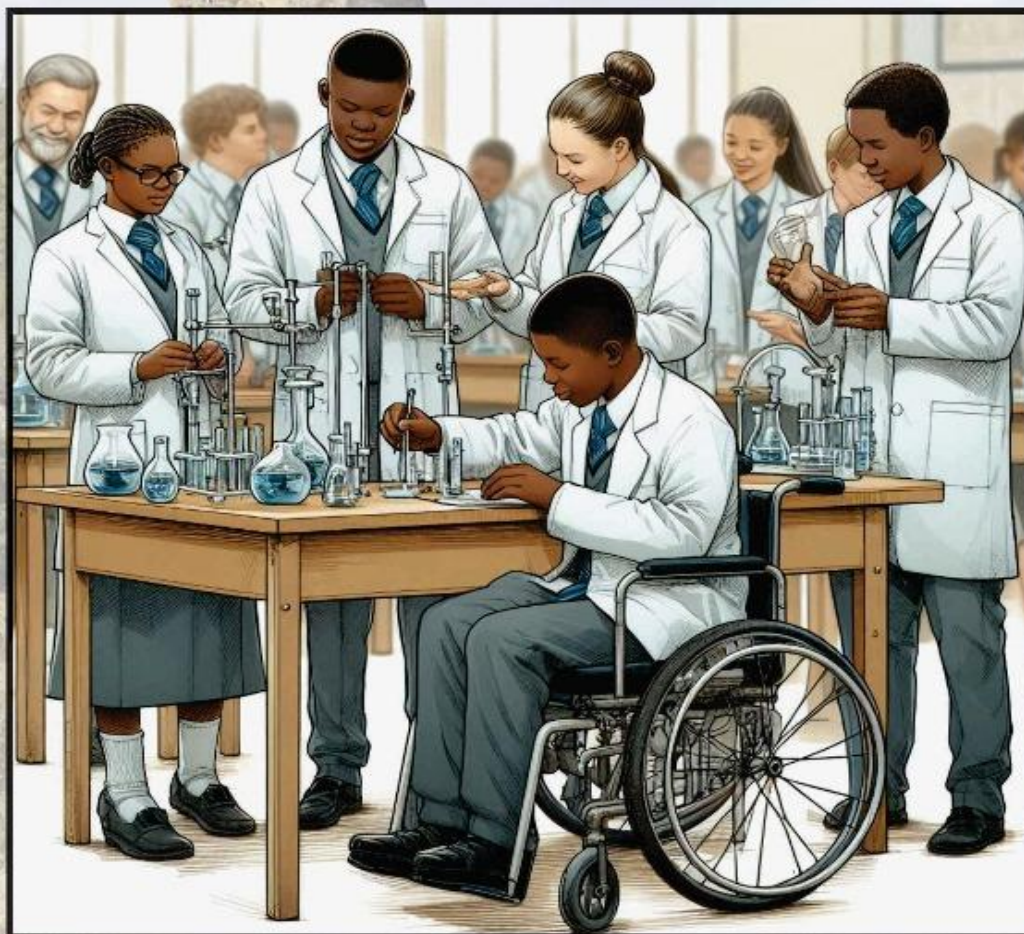




ZIMBABWE

Ministry of Primary and Secondary Education



COMBINED SCIENCE SYLLABUS

2024-2030

FORM 1 - 4

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1.0 PREAMBLE

1.1 INTRODUCTION

This Heritage-Based Combined Science syllabus covers four years of Secondary Education, Forms 1 – 4. The syllabus provides knowledge and skills 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 and hands on approach to the learning area is adopted to develop scientific thinking and application of acquired knowledge and skills through exploitation of country's heritage.

1.2 RATIONALE

This syllabus develops learners' scientific skills in Physics, Chemistry and Biology. It develops knowledge of scientific concepts and principles and their application in solving everyday problems. It fosters creativity, innovation, critical thinking and problem-solving abilities among learners. It also enables learners to acquire 21st century scientific skills for an innovation and knowledge driven education.

1.3 SUMMARY OF CONTENT

The Combined Science learning area covers concepts in Biology, Chemistry and Physics. The syllabus covers scientific skills such as observing, recording, measuring, presentation, analysis and interpretation of data. The Combined Science also promotes the impartation of 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 the Junior School Module
- engaged in science experiments
- engaged in project and collaborative work
- used measuring instruments such as rulers, thermometers, clocks and balances

1.5 CROSS- CUTTING THEMES

The following cross-cutting priorities have to be taken into consideration in the teaching and learning of Heritage-based Combined Science, for further studies, life and work.

- Gender stereotyping
- Children's rights and responsibilities
- Disaster risk management
- Entrepreneurship
- Health and wellbeing
- Environmental management
- Climate change

2.0 PRESENTATION OF THE SYLLABUS

This Form 1 to 4 Heritage-based 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 further:

- 3.1 develop desirable scientific literacy
- 3.2 acquire critical thinking, creativity and problem-solving skills that apply to real life situations
- 3.3 gain 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 everyday problems and in understanding new situations
- 4.2 conduct experiments, record results, describe observations and draw conclusions
- 4.3 demonstrate an understanding of scientific terms, laws, facts, concepts, theories and phenomena
- 4.4 exhibit knowledge and understanding in relation to scientific and technological applications with their social, economic and environmental implications
- 4.5 show relevant attitudes to science such as accuracy and precision, objectivity, integrity, enquiry initiative and inventiveness
- 4.6 portray 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 draw scientific diagrams in two dimensions.
- 4.9 relate scientific principles, formulae and methods to solving qualitative and quantitative problems.
- 4.10 apply scientific principles, methods and techniques in value addition and beneficiation of our natural resources.
- 4.11 use appropriate methods of recycling and/or disposing wastes.
- 4.12 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
- Robotics

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 learning area. 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:

- 6.1.1 Experimentation
- 6.1.2 Demonstrations
- 6.1.3 Problem solving
- 6.1.4 Field trips
- 6.1.5 Games
- 6.1.6 Cooperative learning/Group work
- 6.1.7 Simulations
- 6.1.8 Research/ Surveys/Case studies
- 6.1.9 Question and Answer
- 6.1.10 Discussions

- 6.1.11 Interviews and Report writing
- 6.1.12 Concept mapping
- 6.1.13 Visual tactile
- 6.1.14 Individualisation

6.2 TIME ALLOCATION

- For adequate coverage of the syllabus, a time allocation of 8 periods of 35 minutes per week is recommended. Double periods are recommended to accommodate practical work. The class size should not exceed 35 learners. At least 2 educational tours per year are recommended.

