



ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

COMBINED SCIENCE (NON-FORMAL) SYLLABUS

LEVEL 1 & 2

2015-2022

Curriculum Development Unit
P.O. Box MP133
Mount Pleasant
Harare

©All Rights Reserved

2015

ACKNOWLEDGEMENTS

The Ministry of Primary and Secondary Education would like to acknowledge contributions made by the following towards the development and production of this syllabus:

- Zimbabwe School Examinations Council (ZIMSEC)
- UNICEF

Draft Syllabus

TABLE OF CONTENTS

Contents	Page
1. 0 PREAMBLE	3
1.1 Introduction.....	3
1.2 Rationale3	
1.3 Summary of Content.....	3
1.4 Assumptions.....	3
1.5 Cross Cutting Issues.....	4
2. 0 PRESENTATION OF SYLLABUS	4
3. 0 AIMS	5
4. 0 OBJECTIVES	6
5. 0 TOPICS	Error! Bookmark not defined.
6. 0 METHODOLOGY AND TIME ALLOCATION	7
7. 0 SCOPE AND SEQUENCE CHART	9
8. 0 CONTENT MATRIX	Error! Bookmark not defined.
9. 0 ASSESSMENT	Error! Bookmark not defined.
10. 0 SPECIFICATION GRID	35
11. 0 APPENCICES	37

CONTENTS

1.0 PREAMBLE.....	Error! Bookmark not defined.
1.1 INTRODUCTION	5
1.2 RATIONALE	5
SUMMARY OF CONTENT	5
1.4 ASSUMPTIONS	5
1.5 CROSS- CUTTING THEMES	6
2.0 PRESENTATION OF THE SYLLABUS	6
3.0 AIMS	6
4.0 OBJECTIVES.....	7
5.0 TOPICS	8
5.2 CHEMISTRY:.....	8
5.3 PHYSICS.....	9
6.0 METHODOLOGY AND TIME ALLOCATION	9
6.1 METHODOLOGY	9
6.2 TIME ALLOCATION.....	10
8.0 COMPETENCY MATRIX	14
8.1.1 BIOLOGY	14
8.1.2 CHEMISTRY	19
8.1.3 PHYSICS.....	22
8.2.1 BIOLOGY	29
8.2.2 CHEMISTRY: LEVEL 2	41
8.2.3 PHYSICS.....	50
9.0 ASSESSMENT.....	62

9.1 Scheme of Assessment	62
9.2 Continuous Assessment	62
9.2.1 Practical tests	63
9.2.2 Written Tests.....	63
9.2.3 End of term examinations	63
9.3 SUMMATIVE ASSESSMENT.....	65
9.3.1 KNOWLEDGE AND COMPREHENSION	65
9.3.2 HANDLING INFORMATION AND SOLVING PROBLEMS	66
9.3.3 EXPERIMENTAL SKILLS	67

Draft Syllabus

1.0 PREAMBLE

1.1 INTRODUCTION

This syllabus covers four years of Secondary Education, level 1-2. The syllabus provides an understanding in Combined Science and a suitable preparation for the study of science beyond Ordinary level. It aims to equip learners in their diverse needs with scientific skills of long term value in an increasingly technological world. A learner- centred practical approach to the subject is adopted to develop scientific thinking and application of acquired knowledge and skills.

1.2 RATIONALE

This syllabus develops learners' scientific skills in Physics, Chemistry and Biology. It develops knowledge and understanding of scientific concepts and principles, critical thinking and problem-solving skills. Learners will gain practical experience and leadership skills through individual and group experimental work.

1.3 SUMMARY OF CONTENT

The Combined Science learning area covers concepts in Biology, Chemistry and Physics. The syllabus covers science concepts such as observing, recording, measuring, presentation of data and analysis. It also imparts practical skills such as handling of apparatus, chemicals, plant and animal specimens safely and confidently.

1.4 ASSUMPTIONS

It is assumed that learners have:

- knowledge of the content of the Science and Technology syllabus offered in Junior School
- engaged in science experiments

- engaged in project and cooperative work
- used measuring instruments such as rulers, thermometers, clocks and balances

1.5 CROSS- CUTTING THEMES

In order to foster competency development for further studies, life and work, the following cross-cutting priorities have to be taken into consideration in the teaching and learning of Combined Science:

- Gender
- Children's rights and responsibilities
- Disaster risk management
- Financial literacy play store
- Health issues
- Heritage studies
- Collaboration
- Environmental issues

2.0 PRESENTATION OF THE SYLLABUS

This level 1-2 Combined Science syllabus is presented as a single document which consists of the preamble, rationale, summary of content, assumptions, cross cutting themes, aims, objectives, topics, methodology, time allocation, scope and sequence, content matrix and assessment. The content is divided into Biology, Chemistry and Physics sections.

3.0 AIMS

The aims of the syllabus are to enable learners to:

3.1 provide an opportunity to develop desirable scientific literacy

3.2 promote critical thinking, creativity and problem-solving skills that apply to real life situations

- 3.3 develop scientific practical skills, accuracy, objectivity, integrity, enquiry and team work
- 3.4 develop attitudes relevant to science such as self-initiative, self-managing and enterprising
- 3.5 relate scientific practices to sustainable use of natural resource
- 3.6 use science to extract value from our natural resources
- 3.7 participate in the technological development of Zimbabwe and the global world

4.0 OBJECTIVES

Learners will be able to:

- 4.1 apply scientific principles in solving problems and in understanding new situations
- 4.2 describe observations, record results and draw conclusions from experiment
- 4.3 demonstrate knowledge of scientific terms, laws, facts, concepts, theories and phenomena
- 4.4 demonstrate knowledge and understanding in relation to scientific and technological applications with their social, economic and environmental implications
- 4.5 demonstrate relevant attitudes to science such as accuracy and precision, objectivity, integrity, enquiry initiative and inventiveness
- 4.6 demonstrate knowledge and understanding of scientific instruments and apparatus including techniques of operations and aspects of safety.
- 4.7 use different forms of data presentation to give rational explanations of scientific phenomena.
- 4.8 plan, organize and carry out experimental investigations.

4.9 draw scientific diagrams in two dimensions.

4.10 apply scientific principles, formulae and methods to solve qualitative and quantitative problems.

4.11 apply scientific principles, methods and techniques in value addition and beneficiation of our natural resources.

4.12 use appropriate methods of recycling and/or disposing wastes.

4.13 communicate scientific information logically and concisely

5.0 TOPICS

5.1 BIOLOGY:

- Laboratory rules and safety
- Cells and levels of organization
- Nutrition
- Respiratory system
- Transport systems
- Reproduction in plants and animals
- Health and diseases

5.2 CHEMISTRY:

- Matter
- Acids, Bases and Salts
- Oxidation and Reduction
- Industrial Processes

- Organic Chemistry

5.3 PHYSICS:

- Measurements
- Force
- Energy
- Magnetism
- Electricity

6.0 METHODOLOGY AND TIME ALLOCATION

6.1 METHODOLOGY

Emphasis should be placed on providing learners with practical experience so that they see science as an active and exciting study. Principles of individualisation, concreteness, totality and wholeness, self activity and stimulation should under pin the implementation of teaching/learning methods in this learning area. The following methods are suggested:

- 6.1 Experiments
- 6.2 Demonstrations
- 6.3 Problem solving
- 6.4 Field trips
- 6.5 Games
- 6.6 Cooperative learning/Group work
- 6.7 Simulations
- 6.8 Case studies/Research
- 6.9 Question and Answer

- 6.10 Discussions
- 6.11 Surveys, Interviews and Report writing
- 6.12 Concept mapping
- 6.13 Visual tactile
- 6.14 Individualisation

6.2 TIME ALLOCATION

- For adequate coverage of the syllabus, a time allocation of 2 hrs per week is recommended.

