play in child development
30.2.3 Choice and care of play items
30.2.4 Making play items

31.0.0 FLOUR MIXTURES AND RAISING AGENTS (28 Lessons)

31.1.0 Specific Objectives

By the end of the topic the learner should be able to:
a) classify different flour mixtures
b) explain how raising agents work
c) make food items using flour mixtures.

31.2.0 Content

31.2.1 Classification of flour mixtures
- batters
- dough

31.2.2 Types and functions of raising agents
- biological
- chemical
- mechanical

31.2.3 Food items made from different flour mixtures
- pancakes
- short crust pastries
- cakes
  - rubbed in
  - creamed
- bread/doughnuts

32.0.0 CLOTHING CONSTRUCTION PROCESSES (44 Lessons)

32.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss processes in garment construction
b) apply the processes in the construction of a garment.

32.2.0 Content

32.2.1 Management of fullness

32.2.2 Pockets

- in-seam pocket
- patch pocket

32.2.3 Interfaced waistband

32.2.4 Openings and fastenings

- button and worked button holes
- hook and eye/bar
- zips
  - concealed
  - semi-concealed

32.2.5 Hem management

- hemming
- slip hemming

32.2.6 Make one of the following:

- skirt
- pair of shorts
- pair of trousers

33.0.0 PRINCIPLES OF WISE BUYING (3 Lessons)

33.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss factors influencing consumer buying
b) explain principles of wise buying
c) state the advantages and disadvantages of common methods of buying.

33.2.0 Content

33.2.1 Factors influencing consumer buying

33.2.2 Principles of wise buying

33.2.3 Common methods of buying goods and services

34.0.0 MAKING A BUDGET (3 Lessons)

34.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of budgeting;
b) make a budget.

34.2.0 Content

34.2.1 Importance of budgeting

34.2.2 Steps in making a budget

FORM FOUR

35.0.0 CARE OF THE SICK AT HOME (12 Lessons)

35.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) state reasons for taking care of the sick at home
b) identify the needs of the sick at home
c) discuss preventative measures in the spread of infections.

35.2.0 Content

35.2.1 Reasons for caring for the sick at home

35.2.2 Care for the sick at home

- physical needs
- emotional needs
- nutritional needs
- social needs
- spiritual needs

35.2.3 Preventative measures in the spread of infections

36.0.0 VENTILATION (4 Lessons)

36.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss reasons for sufficient ventilation in a room
b) identify ways of ventilating a room.

36.2.0 Content

36.2.1 Reasons for adequate ventilation in a room

36.2.2 Dangers of poor ventilation

36.2.3 Ways of ventilating a room

- natural
- mechanical

37.0.0 FUELS IN THE HOME (8 Lessons)

37.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify fuels used in the home
b) discuss the advantages and disadvantages of the fuels
c) explain the precautions to take while handling fuels in the home
d) explain methods of conserving energy.

37.2.0 Content

37.2.1 Fuels used in the home

- wood
- charcoal
- kerosene
- gas
- electricity
- bio-gas
- solar
- others

37.2.2 Advantages and disadvantages of fuels used in the home

37.2.3 Precautions to take while handling and storing fuels in the home

37.2.4 Methods of conserving energy

38.0.0 LIGHTING IN THE HOME (8 Lessons)

38.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) identify sources of light;
b) explain methods of lighting a house;
c) discuss reasons for appropriate lighting;
d) care for lighting fixtures and lamps.

38.2.0 Content

38.2.1 Sources of light

- natural
- artificial

38.2.2 Methods of lighting the home

- direct lighting

- semi-direct lighting
- indirect lighting
- decorative lighting

38.2.3 Reasons for appropriate lighting

38.2.4 Care of lighting fixtures and lamps

39.0.0 SOFT FURNISHINGS IN THE HOME (20 Lessons)

39.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss the colour wheel
b) discuss factors to consider when choosing soft furnishings for the home
c) choose and arrange flowers for different occasions.

39.2.0 Content

39.2.1 Colour wheel
- choice of colour
- colour scheme

39.2.2 Furniture and soft furnishings
- definitions
- reasons for using soft furnishings
- choice of soft furnishings

39.2.3 Flower arrangement
- points to consider in flower arrangements

40.0.0 FOOD PRESERVATION (12 Lessons)

40.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) explain the reasons for preserving food
b) state advantages and disadvantages of food preservation
c) discuss methods of preserving food.

40.2.0 Content

40.2.1 Definition of food preservation
40.2.2 Reasons for preserving food
40.2.3 Advantages and disadvantages of food preservation
40.2.4 Methods of preserving food
- traditional
- modern

41.0.0 CONVENIENCE FOODS (2 Lessons)

41.1.0 Specific objectives

By the end of the topic the learner should be able to:

a) explain the meaning of convenience foods
b) identify convenience foods
c) state the advantages and disadvantages of convenience foods.

41.2.0 Content

41.2.1 Meaning of convenience foods
41.2.2 Convenience foods
41.2.3 Advantages and disadvantages of convenience foods

42.0.0 RÉCHAUFFÉ COOKERY (8 Lessons)

42.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) define réchauffé cookery
b) state the advantages and disadvantages of using left-over foods
c) discuss factors to consider when using left-over foods
d) make réchauffé dishes.