7.0 SCOPE AND SEQUENCE

7.1 BIOLOGY

TOPIC	Form 1	Form 2	Form 3	Form 4
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 and animal cells	<ul style="list-style-type: none">• Types of variation: continuous and discontinuous	<ul style="list-style-type: none">• Structures and functions of specialised cells• Use of a microscope	<ul style="list-style-type: none">• Ecosystems
Nutrition	<ul style="list-style-type: none">• Diet	<ul style="list-style-type: none">• Photosynthesis• Digestive system in humans	<ul style="list-style-type: none">• Factors affecting rate of photosynthesis• Conditions necessary for photosynthesis• Teeth and digestion	<ul style="list-style-type: none">• Human diet: balanced diet• Deficiency diseases• Food tests
Respiratory systems	<ul style="list-style-type: none">• Respiratory gases	<ul style="list-style-type: none">• Respiratory organs• Breathing mechanism	<ul style="list-style-type: none">• Gaseous exchange in alveoli	<ul style="list-style-type: none">• Respiration: aerobic and anaerobic respiration

TOPIC	Form 1	Form 2	Form 3	Form 4
Transport systems	<ul style="list-style-type: none"> • Osmosis and diffusion • Components of blood 	<ul style="list-style-type: none"> • Root and stem structure • Water and ion uptake • Heart structure and associated blood vessels 	<ul style="list-style-type: none"> • Transpiration: factors affecting rate of transpiration • Measurement of transpiration • Plasmolysis • Turgidity • Blood circulation 	<ul style="list-style-type: none"> • Adaptations of plants to reduce transpiration • Structure of blood vessels
REPRODUCTIVE SYSTEMS	<ul style="list-style-type: none"> • Reproduction in plants: flower structure, pollination, fertilisation, seed dispersal • Human reproductive organs • Puberty 	<ul style="list-style-type: none"> • Detailed structure of a wind- and insect-pollinated flower • Functions of human reproductive organs 	<ul style="list-style-type: none"> • Structure of the seed • Germination • Male and female reproductive systems • Sex cells • Fertilisation, pregnancy, placenta and child care • Menstrual cycle 	<ul style="list-style-type: none"> • Asexual and sexual reproduction in plants • Inheritance • Methods of contraception • Contraceptives
HEALTH AND DISEASES	<ul style="list-style-type: none"> • Health and hygiene • Methods of transmission of pathogens. • Common parasitic diseases: cholera, Ebola, malaria, bilharzia • 	<ul style="list-style-type: none"> • Sexually Transmitted Infections (STIs) • Life cycle of bilharzia parasite and symptoms of bilharzia 	<ul style="list-style-type: none"> • Sexually Transmitted Infections (STIs) • Signs and symptoms, causes and treatment/control of cholera, Ebola, malaria and typhoid • Abuse of drugs: medicinal uses, addiction, hallucination, depressants 	<ul style="list-style-type: none"> • HIV/AIDS • Immunity

CHEMISTRY

TOPIC	Form 1	Form 2	Form 3	Form 4
SEPARATION	<ul style="list-style-type: none"> • Filtration • Magnetism • Winnowing • Decanting • Evaporation 	<ul style="list-style-type: none"> • Applications of: filtration, magnetism, winnowing, decanting, evaporation 	<ul style="list-style-type: none"> • Distillation, fractional distillation 	<ul style="list-style-type: none"> • Paper chromatography
MATTER	<ul style="list-style-type: none"> • States of matter • Kinetic theory • Periodic Table: identification of elements • Metals and non-metals • Elements, mixtures and compounds 	<ul style="list-style-type: none"> • Concentrations of solutions • Groups and periods 	<ul style="list-style-type: none"> • Structure of atoms • Electronic configurations • Periodic table • Nuclide notation • Names and groups of elements • Mole concept, empirical and molecular formulae • Concentration 	<ul style="list-style-type: none"> • Reactivity series • Factors affecting rate of reaction

<ul style="list-style-type: none"> ACIDS, BASES AND SALTS 	<ul style="list-style-type: none"> Identification of acids and bases: litmus paper test 	<ul style="list-style-type: none"> Acid- base reactions 	<ul style="list-style-type: none"> pH scale preparation of salts reactions of metal + acid, acid + base, acid + carbonate 	<ul style="list-style-type: none"> Titration of bases with acid
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> Production of peanut butter 	<ul style="list-style-type: none"> Production of soap 	<ul style="list-style-type: none"> Fractional distillation of liquid Electrolysis Electroplating 	<ul style="list-style-type: none"> Haber process Contact process
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> Rusting: factors 	<ul style="list-style-type: none"> Chemical reactions: combustion 	<ul style="list-style-type: none"> Extraction of iron 	<ul style="list-style-type: none"> Alloy formation

PHYSICS

TOPIC	Form 1	Form 2	Form 3	Form 4
DATA PRESENTATION	<ul style="list-style-type: none"> Tallies, tables, bar graphs 	<ul style="list-style-type: none"> straight line graphs 	<ul style="list-style-type: none"> pie charts, line graphs, interpretation 	<ul style="list-style-type: none"> pie charts, line graphs, interpretation and analysis
MEASUREMENT	<ul style="list-style-type: none"> Physical quantities S.I units 	<ul style="list-style-type: none"> Prefixes Conversions Density 	<ul style="list-style-type: none"> Physical quantities, accuracy and precision Density of liquids 	<ul style="list-style-type: none"> Derived quantities
FORCE	<ul style="list-style-type: none"> Effects of force Types of force Measurement of force 	<ul style="list-style-type: none"> Moments of force Resultant force Levers 	<ul style="list-style-type: none"> Weight/mass machines: inclined plane, pulleys, levers and gears 	<ul style="list-style-type: none"> Principles of pressure Fluid systems pumps
ENERGY	<ul style="list-style-type: none"> Types of energy Energy conversions 	<ul style="list-style-type: none"> Law of conversion of energy Calculations on work Properties of light Sound energy 	<ul style="list-style-type: none"> Petrol and diesel engines Heat transfer: convection, conduction and radiation 	<ul style="list-style-type: none"> Heat transfer applications: solar water heater and solar cooker Telecommunications

MAGNETISM AND ELECTRICITY	<ul style="list-style-type: none"> • Magnets, poles, fields, compass • Static electricity: charges • Current electricity: conductors and insulators • Circuit components 	<ul style="list-style-type: none"> • Attraction and repulsion • Circuit symbols and diagrams • Measurement of electricity 	<ul style="list-style-type: none"> • Electromagnetism • Motor effect • Generator effect • Electroscope • Lightning • Ohm's Law • Resistance • Resistors • Electrical power and energy 	<ul style="list-style-type: none"> • Power generation • Electrical safety • Domestic electricity
<ul style="list-style-type: none"> • ROBOTICS • Principles of robotic systems 	<ul style="list-style-type: none"> • Introduction to robotics <ul style="list-style-type: none"> -History of robots -Types of robots -Basic components of a robot 	<ul style="list-style-type: none"> • Safety and ethics in robotics 	<ul style="list-style-type: none"> • Sensors and actuators 	

<ul style="list-style-type: none"> robot design methodologies 		<ul style="list-style-type: none"> Tools and applications for robot design 	<ul style="list-style-type: none"> Logic gates Tools and applications for robot design 	
robot construction and programming		<ul style="list-style-type: none"> Robot construction Robot programming 		<ul style="list-style-type: none"> Robot construction Robot programming