7.0 SCOPE AND SEQUENCE

7.1 BIOLOGY

TOPIC	LEVEL 1	LEVEL 2
Laboratory Safety and apparatus	<ul style="list-style-type: none"> • Laboratory rules and safety • Introduction to laboratory apparatus 	
Cells and levels of organisation	<ul style="list-style-type: none"> • Plant and animal cell structure • Similarities and differences of plant cells • Structures and functions of specialised cells 	<ul style="list-style-type: none"> • Types of variation: continuous and discontinuous • Ecosystems
Nutrition	<ul style="list-style-type: none"> • Diet • Human diet: balanced diet • Deficiency diseases 	<ul style="list-style-type: none"> • Photosynthesis • Factors affecting rate of photosynthesis • Conditions necessary for photosynthesis

	<ul style="list-style-type: none"> • Food tests 	<ul style="list-style-type: none"> • Digestive system in humans • Teeth and digestion
Respiratory systems	<ul style="list-style-type: none"> • Respiratory gases, gaseous exchange aerobic and anaerobic respiration 	
Transport Systems	<ul style="list-style-type: none"> • Osmosis diffusion • Root and stem structure • Turgidity and plasmolysis • Water and ion uptake • Components of blood • Heart structure and associated vessels 	<ul style="list-style-type: none"> • Transpiration: factors affecting rate of transpiration • Measurement of transpiration • Blood Circulation • Structure of blood vessels
Reproductive system	<ul style="list-style-type: none"> • Reproduction in plants: wind and insect pollinated flower structure , pollination, fertilisation, seed dispersal, germination • Asexual reproduction in plants • Human reproductive organs • Puberty • Menstrual cycle • Functions of human reproductive organs • Sex cells, fertilisation, pregnancy, placenta and child care • Methods of contraception, contraceptives • Inheritance 	

7.2 CHEMISTRY

TOPIC	LEVEL 1	LEVEL 2
Separation	<ul style="list-style-type: none">• Filtration• Magnetism• Winnowing• Decanting• Evaporation• Application of separation methods	<ul style="list-style-type: none">• Fractional distillation• Paper chromatography
Matter	<ul style="list-style-type: none">• States of matter• Kinetic theory• Periodic table: groups and periods• Metals and non metals• Reactivity series• Factors affecting rate of reaction• Elements, mixtures compounds	<ul style="list-style-type: none">• Periodic table, names and groups of elements• Structure of atoms• Electronic configuration• Nuclide notation• Mole concept and concentration• Empirical and molecular formulae
Acid, bases and salts	<ul style="list-style-type: none">• Identification of acids and bases: litmus paper test, pH scale• Preparation of salts• Reactions of metal + acids, acid + base, acid + carbonate	<ul style="list-style-type: none">• Acid base reactions• Titrations of bases with acids
Industrial processes	<ul style="list-style-type: none">• Production of peanut• Production of soap• Fractional distillation liquid• Contact process	<ul style="list-style-type: none">• Electrolysis• Electroplating• Haber process
Oxidation and reduction	<ul style="list-style-type: none">• Rusting factors• Chemical reactions: combustion	<ul style="list-style-type: none">• Extraction of iron• Alloy formation

7.3 PHYSICS

TOPIC	LEVEL 1	LEVEL 2
Data presentation	<ul style="list-style-type: none"> • Tallies, tables and Straight line graphs 	<ul style="list-style-type: none"> • Pie charts, line graphs, interpretation and analysis
Measurement	<ul style="list-style-type: none"> • Physical quantities • Accuracy and precision • S.I units, prefixes • Conversions 	<ul style="list-style-type: none"> • derived quantities • density
Force		<ul style="list-style-type: none"> • Machines: inclined, plane, pulleys, lever and gears • Pressure • Fluid systems • Pumps
Energy	<ul style="list-style-type: none"> • Types of energy • Energy conversions • Calculation on work • Properties of light • Sound energy 	<ul style="list-style-type: none"> • Petrol and diesel engines • Heat transfer: Convection, conduction and radiation • Heat transfer applications: solar water heater and solar cooker • Telecommunications
Magnetism	<ul style="list-style-type: none"> • Magnets, poles, fields, compass • Properties of magnets • Static electricity: charges, • Attraction and repulsion • Current electricity: conductors and insulators • Circuit components • Circuit symbols 	<ul style="list-style-type: none"> • Electromagnetism • Motor effect • Generator effect • Power generation • Domestic electricity • Electrical power and energy • Electrical safety • Electroscope

	<ul style="list-style-type: none"> • Measurement of electricity • Ohm's law 	
--	---	--

8.0 COMPETENCY MATRIX

LEVEL 1

8.1.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
LABORATORY SAFETY AND APPARATUS	<ul style="list-style-type: none"> • explain laboratory rules • identify laboratory apparatus and their uses 	<ul style="list-style-type: none"> • Laboratory rules • laboratory apparatus: beaker, measuring cylinder, test tube, crucible, evaporation dish, tripod stand, wire gauze, Bunsen burner, spirit burner, spatula, funnel 	<ul style="list-style-type: none"> • discussing laboratory rules • discussing and drawing laboratory apparatus 	<ul style="list-style-type: none"> • multimedia
CELLS AND LEVELS OF ORGANISATION	<ul style="list-style-type: none"> • describe the structure of a plant and an animal cell • list differences between plant and animal cells 	<ul style="list-style-type: none"> • Plant cell: cell membrane, cell wall, cytoplasm, nucleus, permanent vacuole • Animal cell: cell membrane, cytoplasm, nucleus 	<ul style="list-style-type: none"> • Using bioviewers and hand lenses to observe and draw cells <p>(avoid using fresh human blood or cheek cells)</p>	<ul style="list-style-type: none"> • Charts on cells • Models of cells • ICT tools • Onion

NUTRITION	<ul style="list-style-type: none"> Describe a balanced diet 	<ul style="list-style-type: none"> Carbohydrates, proteins, fats, vitamins, fibre, mineral salts and water Functions of nutrients 	<ul style="list-style-type: none"> Naming different kinds of foods and discussions of their nutrients 	<ul style="list-style-type: none"> Charts on collection of foods Food samples
NUTRITION	<ul style="list-style-type: none"> explain importance of plants as producers describe digestive system of humans 	<ul style="list-style-type: none"> Animals as consumers of food Photosynthesis Carbondioxide +water =sugars + oxygen Digestive system in Humans: alimentary canal 	<ul style="list-style-type: none"> Discussing the conversion of solar energy to chemical energy by plants Observing a model of the alimentary canal 	<ul style="list-style-type: none"> Charts on leaf structure ICT tools Models of the alimentary canal
RESPIRATORY SYSTEM	<ul style="list-style-type: none"> Describe the respiratory system 	<ul style="list-style-type: none"> nitrogen 78%,oxygen 20%,carbon dioxide 0,03%,water vapour less in air Test for oxygen and carbon dioxide 	<ul style="list-style-type: none"> Discussing the composition of air Comparing oxygen in inhaled and exhaled air experiment Blowing into limewater or bicarbonate 	<ul style="list-style-type: none"> Model of breathing system, Internet Glowing wooden splint Lime water Diagram of respiratory system

			<p>indicators</p> <ul style="list-style-type: none"> • Using glowing wooden splint for oxygen test • Comparing inhaled and exhaled air 	
RESPIRATION	<ul style="list-style-type: none"> • state word equations for respiration 	<ul style="list-style-type: none"> • $\text{Glucose} + \text{Oxygen} \rightarrow \text{carbon dioxide} + \text{water}$ 	<ul style="list-style-type: none"> • Carrying out experiments to show that energy is released during burning of food(during respiration) 	<ul style="list-style-type: none"> • Models of respiration • ICT tools
TRANSPORT SYSTEMS	<ul style="list-style-type: none"> • describe water and ion movement in plants 	<ul style="list-style-type: none"> • Osmosis • Diffusion • Active uptake 	<ul style="list-style-type: none"> • Demonstrating water movement in a plant using potassium permanganate 	<ul style="list-style-type: none"> • use of potted plants • ICT tools
	<ul style="list-style-type: none"> • Outline the internal structures of a root and stem 	<ul style="list-style-type: none"> • Root and stem structures of a dicotyledonous plant: epidermis, cortex, phloem, cambium, xylem 	<ul style="list-style-type: none"> • Discussing the internal structures of a root and stem • Viewing of prepared slides • Carrying out an experiment to show arrangement of 	<ul style="list-style-type: none"> • Plant • ICT tools • Microscope • Bio-viewer

			vascular tissue using dye	
	<ul style="list-style-type: none"> describe the circulatory system 	<ul style="list-style-type: none"> components of blood functions of components structure of heart blood vessels and heart Human circulatory system Blood vessels and heart Structure of heart; ventricles and valves; bicuspid and tricuspid, semi lunar valves Movement of blood 	<ul style="list-style-type: none"> Examining model of circulatory system Drawing and labelling structure of the heart Identifying vessels to and from heart 	<ul style="list-style-type: none"> Model of human circulatory system ICT tools
REPRODUCTION IN PLANTS	<ul style="list-style-type: none"> describe reproduction in plants distinguish between monocotyledonous and dicotyledonous plant seeds 	<ul style="list-style-type: none"> Flowers, carpel, stamens -Pollen grains -Ovule, ovary ,fruit Structure of maize and bean seeds -testa, radicle, plumule, endosperm, cotyledon -Germination 	<ul style="list-style-type: none"> observing a flower using hand lens/ bio viewers comparing internal and external features of the monocotyledonous and dicotyledonous plant seeds 	<ul style="list-style-type: none"> -charts on seeds flowers -computer -simulations -internet