42.2.0 Content

42.2.1 Definition of réchauffé cookery
42.2.2 Advantages and disadvantages of using left over foods
42.2.3 Storage of left over foods
42.2.4 Factors to consider when using left over foods
42.2.5 Réchauffé dishes

43.0.0 CLOTHING CONSTRUCTION PROCESSES (52 Lessons)

43.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) discuss selected processes in garment construction
b) apply the processes in garment construction.

43.2.0 Content

43.2.1 Processes in garment construction

- collars
  - straight
  - curved
- cuffs
- set-in sleeves
- facings and interfacings

43.2.2 Make one of the following

- shirt
- blouse

44.0.0 PROBLEMS OF THE CONSUMER (2 Lessons)

44.1.0 Specific Objective

By end of the topic the learner should be able to discuss common problems affecting the consumer.

44.2.0 Content

44.2.1 Problems of a consumer

- scarcity of resources
- inflation
- lack of information
- lack of awareness of ones rights

45.0.0 CONSUMER PROTECTION (4 Lessons)

45.1.0 Specific Objectives

By the end of the topic the learner should be able to:

a) explain the importance of consumer protection
b) state the rights of a consumer
c) identify consumer protection agencies.

45.2.0 Content

45.2.1 Importance of consumer protection
45.2.2 Rights of a consumer
45.2.3 Agencies dealing with consumer protection

APPENDIX 1

SUGGESTED LEARNING/TEACHING RESOURCES

Needlework Tools and Equipment

1. Sewing Machines (choose whichever is suitable)
   - Treadle
   - Electric
   - Hand
2. Ironing Surfaces
   - Ironing board
   - Ironing table/blanket/sheet
   - Sleeve board
3. Cutting out table
4. Large mirror
5. Storage cupboards/wardrobes
   - clothes hangers
6. Scissors
   - dressmakers shears
   - buttonholes scissors
   - embroidery scissors
   - paper scissors
7. Tape measures
8. Dressmakers pins
9. Needles
10. Tracing wheels/dressmakers carbon papers
11. Metre rulers
12. Seam rippers
13. Stilettos *
14. Bodkin *
15. Tailors chalk
16. French curve *

* Not compulsory

Sewing Notions

- machine sewing threads
- tacking thread
- materials for coursework and samples
- trimmings – ribbons, lace, embroidery threads (depending on coursework articles)
- fasteners

Cooking tools and equipment

1. Cookers/stoves (choose which ever is suitable)
   - gas
   - electric
   - kerosene
   - charcoal
   - firewood
   - micro wave
2. Food storage equipment
   - cupboards
   - refrigerators
3. Saucepans/sufurias/ pots (all with covers)
4. Frying pans
   - deep frying pan
   - flat frying pan
5. Clay pots
6. Pressure cooker
7. Knives
   - kitchen knife (French chef knife)
   - vegetable knife
   - bread knife
   - palette knife
   - potato peeler
   - table knives
8. Spoons
   - tablespoons
   - dessert spoons
   - teaspoons
   - serving spoon
   - ladle
   - wooden spoons (mwiko)
9. Forks
10. Cups
    - plastic
    - tea cups
    - mugs
11. Drinking glasses
12. Fish slice
13. Flour dredgers
14. Sieves
    - large
    - small
15. Mixing bowls
16. Chopping boards
17. Plates
    - kitchen - plastic, enamel
    - table
    - platters
18 Measuring/equipment
    - measuring jug
19. Rolling pins

20. Casserole dishes *
21. Serving dishes
22. Graters
23. Kettles
24. Kitchen scissors *
25. Mortar and pestle *
26. Salt shakers
27. Water jug
28. Trays
29. Whisks
    - hand
    - rotary
30. Potato mashers
31. Skewers *
32. Roasting dish
33. Dustbin with cover
34. Labour saving, equipment *
    - meat miner
    - food processors
    - blenders
    - juicers
    - extractors
    - deep friers
    - rice cookers
    - shredders
    - sandwich makers

* Not compulsory

Baking Equipment

1. baking tins
2. baking trays
3. cooling trays
4. bread tins

Cleaning and Laundering Equipment

1. Water storage equipment
2. Water heater
3. Basins
4. Buckets
5. Dustpan
6. Brooms
    - yard broom
    - soft broom
    - carpet brush *
7. Brushes
    - clothes brush
    - scrubbing brush
    - shoe brushes
    - cobweb brush
    - bottle brush
8. Rubber squeezers *
9. Floor mops, rags or clothes
10. Dusters
11. Clothes line
12. Pegs
13. Hangers
14. Irons
15. Ironing surfaces
16. Soap dishes
17. Garbage bin with cover (large)

* Not compulsory

APPENDIX II

SUGGESTED ASSESSMENT METHODS

1. Practical work
2. Project work
3. Field trips
4. Oral questions
5. Quizzes
6. Written tests and examination
7. Group reports