8.0 COMPETENCY MATRIX

FORM 1

8.1.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	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 demonstrate use of laboratory apparatus 	<ul style="list-style-type: none"> Laboratory rules laboratory apparatus: beaker, measuring cylinder, test tube, crucible, 	<ul style="list-style-type: none"> discussing laboratory rules discussing and drawing laboratory apparatus taking readings from laboratory apparatus 	<ul style="list-style-type: none"> Multimedia & Braille/Jaws software laboratory apparatus

		evaporation dish, tripod stand, wire gauze, Bunsen burner, spirit burner, spatula, funnel	such as measuring cylinder, balances	
CELLS AND LEVELS OF ORGANISATION	<ul style="list-style-type: none"> describe the structure of a plant and an animal cell list similarities and 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 bio viewers and hand lenses to observe and draw cells (avoid using fresh human blood or cheek cells) 	<ul style="list-style-type: none"> Charts on cells Models of cells ICT tools and braille/jaws softwares Onion Hand lens
NUTRITION	<ul style="list-style-type: none"> define balanced diet list component of balanced diet name functions of nutrients 	<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 Discussing function of nutrients 	<ul style="list-style-type: none"> Charts on collection of foods Food samples E-learning packages

RESPIRATORY SYSTEM	<ul style="list-style-type: none"> • State the percentage composition of air • Identify respiratory gases • describe the test for carbon dioxide gas • test for oxygen gas 	<ul style="list-style-type: none"> • Nitrogen 78%, oxygen 20%, carbon dioxide 0,03%, rare gases, water vapour less in air • Oxygen and carbon dioxide • Carbon dioxide • Oxygen 	<ul style="list-style-type: none"> • Discussing the composition of air • Comparing oxygen in inhaled and exhaled air experiment • Blowing into lime water or bicarbonate indicator • Using glowing wooden splint for oxygen test 	<ul style="list-style-type: none"> • Model of breathing system • Internet • Inverted jar, candle, water trough • Lime water/bicarbonate indicator • Glowing wooden splint
TRANSPORT SYSTEMS	<ul style="list-style-type: none"> • describe water movement in plants • identify components of blood stating the functions of each component 	<ul style="list-style-type: none"> • Osmosis • Diffusion • Components of blood • Functions of the components 	<ul style="list-style-type: none"> • Demonstrating water movement in a plant using potassium permanganate/ methylene blue/coloured solutions • Observing components of blood cells 	<ul style="list-style-type: none"> • use of potted plants • ICT tools & braille/ jaws software • Bio viewer, bioset
REPRODUCTION IN PLANTS AND HUMANS	<ul style="list-style-type: none"> • describe structure of a simple flower • describe pollination and fertilization 	<ul style="list-style-type: none"> • Flowers, carpel, stamens • Pollen grains • Ovule, ovary, fruit • Signs of puberty, such as breasts, 	<ul style="list-style-type: none"> • Observing a flower using hand lens/ bio viewers 	<ul style="list-style-type: none"> • Charts on flowers • Flowers • Models of human being • Computer

	<ul style="list-style-type: none"> state signs of puberty 	beard, mensuration, growth of pubic hair, widening of pelvic girdle, voice deepening	<ul style="list-style-type: none"> Emphasising on pre-mensural symptoms such as period pain 	<ul style="list-style-type: none"> Simulations ICT tools
HEALTH AND DISEASES	<ul style="list-style-type: none"> describe a healthy person state importance of hygiene list ways of disposing litter/ waste, stating their advantages and disadvantages 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 <p> cholera – water ebola - contact malaria - vector bilharzia - vector </p>	<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 (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> State methods of separating mixtures 	<ul style="list-style-type: none"> Filtration, Magnetism, Winnowing, Decanting, Evaporation 	<ul style="list-style-type: none"> Carrying out experiments to illustrate methods of separating 	<ul style="list-style-type: none"> Magnet Sulphur ICT tools
MATTER	<ul style="list-style-type: none"> identify the three states of matter describe properties of solids, liquids and gases in terms of kinetic theory of matters describe the arrangement of particles 	<ul style="list-style-type: none"> solids, liquids and gases properties of solids, liquids and gases particle arrangement in solids, liquids and gases Kinetic theory 	<ul style="list-style-type: none"> Identifying the three states using salt, water and air Compressing a gas in syringe Discussing particle arrangement in solids, liquids and gases Carrying out experiments on heating ice block, candle 	<ul style="list-style-type: none"> salt, water, stones, syringe, beakers, ice, candles, naphthalene flakes iodine crystals models

	<p>in solids, liquids and gases</p> <ul style="list-style-type: none"> identify mixtures, elements and compounds Describe the factors that affect solubility Identify metals and non-metals on periodic tables 	<p>Elements, mixtures, Compounds</p> <p>Particle size, temperature, stirring</p> <p>Common</p>	<p>wax, naphthalene, iodine crystals</p> <ul style="list-style-type: none"> Dissolving potassium permanganate crystals in water Identifying elements on the Periodic Table Mixing of iron and Sulphur, sand and maize grains Heating iron and sulphur Dissolving salt/sugar, iron/Sulphur in water Identifying elements on periodic table 	<ul style="list-style-type: none"> Periodic Tables iron filings Sulphur powder sand, maize beakers spatulas salt/sugar water
ACIDS AND BASES	<ul style="list-style-type: none"> identify acids and bases using red and blue litmus list properties of acids and bases 	<ul style="list-style-type: none"> Acids and bases 	<ul style="list-style-type: none"> Dipping litmus paper in HCL, NaOH, H₂O, CuSO₄, tap water 	<ul style="list-style-type: none"> Red/blue litmus Solutions (acids and base)

INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> outline production of peanut butter Outline the production of oil from peanut butter State uses of oil 	<ul style="list-style-type: none"> Processes: Shelling, roasting, grinding and packaging Equipment: sheller, peanut butter making machine 	<ul style="list-style-type: none"> Preparing peanut butter Pressing peanut butter to produce oil 	<ul style="list-style-type: none"> Winnowing basket Mortar and pestle Grinding stone (guyo/imbokodo)
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> state conditions necessary for rusting explain methods of preventing rusting 	<ul style="list-style-type: none"> Conditions: oxygen and moisture Methods: painting, galvanising, plating 	<ul style="list-style-type: none"> carrying out experiments to investigate conditions necessary for rusting 	<ul style="list-style-type: none"> iron nails oil multimedia
ORGANIC CHEMISTRY	<ul style="list-style-type: none"> identify forms of fuels compare the efficiency of different fuels 	<ul style="list-style-type: none"> Fuels: liquid, solid, gaseous 	<ul style="list-style-type: none"> Discussing forms of fuels Carrying out experiments to compare the efficiency of fuels 	<ul style="list-style-type: none"> Wood, Paraffin, Methylated spirit burner, Bunsen burners