HUMAN REPRODUCTIVE SYSTEM	<ul style="list-style-type: none"> • draw and label the female and male reproductive organs-state signs of puberty • describe the menstrual cycle 	<ul style="list-style-type: none"> • -structure of the male and female reproductive organs <ul style="list-style-type: none"> - Menstrual cycle 	<ul style="list-style-type: none"> • -discussing the cyclic changes 	<ul style="list-style-type: none"> • -models of reproductive system • -internet
HEALTH AND DISEASES	<ul style="list-style-type: none"> • Define health • state importance of hygiene • describe methods of transmission of diseases 	<ul style="list-style-type: none"> • State of being mentally, socially and physically well • Importance of personal hygiene and food hygiene • Burying, recycling, burning • water, food, vectors, contact cholera – water ebola - contact malaria - vector bilharzia - vector 	<ul style="list-style-type: none"> • Discussing the state of a health person • Cleaning of classrooms • Carrying simple disinfection of drains • Discussing cleaning of a toilet • Picking and burying wastes • Discussing methods of disease transmission 	<ul style="list-style-type: none"> • ICT tools • Disinfectants • Brooms • Mops • EMA resource person • Print media

--	--	--	--	--

8.1.2 CHEMISTRY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> Describe separating of 	<ul style="list-style-type: none"> Filtration, Magnetism, 	<ul style="list-style-type: none"> Carrying out experiments to illustrate methods of 	<ul style="list-style-type: none"> Magnet

	mixtures	Winnowing, Decanting, Evaporation	separating	<ul style="list-style-type: none"> • Sulphur • ICT tools
MATTER	<ul style="list-style-type: none"> • identify the three states of matter • describe properties of solids, liquids and gases • identify mixtures, elements and compounds • Describe solubility 	<ul style="list-style-type: none"> • solids, liquids and gases • properties of solids, liquids and gases • colour density • Kinetic theory • Mole concept: • concentration • Elements, mixtures, Compounds • Particle size, temperature, stirring 	<ul style="list-style-type: none"> • demonstrating the three states using salt, water and air • compressing a gas in syringe • discussing particle arrangement • carrying out experiments on heating ice block, candle wax, naphthalene, iodine crystals • dissolving potassium permanganate crystals in water • carrying out experiments on dissolving coloured substances(differing amounts to be dissolved) • identifying elements on the 	<ul style="list-style-type: none"> • salt, water, stones, syringe, beakers, ice, candles naphthalene flakes • iodine crystals • models • Periodic Tables • iron filings • Sulphur powder • sand, maize • beakers • spatulas • salt/sugar • water

			Periodic Table <ul style="list-style-type: none"> • mixing of iron and Sulphur , sand and maize grains • heating iron and sulphur • dissolving salt/sugar, iron/Sulphur in water 	
ACIDS AND BASES	<ul style="list-style-type: none"> • identify properties of acids and bases • describe an acid–base reaction 	<ul style="list-style-type: none"> • Acids and bases • Reactions 	<ul style="list-style-type: none"> • dipping litmus paper in HCL,NaOH,H2O,CuSO4,t ap water • Carrying out experiments to demonstrate acid- base reactions 	<ul style="list-style-type: none"> • Red/blue litmus • Solutions (acids and base) •
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> • Outline production of substances used at home 	Sheller, roasting, grinding packaging Equipment peanut butter making machine <ul style="list-style-type: none"> • saponification 	<ul style="list-style-type: none"> • Preparing peanut butter • Making soap • Visiting soap manufacturing companies 	<ul style="list-style-type: none"> • Winnowing basket • Mortar and pestle • Grinding stone (guyo/imbokodo) • NaOH solution, NaCl solution, plant /animal fat
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> • explain the process of oxidation and reduction 	<ul style="list-style-type: none"> • Oxidation, reduction • Conditions for 	<ul style="list-style-type: none"> • carrying out experiments to investigate conditions 	<ul style="list-style-type: none"> • iron nails • oil • multimedia

	<ul style="list-style-type: none"> distinguish between physical and chemical changes 	<p>rusting:</p> <ul style="list-style-type: none"> Oxygen, water Methods: painting, galvanising, plating Chemical reactions word equations 	<p>necessary for rusting</p> <ul style="list-style-type: none"> burning Magnesium ribbon melting ice, burning sugar/mealie-meal 	<ul style="list-style-type: none"> burner Magnesium ribbon and mealie meal/sugar
ORGANIC CHEMISTRY	<ul style="list-style-type: none"> compare different fuels describe complete and incomplete combustion 	<ul style="list-style-type: none"> Fuels : liquid, solid, gaseous complete and incomplete combustion Global warming, deforestation 	<ul style="list-style-type: none"> Discussing forms of fuels Carrying out experiments to compare the efficiency of fuel 	<ul style="list-style-type: none"> Wood, Paraffin, Methylated spirit burner, Bunsen burners Burner (paraffin/methylated) Gas burners

LEVEL 1

8.1.3 PHYSICS

	<ul style="list-style-type: none"> describe the effect of force identify various types of force 	<ul style="list-style-type: none"> Effects of Forces: deformation of solids, change of position,, change in speed and direction Types of forces: gravitational force, weight, mechanical force, electrostatic force ,magnetic force and friction S.I unit: newton (N) Forcemeter Spring balance 	<ul style="list-style-type: none"> Carrying out experiments on effects of forces Measuring force using spring balance or forcemeter 	<ul style="list-style-type: none"> Foam rubber, springs, trolleys, rubber bands Magnets, rulers, bricks Trolleys Masses Forcemeter Spring balance
ENERGY	<ul style="list-style-type: none"> describe effects of energy 	<ul style="list-style-type: none"> Effects of energy 	<ul style="list-style-type: none"> Demonstrating the effects of energy: burning fuels, 	<ul style="list-style-type: none"> spring, candle, ball, catapult, magnesium ribbon

	<ul style="list-style-type: none"> • identify different -forms of energy 	<p>Forms and sources of energy</p> <ul style="list-style-type: none"> • Kinetic, potential, light, heat, electrical, chemical, sound • Forms of potential energy: gravitational, elastic, chemical 	<p>bouncing a ball, making objects move, compressing a spring</p> <ul style="list-style-type: none"> • Running upstairs, lighting a torch, clapping hands, raising a brick • Carrying out experiments to show potential energy 	<ul style="list-style-type: none"> • torch, brick, musical instruments • trolleys • catapult • torch cell
--	---	--	--	---

	<ul style="list-style-type: none"> • identify energy conversions • identify energy convertors 	<ul style="list-style-type: none"> • Energy conversion: energy changes, energy chains • Energy convertors 	<ul style="list-style-type: none"> • Lighting a torch • Using a dynamo to light a bulb • Using a catapult and solar panel • Discussing various energy convertors 	<ul style="list-style-type: none"> • Torch • Dynamo • Catapult • Solar panel • Bulb • Green plants • Engines refrigerator • Cell
MAGNETISM	<ul style="list-style-type: none"> • identify types of magnets • distinguish magnetic material from non-magnetic materials 	<ul style="list-style-type: none"> • Magnets: bar magnets, horse shoe magnets, C - magnets, E-magnets • Magnetic and non-magnetic materials 	<ul style="list-style-type: none"> • Classifying magnets • Using magnets to identify magnetic and non-magnetic materials • suspending a bar magnet 	<ul style="list-style-type: none"> • Horse shoe magnets • Bar magnets • C-magnets • E-magnets • Steel, iron nails, copper, aluminum, wood, plastic, glass • bar magnet, string, campus,