8.1.3 PHYSICS

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
DATA PRESENTATION	<ul style="list-style-type: none"> Present data in the form of tallies, tables and bar graphs Interpret data presented in the form of tallies, tables and bar graph 	<ul style="list-style-type: none"> tallies, tables and bar graphs 	<ul style="list-style-type: none"> collecting and presenting data in the form of tallies, tables and bar graphs 	<ul style="list-style-type: none"> multimedia
MEASUREMENTS	<ul style="list-style-type: none"> estimate physical quantities identify appropriate instruments for measuring physical quantities measure accurately read an instrument scale to the nearest division identify units including S.I units 	<ul style="list-style-type: none"> Length, mass, time and temperature Length, mass, time and temperature SI units: metre (m), kilogram(kg), degree Celsius, second(s) Parallax error and zero error 	<ul style="list-style-type: none"> Estimating length, time, mass and temperature Measuring length, time, temperature and mass Taking measurements at different points 	<ul style="list-style-type: none"> Metre rule Thermometer Balance Stop watch ICT tools

FORCE	<ul style="list-style-type: none"> demonstrate the effect of forces on position, shape and size identify various types of force state the unit of force identify instruments for measuring 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) Force meter Spring balance 	<ul style="list-style-type: none"> Carrying out experiments on effects of forces Carrying out experiments on gravitational force, push and pull, electrostatic force, magnetic force, friction Measuring force using spring balance or force meter 	<ul style="list-style-type: none"> Metre rule Thermometer Balance Stop watch ICT tools Foam rubber, springs, trolleys, rubber bands Magnets, rulers, bricks Trolleys Masses Force meter Spring balance
ENERGY	<ul style="list-style-type: none"> describe effects of energy identify different -forms of energy list forms of potential energy 	<ul style="list-style-type: none"> Effects of energy Forms and sources of energy Kinetic, potential, light, 	<ul style="list-style-type: none"> Demonstrating the effects of energy: burning fuels, bouncing a ball, making objects move, compressing a spring 	<ul style="list-style-type: none"> spring, candle, ball, catapult, magnesium ribbon

		heat, electrical, chemical, sound • Forms of potential energy: gravitational, elastic, chemical	• Running upstairs, lighting a torch, clapping hands, raising a brick • Carrying out experiments to show potential energy	• torch, brick, musical instruments • trolleys • catapult • torch cell
	• identify energy conversions • construct energy chains • identify energy convertors	• Energy conversion: energy changes, energy chains • Energy convertors	• Lighting a torch • Using a dynamo to light a bulb • Using a catapult and solar panel • Discussing various energy convertors	• Torch • Dynamo • Catapult • Solar panel • Bulb • Green plants • Engines refrigerator • Cell • Bulb • Solar cells • Generators

MAGNETISM	<ul style="list-style-type: none"> • identify types of magnets • distinguish magnetic material from non-magnetic materials • identify the poles of a magnet 	<ul style="list-style-type: none"> • Magnets: bar magnets, horse shoe magnets, C-magnets, E-magnets • Magnetic and non-magnetic materials • Poles and magnets: South and north poles: earth as magnet 	<ul style="list-style-type: none"> • Classifying magnets • Using magnets to identify magnetic and non-magnetic materials • suspending a bar magnet • using a compass 	<ul style="list-style-type: none"> • Horse shoe magnets • Bar magnets • C-magnets • E-magnets • Steel, iron nails, copper, aluminium, wood, plastic, glass • bar magnet, string, compass,
ELECTRICITY	<ul style="list-style-type: none"> • state the two types of charges • describe the production of charges • define current 	<ul style="list-style-type: none"> • Negative, positive • Static electricity • Current as flow of charges 	<ul style="list-style-type: none"> • Rubbing polythene or perspex on hair or dry cloth 	<ul style="list-style-type: none"> • Polythene • Perspex • Dry cloth • Plastic • Wood

	<ul style="list-style-type: none"> distinguish between conductors and insulators identify components of direct current (d.c) circuit draw and label a simple direct current (d.c) circuit 	<ul style="list-style-type: none"> 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"> Iron bar electrolytes, Carbon rods, Copper rods Light bulb Voltmeter Ammeter Circuit boards Cells Bulbs Switches Resistors Chart of standard electrical symbols ICT tools
ROBOTICS Principles of robotic systems	<ul style="list-style-type: none"> Define robotics and robot Outline the history and evolution of robotics identify types of robots List basic components of robots 	<ul style="list-style-type: none"> Evolution of robotics Fixed and mobile robots Basic components of a robot - motion sensors 	<ul style="list-style-type: none"> Discussing the history and evolution of robotics Identifying types of robots Naming components of robots 	<ul style="list-style-type: none"> ICT tools Robotic kits Charts Camera LED LCD Memory card

		<ul style="list-style-type: none"> - gears - Micro controller such as ESP32, ESP8266 and STM32 - power source -Motors (actuators) such as Savor motor, Stepper motor, DC motor and Vibration motor - motor drive 		<ul style="list-style-type: none"> • Drones
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FORM 2

8.2.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
TYPES OF VARIATION	<ul style="list-style-type: none"> state differences among living organisms compare continuous and discontinuous variation 	<ul style="list-style-type: none"> variation: height, mass, shoe size, skin/ coat colour, sex, right or left handedness, tongue rolling 	<ul style="list-style-type: none"> comparing height, mass, shoe size, skin/ coat colour, sex, right or left handedness, tongue rolling 	<ul style="list-style-type: none"> leaves seeds in a pod ICT tools
NUTRITION	<ul style="list-style-type: none"> explain importance of plants as producers state the word equation for photosynthesis describe digestive system of humans 	<ul style="list-style-type: none"> Animals as consumers of food Photosynthesis 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 ORGANS	<ul style="list-style-type: none"> state word equations for respiration label parts of respiratory system 	<ul style="list-style-type: none"> Glucose + Oxygen → carbon dioxide + 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"> Outline the internal structures of a root and stem describe water and ion uptake by plants describe the circulatory system name the main blood vessels to and from the heart state functions of the heart 	<ul style="list-style-type: none"> Root and stem structures of a dicotyledonous plant: epidermis, cortex, phloem, cambium, xylem Osmosis and active uptake Human circulatory system Blood vessels and heart Structure of heart: atria, 	<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 vascular tissue using dye Examining model of the heart Drawing and labelling structure of the heart 	<ul style="list-style-type: none"> Plant ICT tools Microscope Bio-viewer Model of human circulatory system ICT tools