		<ul style="list-style-type: none"> • Poles and magnets: South and north poles: earth as magnet 	<ul style="list-style-type: none"> • using a campus 	
ELECTRICITY	<ul style="list-style-type: none"> • define current • distinguish between conductors and insulators • draw and label a simple direct current (d.c) circuit 	<ul style="list-style-type: none"> • Current as flow of charges • Conductors and insulators • Cells, batteries, bulbs, switches, resistors, standard symbols 	<ul style="list-style-type: none"> • Carrying out experiment on conductivity of different materials • Drawing circuit diagrams using symbols 	<ul style="list-style-type: none"> • Plastic • Wood • Iron bar electrolytes, • Carbon rods, • Copper rods • Light bulb • Voltmeter • Ammeter • Circuit boards • Cells • Bulbs • Switches • Resistors • Chart of standard electrical symbols

				<ul style="list-style-type: none">• ICT tools
--	--	--	--	---

Draft Syllabus

LEVEL 2

8.2.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
STRUCTURE AND FUNCTION OF A CELL	<ul style="list-style-type: none"> • state the function(s) of the specialised cells • describe different types of ecosystem • explain energy flow in an ecosystem 	<p>-red blood cell -muscle cell -palisade cell -root hair cells</p> <p>Draw and label specialised cell</p> <p>Use a microscope</p> <ul style="list-style-type: none"> • Garden, pond and plantation • Components of ecosystem • Bio-diversity • Soil infertility, pests and diseases • artificial ecosystem • food chains 	<p>Examining various ecosystems e.g. garden, pond, forest</p> <ul style="list-style-type: none"> • Engaging in field trips to observe natural ecosystem • Illustrating food chains, food webs and pyramids of biomass • Discussing energy input and energy flow <p>Explaining the carbon and nitrogen cycle</p> <p>Explaining problems caused by limited bio-</p>	<ul style="list-style-type: none"> • Microscope • Charts • Bio-viewers • Bio sets • Printed multimedia • ICT tools • Prepared slides

		<ul style="list-style-type: none"> • e food chains, food webs , pyramids of biomass • carbon and nitrogen cycles • Advantages and disadvantages 	diversity	
NUTRITION Factors affecting the rate of photosynthesis	<ul style="list-style-type: none"> • describe experiments on factors which affect the rate of photosynthesis • describe the leaf 	<ul style="list-style-type: none"> • Water, light carbon dioxide, chlorophyll • Carbohydrates and oxygen • Translocation, storage and structure formation, respiration • Epidermis, stomata, vascular tissue, mesophyll, guard cells • Surface area, stomata, palisade cells, air spaces. 	<ul style="list-style-type: none"> • Illustrating food chains, food webs and pyramids of biomass • Discussing energy input and energy flow Explaining the carbon and nitrogen cycles 	<ul style="list-style-type: none"> • Iodine solution • Leaves • Glowing splint • Light source • Pond weed • Sodium hydrogen carbonate/Soda lime/Sodium hydroxide • Microscope • Bio-viewer • ICT tools
HUMAN NUTRITION Alimentary canal	<ul style="list-style-type: none"> • draw and label parts of the alimentary canal and associated organs • state the functions of parts of the alimentary 	<ul style="list-style-type: none"> • Mouth, oesophagus stomach, small and large intestines, gall bladder, pancreas, liver • Ingestion, digestion, absorption, assimilation 	<ul style="list-style-type: none"> • Watching video simulation to examine human alimentary canal • Identifying parts 	<ul style="list-style-type: none"> • ICT tools • Recommended textbooks

	canal of a human	and egestion	using a chart	
NUTRITION	<ul style="list-style-type: none"> • Describe mechanical and chemical digestion • describe the functions of the components of a balanced diet in the body • Explain malnutrition associated diseases • Describe food tests 	<ul style="list-style-type: none"> • Incisor • Canines • Premolar and molar • Use of teeth • Importance of digestion • End products of use of enzymes • Carbohydrate: glucose • protein: amino acids • Fats: fatty acids and glycerol • Components of a balanced diet • Deficiency diseases • Kwashiorkor, goitre, rickets, scurvy, anaemia and night blindness • Food tests 	<ul style="list-style-type: none"> • Discussing the functions of teeth and their structure • Observing types of teeth on the skeleton models • Using a model to examine action of amylase on starch • Discussing mechanical and chemical digestion • Testing for glucose proteins and fats • Planning balanced meal • Discuss diabetes melitas 2, obesity and anorexia 	<ul style="list-style-type: none"> • ICT tools • Skeleton model • Visking tubing/egg shell • Recommended textbooks • Iodine solution • Benedict solution/ Clinistix • Ethanol • Sodium hydroxide

<p>RESPIRATORY SYSTEMS</p> <p>Gaseous exchange in alveoli</p>	<ul style="list-style-type: none"> state the differences between inhaled and exhaled air describe the role and adaptations of the alveoli state word equations for aerobic and anaerobic respiration 	<ul style="list-style-type: none"> Percentage composition of inhaled and exhaled air Diffusion of carbon dioxide and oxygen Adaptations-1 cell thick, moist, large surface area, network of blood capillaries Word equations: glucose + oxygen → carbon dioxide + water + energy glucose → lactic acid + less energy 	<ul style="list-style-type: none"> Describing gaseous exchange in the alveoli Discussing adaptations Discussing aerobic and anaerobic respiration Carrying out experiments to show release of energy and carbon dioxide from animals and germinating seeds 	<ul style="list-style-type: none"> ICT tools Limewater/bicarbonate indicator solution Small animals Germinating seeds
<p>TRANSPORT SYSTEMS</p> <p>Transpiration</p>	<ul style="list-style-type: none"> explain the process of transpiration state factors affecting the rate of transpiration measure transpiration in a plant 	<ul style="list-style-type: none"> Water loss in plants Wind speed, temperature, humidity, surface area, light intensity, number of stomata Use of a potometer Water and mineral salts uptake, cooling the plant 	<ul style="list-style-type: none"> Discussing the process of transpiration Carrying out experiments to investigate factors affecting the rate of transpiration 	<ul style="list-style-type: none"> ICT tools Potometer

	<ul style="list-style-type: none"> • outline the importance of transpiration • describe adaptations of plant leaves to reduce transpiration 	<ul style="list-style-type: none"> • Reduction of surface area, thickness of cuticle, distribution of stomata, presence of hairs 	<ul style="list-style-type: none"> • Explaining the importance of transpiration • Discussing adaptations of plant leaves to minimize water loss • Carrying out experiment to demonstrate the distribution, role of stomata and water loss • Field touring to identify various types of leaves • 	
--	---	---	--	--

Plasmolysis and turgidity	<ul style="list-style-type: none"> • explain the terms plasmolysis and turgidity • describe the effects of water loss and water gain in plant cells 	<ul style="list-style-type: none"> • Plasmolysis • Turgidity 	<ul style="list-style-type: none"> • Discussing plasmolysis and turgidity • Watching video simulations on plasmolysis and turgidity • carrying out experiments to demonstrate plasmolysis and turgidity using potato strips 	<ul style="list-style-type: none"> • ICT tools • Potato strips • Visking tubing
Blood circulation	<ul style="list-style-type: none"> • state the functions of blood • describe the double circulatory system • describe the structure of blood vessels • draw and label the structure of blood vessels • outline the differences among blood vessels 	<ul style="list-style-type: none"> • Transport, Defence, Homeostasis • Blood circulatory system • Veins, arteries and capillaries • Structure of blood vessels • Lumen, valves ,thickness 	<ul style="list-style-type: none"> • Watching video simulations on the blood circulatory system • Discussing the structure of blood vessels • Illustrating the structure of veins, 	<ul style="list-style-type: none"> • Multimedia • Circulatory System Model