		<ul style="list-style-type: none"> • ventricles and valves; bicuspid and tricuspid, semi lunar valves • Movement of blood 		
REPRODUCTIVE SYSTEMS	<ul style="list-style-type: none"> • distinguish between monocotyledonous and dicotyledonous plant seeds • describe functions of cotyledon and endosperm • state the functions of the female and male reproductive systems 	<ul style="list-style-type: none"> • Structure of maize and bean seeds: testa, radicle, plumule, endosperm and cotyledon • Human reproductive systems: Penis, testis, sperm duct, urethra, prostate glands, vagina, ovary, oviduct, uterus, cervix 	<ul style="list-style-type: none"> • comparing internal and external features of the monocotyledonous and dicotyledonous plant seeds • discussing the functions of male and female reproductive systems 	<ul style="list-style-type: none"> • multimedia • models of reproductive systems • multimedia
HEALTH AND DISEASES	<ul style="list-style-type: none"> • state causes of diseases • describe causes of bilharzia • describe the life cycle of bilharzia parasite 	<ul style="list-style-type: none"> • Contaminated food, water, air • Bilharzia worm • Snail-human host • Eggs in water 	<ul style="list-style-type: none"> • discussing the transmission of bilharzia parasite and methods of preventing spread of bilharzia 	<ul style="list-style-type: none"> • bilharzia life cycle chart • multimedia

8.2.2 CHEMISTRY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> state the applications of filtration, winnowing and magnetism and evaporation 	<ul style="list-style-type: none"> application: treatment of water, grain separation, separation of metallic objects from grain before grinding, separation of metallic waste for recycling, sugar production 	<ul style="list-style-type: none"> discussing applications of the separation methods 	<ul style="list-style-type: none"> multimedia
MATTER	<ul style="list-style-type: none"> determine the concentrations by colour densities of dissolved substances determine the concentration of a substance by varying the 	<ul style="list-style-type: none"> Mole concept: concentration 	<ul style="list-style-type: none"> carrying out experiments on dissolving-coloured substances (differing amounts to be dissolved) 	<ul style="list-style-type: none"> potassium permanganate ammonium dichromate

	amount of solute in a given solvent			
ACIDS, BASES AND SALTS	<ul style="list-style-type: none"> describe an acid–base reaction 	<ul style="list-style-type: none"> Acids–base reactions 	<ul style="list-style-type: none"> Carrying out experiments to demonstrate acid- base reactions 	<ul style="list-style-type: none"> litmus paper Dilute HCl, H₂SO₄ and NaOH solution
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> Outline the manufacture of soap 	<ul style="list-style-type: none"> Production of soap/ saponification 	<ul style="list-style-type: none"> Making soap Visiting soap manufacturing companies 	<ul style="list-style-type: none"> NaOH solution, NaCl solution, plant /animal fat
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> write simple word equations define oxidation and reduction in terms of oxygen distinguish between physical and chemical changes 	<ul style="list-style-type: none"> Chemical reactions 	<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"> define complete and incomplete combustion of fuels 	<ul style="list-style-type: none"> Complete and incomplete combustion 	<ul style="list-style-type: none"> lighting burners (methylated spirit) with long and short wicks/ paraffin stove 	<ul style="list-style-type: none"> Burner (paraffin/ methylated) Gas burners

	<ul style="list-style-type: none"> list the products of complete and incomplete combustion of fuels describe the effects of burning fuels 	<ul style="list-style-type: none"> Global warming, deforestation, 	<ul style="list-style-type: none"> lighting Bunsen burner sleeve wide/narrow Carrying out environmental awareness campaign 	<ul style="list-style-type: none"> Posters, drama.
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8.2.3 PHYSICS

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
DATA PRESENTATION	<ul style="list-style-type: none"> Construct a straight-line graph from appropriate data 	<ul style="list-style-type: none"> Straight line graph 	<ul style="list-style-type: none"> Drawing a straight-line graph from given data 	<ul style="list-style-type: none"> multimedia
MEASUREMENTS	<ul style="list-style-type: none"> convert units measure mass of a liquid measure the volume of an irregular object 	<ul style="list-style-type: none"> Multiples of S.I units Measurement of mass Measurement of volume by displacement 	<ul style="list-style-type: none"> Converting metre to centimetre, millimetre, kilogram to gram, minutes to second Carrying out experiments on measurement by differences of mass 	<ul style="list-style-type: none"> Metre rule, balance, stopwatch, Beaker and water

<p>FORCES</p>	<ul style="list-style-type: none"> determine the thickness, volume and mass of small objects calculate density calculate the resultant of a pair of inline forces define moment of a force calculate moment of a force state the principle of moments 	<ul style="list-style-type: none"> Measurement of volume, thickness and mass of small objects Formula for density Balanced and unbalanced forces Resultant force Moment of force = force \times perpendicular distance from the pivot 	<ul style="list-style-type: none"> Carrying out experiments on measurement of irregular objects Carrying out experiments on measurements of volume, thickness and mass carrying out experiments to find mass and volume Carrying out experiments to demonstrate equal and unequal forces 	<ul style="list-style-type: none"> Measuring cylinder Irregular objects Overflow can String Book, seeds, pins Metre rule Balance Stopwatch Regular and irregular objects, liquids force meters, levers,
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	<ul style="list-style-type: none"> • apply the principle of moments in simple calculations • define friction • measure friction • state the applications of frictional force 	<ul style="list-style-type: none"> • At equilibrium: Clockwise moments = anti clockwise moments • Frictional forces: forces opposing motion • nature of surface • car braking system • tyre treads • soles of shoes • road surfaces 	<ul style="list-style-type: none"> • Demonstrating moments of force • applying the principle of moments • Carrying out experiments to investigate frictional forces 	<ul style="list-style-type: none"> • masses, balance, metre rule, • spring balance
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MACHINES	<ul style="list-style-type: none"> define a machine construct a simple machine 	<ul style="list-style-type: none"> Simple machines: levers 	<ul style="list-style-type: none"> Lifting a load using a crowbar Constructing a simple machine 	<ul style="list-style-type: none"> Crowbar Planks masses
ENERGY	<ul style="list-style-type: none"> state the law of conservation of energy define work and energy state the S.I unit of work and energy calculate the work done or energy used by forces list sources of light energy show that light travels in a straight line 	<ul style="list-style-type: none"> Conservation of energy Work and energy Joule (J) Work done or energy used = force x distance moved Sun, fire, electric bulb Production of shadows 	<ul style="list-style-type: none"> Carrying out experiments to demonstrate Work done = Energy used Solving problems on work done and energy used observing sources of light carrying out experiments to demonstrate that light 	<ul style="list-style-type: none"> force meter object ruler bulb, torch, fire, candle, sun light source, slits screen ball multimedia

			travels in a straight line (production of shadows)	
	<ul style="list-style-type: none"> explain the production and transmission of sound 	Sound Energy <ul style="list-style-type: none"> vibrations passing of sound energy through different media 	<ul style="list-style-type: none"> Producing sound using musical instruments Conducting a bell jar experiment to show that sound requires a material medium for transmission 	<ul style="list-style-type: none"> musical instruments Tuning fork bell jar vacuum pump electric bell
MAGNETISM AND ELECTRICITY	<ul style="list-style-type: none"> describe properties of magnets state the law of magnetism draw magnetic fields 	<ul style="list-style-type: none"> Polarity, field direction and strength Attraction, repulsion, like and unlike poles Magnetic fields 	<ul style="list-style-type: none"> Illustrating properties of magnets Carrying experiments out using magnets Demonstrating magnetic fields 	<ul style="list-style-type: none"> bar magnets, string, compass bar magnets iron filings, magnets, plain paper