			<p>capillaries and arteries</p> <ul style="list-style-type: none"> • Watching video simulations on the structure of blood vessels • Discussing the structure of blood vessels • Illustrating the structure of veins, capillaries and arteries • Watching video simulations on the structure of blood vessels • Discussing the structure of blood vessels • Illustrating the structure of veins, capillaries and arteries • Watching video simulations on the structure of blood vessels • Listing the differences among 	
--	--	--	---	--

			blood vessels	
REPRODUCTIVE SYSTEMS IN PLANTS	<ul style="list-style-type: none"> Describe sexual and asexual reproduction in plants outline the differences between sexual and asexual reproduction in plants 	<ul style="list-style-type: none"> Wind pollinated flower Insect pollinated flower <ul style="list-style-type: none"> Immunity Asexual/vegetative reproduction Methods of asexual reproduction: rhizomes, cuttings, tubers Advantages and disadvantages of asexual reproduction Differences between sexual and asexual reproduction 	<ul style="list-style-type: none"> Examining the structure of wind and insect pollinated flower Drawing the structures of wind and insect pollinated flower Discussing asexual reproduction in plants Listing methods of asexual reproduction Identifying advantages and disadvantages of asexual reproduction Listing differences between sexual and asexual reproduction 	<ul style="list-style-type: none"> Plant specimen Multimedia

Germination	<ul style="list-style-type: none"> • describe the process of germination • investigate conditions necessary for germination • calculate percentage germination 	<ul style="list-style-type: none"> • Germination • Moisture, warmth, oxygen • Percentage germination 	<ul style="list-style-type: none"> • Discussing the process of germination • Carrying out experiments to demonstrate conditions necessary for germination • Determining germination percentage 	<ul style="list-style-type: none"> • Seeds • Multi-media
Reproductive systems in humans	<ul style="list-style-type: none"> • Describe the male and female reproductive system and sex cells • describe the role of the placenta • describe the menstrual cycle • describe methods of contraception 	<ul style="list-style-type: none"> • male and female reproductive system • functions • Sperm and ovum • Hormones i.e. progesterone, oestrogen 	<ul style="list-style-type: none"> • the male and female reproductive systems • Drawing the structure of sex cells • Illustrating the menstrual cycle 	<ul style="list-style-type: none"> • models of reproductive organs • ICT tools • Multimedia • Bio-viewers • Multi-media

		<ul style="list-style-type: none"> • Ovulation • Menstruation • Placenta 	<ul style="list-style-type: none"> • Watching video simulations of the placenta 	<ul style="list-style-type: none"> • Multi-media 	
		<ul style="list-style-type: none"> • Nutrients, wastes, antibodies, oxygen • Natural methods, barrier methods, hormonal methods and spermicides • Advantages and disadvantages of contraception • 	<ul style="list-style-type: none"> • Listing the substances exchanged in the placenta • Discussing contraceptive methods, • Stating examples • Identifying advantages and disadvantages 		
HEALTH DISEASES	AND	<ul style="list-style-type: none"> • Describe STIs • state the control methods and treatment • describe the causes, signs and symptoms and treatment of malaria, typhoid, ebola and 	<ul style="list-style-type: none"> • Gonorrhoea • Syphilis • Chancroid • Genital herpes • Pathogens -virus 	<ul style="list-style-type: none"> • Discussing STIs • Identifying the sign, symptoms and effects of STIs • Watching videos on signs and symptoms of STIs 	<ul style="list-style-type: none"> • Bio-viewers • Multi-media

	<p>cholera</p> <ul style="list-style-type: none"> • describe the effects of tobacco smoking and alcohol on health • explain effects of substance abuse • Describe immunity • describe how HIV/AIDS is spread • describe the spread and effects of HIV/AIDS on the body • 	<p>-bacteria</p> <ul style="list-style-type: none"> • Abstinence, condoms, contact tracing • Causes, signs and symptoms of: • Malaria • Typhoid • Ebola • Cholera • Emphysema, bronchitis, lung cancer, low birth 	<ul style="list-style-type: none"> • Listing the causes • Using the signs and symptoms • Discussing the causes • Outlining the disease control methods • Discussing the effects of smoking 	<ul style="list-style-type: none"> • Print media • Multi-media
--	--	--	---	--

		<p>weight</p> <ul style="list-style-type: none"> • Liver cirrhosis, social implications, reduced reaction time • Hallucinations, addiction • Damaged muscles, heart and addiction • Mandrax • cannabis • solvents • Passive, active, natural and artificial immunity • Breastfeeding, immunisation schedule • HIV/AIDS effects an spread • Inability to resist infection • Methods of controlling the spread of HIV/AIDS • Life cycle of malaria parasite in humans and in anopheles mosquito • Methods of controlling malaria 	<ul style="list-style-type: none"> • Identifying effects of excessive alcohol consumption • Listing effects of mandrax and cannabis • Explaining effects of breathing solutions • • • Discussing immunity • Identifying different types of immunity • Discussing how infants acquire immunity • • • Discussing the spread of HIV/AIDS • Explaining effects of HIV on the body 	
--	--	---	---	--

			<ul style="list-style-type: none">• Discussing methods of controlling the spread of HIV/AIDS• Discussing methods of controlling anopheles mosquito at its different developmental stages
--	--	--	---

Draft Syllabus

8.2.2 CHEMISTRY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> describe the processes of separating substances. State application of paper chromatography. 	<ul style="list-style-type: none"> distillation and fractional distillation Paper chromatography: solvent, mixture of dyes, solvent front, initial position of dye and solvent 	<ul style="list-style-type: none"> demonstrating distillation of impure water and fractional distillation of dilute ethanol Carrying out an experiment to separate mixtures using paper chromatography 	<ul style="list-style-type: none"> ethanol distillation unit fractional distillation unit Filter paper
MATTER	<ul style="list-style-type: none"> Describe in detail first 20 elements in the periodic table describe ionic and covalent bonding 	<ul style="list-style-type: none"> nuclide notation a_bX calculate number of neutrons positions of sub atomic particles Isotopes: ${}^{16}O$ and ${}^{18}O$, ${}^{35}Cl$ and ${}^{37}Cl$ ${}^{12}C$ and ${}^{14}C$ Proton, neutrons and electron mass number, proton number 	<ul style="list-style-type: none"> Identifying positions of elements on the Periodic Table, their groups and periods Drawing the structure of an atom Producing electronic configuration diagrams Burning magnesium ribbon to demonstrate chemical reaction 	<ul style="list-style-type: none"> Periodic Table chart Computer simulation of atomic structure Magnesium ribbon Lead nitrate, HCO_3, H_2SO_4 Barium nitrate Silver nitrate

		<ul style="list-style-type: none"> • Structure of an atom: nucleus, electron shells • Electronic configurations • Bonding • Ionic bonding: NaCl, MgO, Na₂O • Covalent bonding: H₂, Cl₂, H₂O 	<ul style="list-style-type: none"> • Experimenting to form precipitates: formation of lead chloride/silver chloride/barium sulphate 	
<ul style="list-style-type: none"> • Define sub atomic particles • calculate the mass number and neutron number 	<ul style="list-style-type: none"> • nuclide notation • proton • neutron • electron $\begin{matrix} a \\ b \end{matrix} X$ <ul style="list-style-type: none"> • Isotopes: ¹⁶O and ¹⁸O ³⁵Cl and ³⁷Cl ¹²C and ¹⁴C 	<ul style="list-style-type: none"> • Explaining relative mass/mass number using models • Defining isotopes 	<ul style="list-style-type: none"> • Periodic Table chart 	

	<ul style="list-style-type: none"> Describe the relationship between the mole and molecular mass (M_r) or atomic mass (A_r) Calculate empirical formula, molecular mass and concentration of solution Describe the properties of elements on the periodic table and the reactivity series 	<ul style="list-style-type: none"> Avogadro number Mole concept $n = \frac{m}{M_r}$ Empirical formula and molecular formula from percentage composition data Concentration Physical and chemical properties of group I, II, VII and VIII Reactions of metals with water, steam, air and dilute acids Uses of halogens Reactivity series 	<ul style="list-style-type: none"> Carrying out experiments to react magnesium, iron, zinc and copper, lead with air, water/steam and dilute acids 	<ul style="list-style-type: none"> Models/use of marble to demonstrate moles Metals Dilute acids
ACIDS AND BASES	<ul style="list-style-type: none"> identify the regions of acidity neutrality and alkalinity of substance. describe the reactions of acids with metal and bases Describe an acid /base 	<ul style="list-style-type: none"> The pH scale Use of universal indicator solution Reaction of dilute acids with metals, bases and carbonates 	<ul style="list-style-type: none"> Drawing the pH scale Carrying out experiments using universal indicator to identify the pH ranges for different substances 	<ul style="list-style-type: none"> pH scale chart Universal indicator solution Ammonia solution, sodium hydroxide, vinegar/lemon

	<ul style="list-style-type: none"> titration procedure 	<ul style="list-style-type: none"> neutralization Acid-base titrations 	<ul style="list-style-type: none"> Reacting dilute hydrochloric acid, nitric acid and sulphuric acid with magnesium, zinc, calcium carbonate, magnesium carbonate, sodium hydroxide Titrating dilute sodium hydroxide against hydrochloric acid 	<ul style="list-style-type: none"> juice, hydrochloric acid, water Dilute acids Hydroxides Metal granules/powder Dilute acids NaOH(aq) Phenolphthalein
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> outline the production of industrial gases describe anode and cathode reactions for electrolysis of molten lead bromide state observations for the electrolysis of molten lead bromide 	<ul style="list-style-type: none"> Fractional distillation of liquid air Electrolysis of water Products of electrolysis of water Components and properties of electrolytic cell Uses of oxygen and hydrogen Electrolyte : dilute H₂SO₄ Electrolytic cell: connecting wires, cathode, anode, battery, electrolyte Electrolysis of: 	<ul style="list-style-type: none"> Discussing the production of nitrogen and oxygen Setting up an electrolytic cell Setting out experiments on electrolysis of water 	<ul style="list-style-type: none"> Flow charts Battery, electrodes molten lead bromide Dilute H₂SO₄ Carbon electrodes

		<p>molten lead bromide</p> <ul style="list-style-type: none"> • Solid lead and bromine fumes • O₂ and H₂ • H₂: haber process • O₂: basic oxygen furnace, medical purposes 		
	<ul style="list-style-type: none"> • Describe coating processes • List the raw materials used to manufacture ammonia • Describe the manufacture of ammonia, sulphuric acid and nitric acid 	<ul style="list-style-type: none"> • Copper electroplating an iron nail • Cathode reaction • Decoration • Prevention of corrosion • Haber Process • Raw materials: <ul style="list-style-type: none"> -Hydrogen from electrolysis of water -Nitrogen from fractional distillation of air • Pressure:200 atm • Catalyst: Iron • Temperature: 450 °C – 500 °C • Contact process 	<ul style="list-style-type: none"> • Setting out experiments to electroplate an iron nail • Discussing reasons for electroplating in groups • Describing the Haber process • Conducting educational tours to Sable Chemicals <p>Discussing the contact process</p> <ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Iron sheet/nail • Copper sulphate solution • Copper electrode • Flow chart of the Haber Process •

		<ul style="list-style-type: none"> • Raw materials: sulphur dioxide from burning iron pyrites/sulphur, oxygen from air • Pressure: 1 atm • Catalyst: vanadium(V) Oxide • Temperature: 450 °C – 500 °C • 		
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> • define oxidation and reduction • Describe the production of iron in the blast furnace • List down alloys of iron and their compositions • Explain the uses and properties of alloys of iron 	<ul style="list-style-type: none"> • Oxidation: loss of electrons, gain of oxygen, loss of hydrogen • Reduction: gain of electrons, loss of oxygen, gain of hydrogen • Redox reactions • Extraction of iron at ZISCO steel in the blast furnace • Lime stone/calcium carbonate/caco₃, iron ore/haematite/Fe₂O₃ coke/carbon/C 	<ul style="list-style-type: none"> • Demonstrating the reaction of copper oxide with hydrogen • Discussing the extraction process • Visiting ZISCO steel 	<ul style="list-style-type: none"> • Copper oxide • Hydrogen gas • ZISCO steel

		<ul style="list-style-type: none"> Reactions in the blast furnace: formation of CO_2, formation CO reduction of Fe_2O_3, decomposition of CaCO_3, formation of slag Alloy formation <ul style="list-style-type: none"> mild steel stainless steel cast iron 	<ul style="list-style-type: none"> Heating sample of Iron (III) Oxide on a charcoal block Discussing the uses of alloys of iron 	<ul style="list-style-type: none"> Iron oxide Charcoal Mild steel Stainless steel utensils Cast iron objects
ORGANIC CHEMISTRY	<ul style="list-style-type: none"> name the members of the homologous series with 3 carbon atoms and describe their structure state the uses of methane, propane, ethane, propene 	<ul style="list-style-type: none"> Hydrocarbons: alkanes alkenes methane ethane propane ethene propene 	<ul style="list-style-type: none"> Outlining the structures of methane, ethane, propane, ethene and propene using models 	<ul style="list-style-type: none"> Models of atoms and bonds
	<ul style="list-style-type: none"> Describe the production of fuels Describe the structure of 	<ul style="list-style-type: none"> Biogas production: role of bacteria temperature 	<ul style="list-style-type: none"> Fermenting sugar solution and maize meal solution (maheu) 	<ul style="list-style-type: none"> Model of bio digester Samples of organic

	<p>ethanol</p> <ul style="list-style-type: none"> Define the term global warming and list causes of global warming 	<p>pH</p> <ul style="list-style-type: none"> Fuel Ethanol <ul style="list-style-type: none"> Fermentation pH role of yeast temperature 30 °C – 35 °C Uses of ethanol Fractional distillation Beverage, medical purpose, fuel, solvent Global warming Combustion Deforestation 	<p>Discussing effects of combustion, veld fires and deforestation</p>	<p>waste (plant and animal waste)</p> <ul style="list-style-type: none"> Sugar solution Maize meal solutions Yeast/malt Fractional distillation apparatus
--	---	--	---	---

8.2.3 PHYSICS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
DATA PRESENTATION	<ul style="list-style-type: none"> Construct a pie chart, interpret and analyse pie charts and line graphs 	<ul style="list-style-type: none"> pie charts and line graphs 	<ul style="list-style-type: none"> explaining data presented in form of pie chart and line graphs 	<ul style="list-style-type: none"> multimedia Graph paper, protractors
MEASUREMENT Physical quantity	<ul style="list-style-type: none"> Describe measurement of physical quantities 	<ul style="list-style-type: none"> Measurement of physical quantities: length (thickness and internal diameter) current, voltage 	<ul style="list-style-type: none"> Measuring length, current, voltage Expressing derived quantity units in terms 	<ul style="list-style-type: none"> Vernier calipers Voltmeter Ammeter

	<ul style="list-style-type: none"> determine density 	<ul style="list-style-type: none"> SI units Density: liquids, regular and irregular objects Derived units Newton, joule, watt, volt, ampere Density ;liquids 	<ul style="list-style-type: none"> of base units Determining density of liquids and irregular objects experimentally 	<ul style="list-style-type: none"> Measuring cylinder Strings Balance Multimedia
<p>FORCE</p> <p>Weight/mass</p>	<ul style="list-style-type: none"> define weight, momentum and inertia distinguish between weight and mass explain Newton's laws of motion 	<ul style="list-style-type: none"> Weight momentum inertia Pressure force = mass x acceleration 	<ul style="list-style-type: none"> Defining weight, momentum and inertia Discussing Newton's laws of motion limited to linear motion Verifying Newton's second law of motion experimentally 	<ul style="list-style-type: none"> Spring balances Trolleys Ticker timer Solid objects of different cross-sectional area Container with holes at different depth Water barometer Oil, water Siphon hydraulic jack