	<ul style="list-style-type: none"> define current and voltage state the S.I units of current and voltage measure current and voltage determine electrical power 	<ul style="list-style-type: none"> Current: ampere (A) Voltage: Volt (V) Power = Current x Voltage 	<ul style="list-style-type: none"> Discussing the meaning of current and voltage Carrying out experiments to measure current and voltage Calculating electrical power 	<ul style="list-style-type: none"> Ammeter Voltmeter Circuit boards Connecting wires Light bulbs
Principles of robotic systems	<ul style="list-style-type: none"> Discuss safety and ethics in robotics 	<ul style="list-style-type: none"> Safety in robotics Ethics in robotics 	<ul style="list-style-type: none"> Discussing safety and ethics in robotics 	<ul style="list-style-type: none"> ICT tools Robotic kits Resource persons
Robot design methodologies	<ul style="list-style-type: none"> Identify tools and applications for robot design use tools and applications for robot design 	<ul style="list-style-type: none"> CAD tools, simulation software, micro controllers (Arduino) 	<ul style="list-style-type: none"> Computer simulation and coding (scratch) 	
Robot construction and programming	<ul style="list-style-type: none"> Construct and code 	<ul style="list-style-type: none"> Robot design and construction 	<ul style="list-style-type: none"> Constructing robots 	

FORM 3

8.2.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
STRUCTURE AND FUNCTION OF A CELL	<ul style="list-style-type: none"> • identify specialized cells • draw and label specialised cells • state the function(s) of the specialised cells • use a microscope to observe cell structure 	<ul style="list-style-type: none"> • Specialised cells <ul style="list-style-type: none"> -red blood cell -muscle cell -palisade cell -root hair cell • Functions of specialised cells 	<ul style="list-style-type: none"> • Drawing specialised cell structures • Using microscope/bio-viewer to observe specialized cells 	<ul style="list-style-type: none"> • Microscope • Charts • Bio-viewers • Biosets • Printed multimedia • ICT tools • Prepared slides

			<p>Use of a microscope only. Identification of parts not necessary</p> <p>Avoiding using fresh, animal cells.</p>	
<p>NUTRITION</p> <p>Factors affecting the rate of photosynthesis</p>	<ul style="list-style-type: none"> describe experiments on factors which affect the rate of photosynthesis describe the fate of end products of photosynthesis 	<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"> Investigating factors affecting rate of photosynthesis Testing for starch in a leaf Testing for oxygen using a glowing splint Observing the internal leaf structure using a 	<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

	<ul style="list-style-type: none"> identify parts of the internal structure of a leaf describe how the leaf is adapted for photosynthesis 		bio-viewer/microscope <ul style="list-style-type: none"> Examining the external structure of the leaf 	
HUMAN NUTRITION Alimentary canal	<ul style="list-style-type: none"> draw and label parts of the alimentary canal and associated organs identify parts of the alimentary canal of a human state the functions of parts of the alimentary canal of a human 	<ul style="list-style-type: none"> Mouth, oesophagus, stomach, small and large intestines, gall bladder, pancreas, liver Ingestion, digestion, absorption, assimilation and egestion 	<ul style="list-style-type: none"> Watching video simulation to examine human alimentary canal Identifying parts using a chart 	<ul style="list-style-type: none"> ICT tools Recommended textbooks
NUTRITION	<ul style="list-style-type: none"> Name types of teeth and their functions 	<ul style="list-style-type: none"> Incisor <ul style="list-style-type: none"> -cutting -biting Canines <ul style="list-style-type: none"> -tearing 	<ul style="list-style-type: none"> Discussing the functions of teeth and their structure 	<ul style="list-style-type: none"> ICT tools Skeleton model Visking tubing/egg shell

	<ul style="list-style-type: none"> Describe mechanical and chemical digestion Explain the importance of digestion Describe the function of a typical enzymes (amylase) Identify the end products of digestion 	<ul style="list-style-type: none"> -gripping Premolar and molar -grinding Chewing Mechanical-breaking down into smaller pieces chemical – use of enzymes to convert from insoluble to soluble smaller molecules Increase surface area for enzyme action and solubility Catalysis for conversion of starch to maltose/glucose 	<ul style="list-style-type: none"> Observing types of teeth on the skeleton models Using a model to examine action of amylase on starch 	<ul style="list-style-type: none"> Recommended textbooks
RESPIRATORY SYSTEMS Gaseous exchange in alveoli	<ul style="list-style-type: none"> state the differences between inhaled and exhaled air describe the role of the alveoli in gaseous exchange 	<ul style="list-style-type: none"> Percentage composition of inhaled and exhaled air Diffusion of carbon dioxide and oxygen 1 cell thick, moist, large surface area, 	<ul style="list-style-type: none"> Carrying out an experiment to show the change in proportions of carbon dioxide and oxygen in inhaled and exhaled air 	<ul style="list-style-type: none"> ICT tools Limewater/bicarbonate indicator solution

	<ul style="list-style-type: none"> explain how the alveoli is adapted for gaseous exchange 	network of blood capillaries	<ul style="list-style-type: none"> Describing gaseous exchange in the alveoli 	
TRANSPORT SYSTEMS Transpiration	<ul style="list-style-type: none"> explain the process of transpiration state factors affecting the rate of transpiration measure transpiration in a plant outline the importance of transpiration 	<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 Explaining the importance of transpiration 	<ul style="list-style-type: none"> ICT tools Potometer
Plasmolysis and turgidity	<ul style="list-style-type: none"> explain the terms plasmolysis and turgidity 	<ul style="list-style-type: none"> Plasmolysis Turgidity 	<ul style="list-style-type: none"> Discussing plasmolysis and turgidity 	<ul style="list-style-type: none"> ICT tools Potato strips

	<ul style="list-style-type: none"> describe the effects of water loss and water gain in plant cells 		<ul style="list-style-type: none"> Watching video simulations on plasmolysis and turgidity carrying out experiments to demonstrate plasmolysis and turgidity using potato strips 	<ul style="list-style-type: none"> Visking tubing
Blood circulation	<ul style="list-style-type: none"> state the functions of blood describe the circulatory system 	<ul style="list-style-type: none"> Transport, Defence, Homeostasis Blood circulatory system 	<ul style="list-style-type: none"> Watching video simulations on the blood circulatory system 	<ul style="list-style-type: none"> Multimedia Circulatory System Model
REPRODUCTIVE SYSTEMS Wind and insect pollinated flowers	<ul style="list-style-type: none"> explain the structures of wind and insect pollinated flowers 	<ul style="list-style-type: none"> Wind flower pollinated Insect flower pollinated 	<ul style="list-style-type: none"> Examining the structure of wind and insect pollinated flower Drawing the structures of wind and insect pollinated flower 	<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	<ul style="list-style-type: none"> draw and label the male and female reproductive system state the functions of the male and female reproductive system 	<ul style="list-style-type: none"> male and female reproductive system functions 	<ul style="list-style-type: none"> drawing the male and female reproductive systems 	<ul style="list-style-type: none"> models of reproductive organs ICT tools
	<ul style="list-style-type: none"> describe the structure and functions of sex cells draw and label the sex cells 	<ul style="list-style-type: none"> Sperm and ovum 	<ul style="list-style-type: none"> Drawing the structure of sex cells 	<ul style="list-style-type: none"> Multimedia Bio-viewers