	<ul style="list-style-type: none"> describe the concept of pressure 	<p>Pressure</p> <p>$P = F/A$</p> <p>Pressure in liquids</p> <p>$P = h\rho g$</p> <p>Atmospheric pressure</p> <p>Manometer Fluid system: siphon and hydraulic systems(car braking system and hydraulic jack)</p>	<p>Determining pressure of solid objects</p> <p>Demonstrating variation of pressure with depth(refer to structure of dam walls)</p> <p>Demonstrating atmospheric pressure</p> <p>Constructing and using simple manometer to determine fluid pressure</p>	
	<ul style="list-style-type: none"> Describe the structures, functions and operations of simple pumps 	<ul style="list-style-type: none"> Lift pump:- Blair pump Force pump: bicycle pump 	<ul style="list-style-type: none"> Illustrating operation of a Blair pump and a bicycle pump 	<ul style="list-style-type: none"> Model of a Blair pump bicycle pump
MOMENTS	<ul style="list-style-type: none"> describe moments 	<ul style="list-style-type: none"> moment of force=force x distance from the pivot at equilibrium; clockwise moments = anticlockwise moments 	<ul style="list-style-type: none"> demonstrating moments of force applying the principle of moments 	<ul style="list-style-type: none"> spring balance

<p>Machines</p>	<ul style="list-style-type: none"> describe functions of machines. 	<ul style="list-style-type: none"> simple machines; levers, pulley system, inclined plane, gears mechanical advantage, velocity ratio and efficiency. Friction and mass of moving parts. Lubrication, bearings and mass reduction 	<ul style="list-style-type: none"> Lifting different loads using the simple machines Carrying out experiments to determine MA, VR and efficiency Calculating mechanical advantage and velocity ratio of the simple machines Demonstrating effects of lubrication, bearings and mass reduction on efficiency 	<ul style="list-style-type: none"> Crow bar Wheel barrow Scissors Pulleys Inclined plane Gears Bearings
<p>Petrol and diesel engines</p>	<ul style="list-style-type: none"> describe the operation of a four stroke petrol and diesel engine 	<ul style="list-style-type: none"> Strokes: intake compression, power and exhaust Fuel and air supply Ignition methods, efficiency, carbon monoxide production 	<ul style="list-style-type: none"> Demonstrating intake, compression, power and exhaust using an engine model Showing how the fuel injector and the carburettor works and their importance Examining the ignition 	<ul style="list-style-type: none"> Model of a four stroke petrol engine Engine block

			and fuel economy of petrol and diesel engine	<ul style="list-style-type: none"> Fuel injector
ENERGY	<ul style="list-style-type: none"> Describe processes of heat transfer state good and bad reflectors, absorbers and emitters of heat 	<ul style="list-style-type: none"> conduction, good and bad conductors convection in liquids and gases good and bad reflectors, absorbers and emitters of heat 	<ul style="list-style-type: none"> carrying out experiments with metal and non-metal rods demonstrating heat movement in liquids and gases carrying out experiments on absorption, emission and reflection of heat using different surfaces 	<ul style="list-style-type: none"> iron copper aluminium wood glass smoke chamber copper sulphate crystals black painted surface white painted and shiny surfaces
ENERGY	<ul style="list-style-type: none"> Describe the functions and designs of a solar cooker and a solar water heater 	<ul style="list-style-type: none"> Solar cooker Solar water heater 	<ul style="list-style-type: none"> Discussing qualitatively functions and design of a solar cooker and 	<ul style="list-style-type: none"> A curved reflective surface Black container

			solar water heater	<ul style="list-style-type: none"> Water heater
TELECOMMUNICATION	<ul style="list-style-type: none"> Describe communication over a distance by telephone, cell phone and email 	<ul style="list-style-type: none"> Transmission, decoding receiver 	<ul style="list-style-type: none"> Discussing communication over a distance 	<ul style="list-style-type: none"> ICT gadgets
ELECTROMAGNETISM	<ul style="list-style-type: none"> describe an experiment to demonstrate that a current carrying conductor has a magnetic field around it. 	<ul style="list-style-type: none"> Magnetic field patterns of long straight conductor, solenoid 	<ul style="list-style-type: none"> Demonstrating magnetic field around a current carrying conductor, using iron filings and plotting compass 	<ul style="list-style-type: none"> Copper wire Iron filings Source of d.c Plotting compass
Motor effect	<ul style="list-style-type: none"> Explain the operation of a simple dc motor 	<ul style="list-style-type: none"> Motor effect: Interaction of magnetic fields, electrical energy converted to kinetic energy, motion 	<ul style="list-style-type: none"> Carrying out an experiment using a current carrying wire between magnets 	<ul style="list-style-type: none"> Copper coil, source of d.c magnets
		<ul style="list-style-type: none"> electrical to mechanical energy strength of magnetic field number of turns in the coil amount of current passed 	<ul style="list-style-type: none"> constructing and operating an electric motor 	<ul style="list-style-type: none"> electric motor model of a motor
Generator effect	<ul style="list-style-type: none"> describe operation of a simple dc and 	<ul style="list-style-type: none"> the generator principle, magnetic field, electric field 	<ul style="list-style-type: none"> carrying out an experiment which 	<ul style="list-style-type: none"> copper coil

	ac generator	and e.m.f	illustrates the generator effect	<ul style="list-style-type: none"> galvanometer magnet source of d.c magnets of different strengths coils of different turns coils of different area a.c generator d.c generator multimedia
	<ul style="list-style-type: none"> describe hydro and thermal power generation 	<ul style="list-style-type: none"> strength of a magnet, relative motion, number of turns and area of coil mechanical energy to electrical energy hydro and thermal power generation 	<ul style="list-style-type: none"> carrying out experiments to investigate factors which affect the magnitude of induced e.m.f. illustrating output voltage graphically discussing factors affecting output voltage Outlining the energy conversions involved in hydro and thermal power generation 	<ul style="list-style-type: none"> Model of hydro and thermal power generation
STATIC ELECTRICITY Electroscope	<ul style="list-style-type: none"> Explain electrostatics 	<ul style="list-style-type: none"> Electron, positive and negative charges The coulomb (C), like and 	<ul style="list-style-type: none"> Demonstrating electrostatic charging Demonstrating attraction and repulsion of charges 	<ul style="list-style-type: none"> Electroscope

		unlike charges	using an electroscope	
Lightning conductor	<ul style="list-style-type: none"> describe the production of lightning and principle of a lightning conductor state the dangers of lightning 	<ul style="list-style-type: none"> Movement of charges between cloud and ground Height, conduction and earthing High voltage electrocution heating effect 	<ul style="list-style-type: none"> Discussing the production of lightning Erecting a lightning conductor Discussing dangers of lightning 	<ul style="list-style-type: none"> multimedia
CURRENT ELECTRICITY Ohm's law	<ul style="list-style-type: none"> describe Ohm's law 	<ul style="list-style-type: none"> Ohm's law $V=IR$ resistance limitations of Ohm's law; temperature 	<ul style="list-style-type: none"> Carrying out experiments to verify Ohm's law Carrying out calculations using Ohm's law determining resistance experimentally using a voltmeter and an ammeter discussing limitations of Ohm's law 	<ul style="list-style-type: none"> Voltmeter Ammeter Bulbs resistors voltmeter ammeter

		<ul style="list-style-type: none"> • factors that affect resistance: length of wire, thickness(cross sectional area) 		
Resistors	<ul style="list-style-type: none"> • determine total resistance of resistors in series and in parallel 	<ul style="list-style-type: none"> • simple electric circuits: cells, switches, resistors, variable resistors, bulbs ammeter, voltmeter and fuses • series and parallel arrangement of resistors • $R = R_1 + R_2 + R_3$ $= \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$ 	<ul style="list-style-type: none"> • setting up practical electric circuits • drawing and interpreting circuit diagrams • determining total resistance of resistors in series and parallel arrangement 	<ul style="list-style-type: none"> • cells • resistors • switches • bulbs • fuses • ammeters • voltmeters • leads • Resistors connected in series and parallel

<p>Electrical power and energy</p>	<ul style="list-style-type: none"> Calculate electrical power and energy 	<ul style="list-style-type: none"> Power and energy Units: watt (W) ,kilowatt-hour (kWh) $P=VI$ $E=VIt$	<ul style="list-style-type: none"> Discussing electrical power and energy use by appliances Determining power and energy using the formulae 	<ul style="list-style-type: none"> Electric iron Electric fan Heating elements Smartphones computers multimedia
---	---	--	---	---