	<ul style="list-style-type: none"> describe the menstrual cycle describe the role of the placenta identify the substances exchanged in the placenta 	<ul style="list-style-type: none"> Hormones i.e. progesterone, oestrogen Ovulation Menstruation Placenta Nutrients, wastes, antibodies, oxygen 	<ul style="list-style-type: none"> Illustrating the menstrual cycle Watching video simulations of the placenta Listing the substances exchanged in the placenta 	<ul style="list-style-type: none"> Multi-media Multi-media
HEALTH AND DISEASES	<ul style="list-style-type: none"> list sexually transmitted infections (STIs) describe the signs, symptoms and effects of: Gonorrhoea, Syphilis, Chancroid, Genital herpes state the causative agents of: 	<ul style="list-style-type: none"> Gonorrhoea Syphilis Chancroid Genital herpes Pathogens <ul style="list-style-type: none"> -virus -bacteria 	<ul style="list-style-type: none"> Discussing STIs Identifying the sign, symptoms and effects of STIs Watching videos on signs and symptoms of STIs Listing the causes 	<ul style="list-style-type: none"> Bio-viewers Multi-media

	<ul style="list-style-type: none"> Gonorrhoea, Syphilis, Chancroid, Genital herpes state the control methods and treatment describe the signs and symptoms of malaria, typhoid, ebola and cholera state the causes of malaria, typhoid, ebola and cholera explain how the diseases are treated 	<ul style="list-style-type: none"> Abstinence, condoms, contact tracing Malaria Typhoid Ebola Cholera 	<ul style="list-style-type: none"> Using the signs and symptoms Discussing the causes Outlining the disease control methods 	<ul style="list-style-type: none"> Print media
	<ul style="list-style-type: none"> describe the effects of tobacco smoking on health describe effects of excessive 	<ul style="list-style-type: none"> Emphysema, bronchitis, lung cancer, low birth weight Liver cirrhosis, social implications, reduced reaction time 	<ul style="list-style-type: none"> Discussing the effects of smoking Identifying effects of excessive alcohol consumption 	<ul style="list-style-type: none"> Multi-media

	<p>consumption of alcohol</p> <ul style="list-style-type: none"> • explain effects of use of mandrax and cannabis • outline the effects of breathing solvents 	<ul style="list-style-type: none"> • Hallucinations, addiction • Damaged muscles, heart and addiction 	<ul style="list-style-type: none"> • Listing effects of mandrax and cannabis • Explaining effects of breathing solutions 	
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8.2.2 PHYSICS

TOPIC	OBJECTIVES Learners should be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
DATA PRESENTATION	<ul style="list-style-type: none"> Interpret and analyse data from 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
MEASUREMENT Physical quantity	<ul style="list-style-type: none"> measure physical quantities accurately using appropriate instruments read instruments scale to the nearest fraction of the division determine density 	<ul style="list-style-type: none"> Measurement of physical quantities: length (thickness and internal diameter) current, voltage Density: liquids and irregular objects 	<ul style="list-style-type: none"> Measuring length, current, voltage Determining density of liquids and irregular objects experimentally 	<ul style="list-style-type: none"> Vernier calipers Voltmeter Ammeter Measuring cylinder Strings Balance Multimedia

FORCE Weight/mass	<ul style="list-style-type: none"> define weight, momentum and inertia explain Newton's laws of motion calculate force, given mass and acceleration 	<ul style="list-style-type: none"> Weight, Momentum Inertia $\text{force} = \text{mass} \times \text{acceleration}$ 	<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
Machines	<ul style="list-style-type: none"> describe the uses and applications of machines determine Mechanical Advantage (MA), Velocity Ratio (VR) and efficiency of levers inclined plane, pulleys and gears 	<ul style="list-style-type: none"> Simple machines: Levers, pulley system, inclined plane, gears Mechanical advantage, velocity ratio and efficiency 	<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 	<ul style="list-style-type: none"> Crow bar Wheel barrow Scissors Pulleys Inclined plane Gears Bearings

	<ul style="list-style-type: none"> • explain energy losses in machines • describe ways of improving efficiency in machines 	<ul style="list-style-type: none"> • Friction and mass of moving parts • Lubrication, bearings and mass reduction 	<ul style="list-style-type: none"> • velocity ratio of the simple machines • Demonstrating effects of lubrication, bearings and mass reduction on efficiency 	
Petrol and diesel engines	<ul style="list-style-type: none"> • describe the operation of a four-stroke petrol and diesel engine • explain the role of the fuel injector and carburettor • outline the difference between petrol and diesel engines 	<ul style="list-style-type: none"> • Strokes: intake compression, power and exhaust • Fuel and air supply • Computer box • 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 and fuel economy of petrol and diesel engine 	<ul style="list-style-type: none"> • Model of a four-stroke petrol engine • Engine block • Fuel injector
ENERGY heat transfer	<ul style="list-style-type: none"> • give a molecular account of the heat transfer 	<ul style="list-style-type: none"> • conduction, good and bad conductors 	<ul style="list-style-type: none"> • carrying out experiments with 	<ul style="list-style-type: none"> • iron • copper

	<ul style="list-style-type: none"> explain convection in terms of the kinetic theory state good and bad reflectors, absorbers and emitters of heat 	<ul style="list-style-type: none"> convection in liquids and gases good and bad reflectors, absorbers and emitters of heat 	<ul style="list-style-type: none"> 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"> aluminium wood glass smoke chamber copper sulphate crystals black painted surface white painted and shiny surfaces
MAGNETISM 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 direct current Plotting compass
Motor effect	<ul style="list-style-type: none"> Illustrate how movement is produced in a current carrying wire in a magnetic field 	<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 direct current magnets