<p>ELECTRICITY IN THE HOME</p>		<ul style="list-style-type: none"> • Hazards safety precautions • Damaged insulation, overheating cables, damp conditions • live wire, neutral wire, earth wire, fuse, colour codes • Two pin plug, double insulation of appliances 	<ul style="list-style-type: none"> • Discussing the hazards and safety precautions • Wiring a three pin plug practically • Identifying appliances that use the two pin plug • Examining appliances with double insulation • Demonstrating the operation of a fuse and switch 	<ul style="list-style-type: none"> • Charts • Three pin plug, fuse <ul style="list-style-type: none"> • Radio, • Different fuse ratings • Switches • Three pin plug
---------------------------------------	--	---	---	--

	<ul style="list-style-type: none"> • Describe uses of electricity in the home • Calculate cost of electricity • Explain the use of solar photo voltaic systems 	<ul style="list-style-type: none"> • Heating • Lighting • Powering electrical devices • Meter reading costs per unit • Energy saving bulbs, solar panels, biogas • Alternative sources of energy, switch off appliances not in use • low power rating appliances • solar photo voltaic cells 	<ul style="list-style-type: none"> • Discussing uses of electricity in the home • Reading of electricity meter, determining the costs of electricity used • Discussing ways of saving electricity • Discussing the use of solar systems as alternative sources of energy in homes 	<ul style="list-style-type: none"> • Electrical appliances used in the home e.g electric jug, iron, welding machines, TV, cake mixers • Energy saving bulbs, other bulbs • Photovoltaic cells
--	---	--	---	--

9.0 ASSESSMENT

9.1 SCHEME OF ASSESSMENT

Forms 1 to 4 Combined Science assessment will be based on 35% continuous assessment and 65% summative assessment.

The syllabus' scheme of assessment is grounded in the principle of equalisation of opportunities hence does not condone direct or indirect discrimination of learners.

Arrangements, accommodations and modifications must be visible in both continuous and summative assessments to enable candidates with special needs to access assessments and receive accurate performance measurement of their abilities. Access arrangements must neither give these candidates an undue advantage over others nor compromise the standards being assessed.

Candidate who are unable to access the assessments of any component or part of component due to disability (transitory or permanent) may be eligible to receive an award based on the assessment they would have taken.

NB For further details on arrangements, accommodations and modifications refer to the assessment procedure booklet.

9.2 CONTINUOUS ASSESSMENT

Continuous assessment for Forms 1 – 4 will consist of practical tests, written tests and end of term examinations:

9.2.1 PRACTICAL TESTS

These are practical tests that teachers give to learners once a month. These may be individual or group activities. The tests should cover manipulation of apparatus, following procedures, result collection, presentation, analysis and evaluation.

9.2.2 WRITTEN TESTS

These are tests set by the teacher to assess the concepts covered during a month. The tests should consist of multiple choice, structured and free response questions.

9.2.3 END OF TERM EXAMINATIONS

These are comprehensive tests of the whole term/s or year's work. These can be set at school/district/provincial level.

Summary of Continuous Assessment Tasks

In Terms 1 to 11, candidates are expected to have done at least the following recorded tasks per term:

- 2 practical tests
- 2 Written tests
- 1 End of term test

Detailed Continuous Assessment Tasks Table

Term	Practical tests	Written Tests	End Of Term Test	Total
1	2	2	1	
2	2	2	1	
3	2	2	1	
4	2	2	1	
5	2	2	1	
6	2	2	1	
7	2	2	1	
8	2	2	1	
9	2	2	1	
10	2	2	1	
11	2	2	1	
12	National Examinations			
Weighting	15%	10%	10%	35%

9.3 SUMMATIVE ASSESSMENT

ASSESSMENT OBJECTIVES

The following objectives reflect those aspects of the aims that will be assessed. Specific behavioural learning objectives are stated in each section of the syllabus.

9.3.1 KNOWLEDGE AND COMPREHENSION

Learners should be able to demonstrate knowledge and understanding of:

- 1.1** scientific instruments and apparatus, techniques and aspects of safety;
- 1.2** scientific units, terminology, symbols and conventions;
- 1.3** scientific quantities and how they are determined;
- 1.4** scientific phenomena, facts and laws, definitions, concepts, theories and models;
- 1.5** personal, social, economic and environmental implications of science applications.

9.3.2 HANDLING INFORMATION AND SOLVING PROBLEMS

Learners should be able to demonstrate, in familiar and unfamiliar situations, their ability to:

- 2.1** extract information relevant to a particular context from data presented in diagrammatic, symbolic, graphical, numerical or verbal form;
- 2.2** use data to recognize patterns, formulate hypotheses and draw conclusions;
- 2.3** translate information from one form to another;
- 2.4** communicate logically and concisely;
- 2.5** explain facts, observations and phenomena in terms of scientific laws, theories and models;
- 2.6** explain technological applications of science and evaluate their associated personal, social, economic, and environmental implications;
- 2.7** make logical decisions based on the examination of evidence and arguments;
- 2.8** apply scientific principles, formulae and methods to solve qualitative and quantitative problems;
- 2.9** suggest explanations of unfamiliar facts, observations and phenomena;

9.3.3 EXPERIMENTAL SKILLS

Learners should be able to:

- 3.1** follow instructions for practical work;
- 3.2** plan, organise and carry out experimental investigations;
- 3.3** select appropriate apparatus and materials for experimental work;
- 3.4** use apparatus and materials effectively and safely;
- 3.5** make accurate, systematic observations and measurements, recognising the variability of experimental measurements;
- 3.6** observe, measure and record results of experimental procedures;
- 3.7** identify possible sources of error in experimental procedures;
- 3.8** draw conclusions and make generalisations from experiments;
- 3.9** extract information from data presented in diagrammatic, graphical or numerical form.

WEIGHTING OF ASSESSMENT OBJECTIVES

	ASSEMENT OBJECTIVES	WEIGHTING
Paper 1 and 2		
Knowledge and comprehension	1.0	60%
Handling information and solving problems	2.0	40%
Paper 3		
Experimental skills	3.0	100%

Paper	Type of paper	Duration	Marks	Weighting
1	Multiple choice	1 Hour	40	30%
2	Theory	2 Hours	100	40%
3	Practical	1 Hour 30 minutes	40	30%

Paper 1 Theory (1 hour, 40 marks)

This paper will consist of 40 compulsory multiple-choice items.

Paper 2 Theory (2 hours, 100 marks) section A ,B, C and D:

Section A – made up of 6 compulsory structured questions of variable marks which add up to 40 marks.

- Section B 20 marks, will be based on the Biology section of the syllabus. It will consist of three free-response Biology questions. Candidates will be required to answer any two questions.
- Section C 20 marks, will be based on the Chemistry section of the syllabus. It will consist of three free-response Chemistry questions. Candidates will be required to answer any two questions
- Section D 20 marks, will be based on the Physics section of the syllabus. It will consist of three free-response Physics questions. Candidates will be required to answer any two questions

Paper 3 Practical Examination (1 hour 30 minutes, 40 marks)

This is a practical consisting of two compulsory questions of 20 marks each from any two sections of the syllabus

NOTE: Examination questions on all papers may be set requiring candidates to apply knowledge to novel situations.

10.0 SPECIFICATION GRID

TOPIC	Paper 1		Paper 2			
	Skill 1.0	Skill 2.0	Skill 1.0		Skill 2.0	
BIOLOGY			Section A	Section B	Section A	Section B
Cells and levels of organization						
Nutrition						
Respiratory system						
Transport systems						
Reproductive systems						
Health and diseases						
SUB TOTAL	8	6	8	12	6	8
CHEMISTRY	Skill 1.0	Skill 2.0	Skill 1.0		Skill 2.0	
			Section A	Section C	Section A	Section C
Matter						
Acids, bases and salts						

Industrial processes						
Oxidation and reduction						
Organic chemistry						
SUB TOTAL	8	5	8	12	5	8
PHYSICS	Skill1.0	Skill2.0	Skill1.0	Skill 2.0		
			Section A	Section D	Section A	Section D
Measurements						
Force						
Energy						
Magnetism						
Electricity						
SUB TOTAL	8	5	8	12	5	8
GRAND TOTAL	24	16	24	36	16	24

NB: Paper 3 consists of two compulsory questions of 20 marks each from any two sections of the syllabus. All questions are on experimental skill(3.0)