	<ul style="list-style-type: none"> describe the operation of a direct current (d.c) motor 	<ul style="list-style-type: none"> electrical to mechanical energy 	<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 an experiment which shows that a change in magnetic field can induce an electro motive force (e.m.f) in a conductor state the factors which affect the magnitude of induced e.m.f describe the operation of an alternating current (a.c) and d.c generator 	<ul style="list-style-type: none"> the generator principle, magnetic field, electric field and e.m.f strength of a magnet, relative motion, number of turns and area of coil mechanical energy to electrical energy 	<ul style="list-style-type: none"> carrying out an experiment which illustrates the generator effect carrying out experiments to investigate factors which affect the magnitude of induced e.m.f. illustrating output voltage graphically discussing factors affecting output voltage 	<ul style="list-style-type: none"> copper coil 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
ELECTRICITY Electroscope	<ul style="list-style-type: none"> Describe simple experiments to show electrostatic 	<ul style="list-style-type: none"> Electron, positive and negative charges 	<ul style="list-style-type: none"> Demonstrating electrostatic charging 	<ul style="list-style-type: none"> Electroscope

	charging using an electroscope <ul style="list-style-type: none"> Describe forces between charges 	<ul style="list-style-type: none"> The coulomb (C), like and unlike charges 	<ul style="list-style-type: none"> Demonstrating attraction and repulsion of charges using an electroscope 	
Principles of robotic systems Sensors and actuators	<ul style="list-style-type: none"> identify sensors and actuators explain the functions of the sensors describe function of actuators 	<ul style="list-style-type: none"> Temperature sensors, ultrasonic sensors, light sensor, pressure sensor, proximity sensor, Actuators <ul style="list-style-type: none"> - electric, -hydraulic - pneumatic 	Identifying sensors and actuators <ul style="list-style-type: none"> Discussing functions of sensors and actuators 	online resources ICT tools Robotic kits Resource persons Braille/jaws software
Robot design methodologies	<ul style="list-style-type: none"> identify tools and applications for robot design apply tools and applications for robot design 	<ul style="list-style-type: none"> CAD tools, simulation software, micro controllers (Arduino) 	<ul style="list-style-type: none"> Computer simulation and coding (scratch) Writing structured programs to control robots for defined tasks 	<ul style="list-style-type: none"> ICT tools Robotic kits Resource persons Braille
Robot construction and programming Logic gates	<ul style="list-style-type: none"> Describe logic gates Construct and code 	<ul style="list-style-type: none"> Logic gates: NOT, OR, AND, NAND, NOR and Truth tables Robot design and construction 	<ul style="list-style-type: none"> Describing logic gates Constructing robots 	<ul style="list-style-type: none"> ICT tools Robotic kits Resource persons Braille

		<ul style="list-style-type: none"> Coding – Python programming 		
Lightning conductor	<ul style="list-style-type: none"> describe the production of lightning Explain the 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
Ohm's law	<ul style="list-style-type: none"> state Ohm's law calculate resistance /voltage/current using Ohm's law describe an experiment to determine resistance 	<ul style="list-style-type: none"> Ohm's law $V=IR$ resistance 	<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 	<ul style="list-style-type: none"> Voltmeter Ammeter Bulbs resistors voltmeter ammeter

	<ul style="list-style-type: none"> state the limitations of Ohm's law 	<ul style="list-style-type: none"> limitations of Ohm's law 	<ul style="list-style-type: none"> discussing limitations of Ohm's law 	
Resistors	<ul style="list-style-type: none"> construct simple electric circuits draw and interpret circuit diagrams calculate resistance in simple circuits 	<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 <ul style="list-style-type: none"> $R = R_1 + R_2 + R_3$ $= 1 + 1 + 1$ $R \quad R_1 \quad R_2 \quad R_3$ 	<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

Electrical power and energy	<ul style="list-style-type: none"> Define electrical power and energy 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
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8.2.2 CHEMISTRY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> describe the processes of distillation and fractional distillation 	<ul style="list-style-type: none"> distillation and fractional distillation 	<ul style="list-style-type: none"> demonstrating distillation of impure water and fractional distillation of dilute ethanol 	<ul style="list-style-type: none"> ethanol distillation unit fractional distillation unit
MATTER	<ul style="list-style-type: none"> describe the arrangement of metals and non-metals in the Periodic Table name the sub-atomic particles state the relative charges and masses of sub-atomic particles state relative position of sub-atomic particles within the atom 	<ul style="list-style-type: none"> metals and non-metals: <ul style="list-style-type: none"> -position Proton, neutrons and electrons Structure of an atom: nucleus, electron shells 	<ul style="list-style-type: none"> Identifying positions of elements on the Periodic Table, their groups and periods Drawing the structure of an atom 	<ul style="list-style-type: none"> Periodic Table chart Computer simulation of atomic structure

	<ul style="list-style-type: none"> name the first 20 elements in the periodic table stating their symbols write the electronic configuration of the first 20 elements describe ionic and covalent bonding 	<ul style="list-style-type: none"> Electronic configurations Bonding Ionic bonding: NaCl, MgO, Na₂O Covalent bonding: H₂, Cl₂, H₂O 	<ul style="list-style-type: none"> Producing electronic configuration diagrams Burning magnesium ribbon to demonstrate chemical reaction Experimenting to form precipitates: formation of lead chloride/silver chloride/barium sulphate 	<ul style="list-style-type: none"> Magnesium ribbon Lead nitrate, HCO, H₂SO₄ Barium nitrate Silver nitrate
	<ul style="list-style-type: none"> define relative mass/mass number define the proton number/atomic number calculate the number of neutrons from given data define isotopes 	<ul style="list-style-type: none"> nuclide notation $\begin{matrix} a \\ b \end{matrix} X$ 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"> Define the Avogadro number State the relationship between the mole and molecular mass (M_r) or atomic mass (A_r) Calculate empirical formula and molecular mass Calculate concentration of solutions in mole/dm^3 and g/dm^3 	<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 	<ul style="list-style-type: none"> Stating Avogadro constant Calculating molecular masses Calculating empirical formula Calculating concentration of solutions 	<ul style="list-style-type: none"> Models/use of marble to demonstrate moles
ACIDS AND BASES	<ul style="list-style-type: none"> identify the regions of acidity neutrality and alkalinity of substance on the pH scale and using universal indicator solution 	<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 juice, hydrochloric acid,

	<ul style="list-style-type: none"> describe the reactions of acids with metal and bases write word and chemical equations for reactions 	<ul style="list-style-type: none"> neutralization 	<ul style="list-style-type: none"> Reacting dilute hydrochloric acid, nitric acid and sulphuric acid with magnesium, zinc, calcium carbonate, magnesium carbonate, sodium hydroxide 	<ul style="list-style-type: none"> water Dilute acids Hydroxides Metal granules/powder
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> outline the production of nitrogen and oxygen define electrolysis label the general components of an electrolytic cell list properties of electrodes and electrolyte describe anode and cathode reactions for electrolysis of molten lead bromide 	<ul style="list-style-type: none"> Fractional distillation of liquid air Electrolytic cell: connecting wires, cathode, anode, battery, electrolyte Electrolysis of: molten lead bromide Solid lead and bromine fumes Electrolysis of water 	<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 H_2SO_4 Carbon electrodes

	<ul style="list-style-type: none"> state observations for the electrolysis of molten lead bromide describe the electrolysis of water state the products formed during the electrolysis of water state the uses of oxygen and hydrogen 	<ul style="list-style-type: none"> Electrolyte : dilute H_2SO_4 O_2 and H_2 H_2: haber process O_2: basic oxygen furnace, medical purposes 		
	<ul style="list-style-type: none"> state the cathode, anode and electrolyte explain the cathode process state reasons for electroplating materials 	<ul style="list-style-type: none"> Copper electroplating an iron nail Cathode reaction Decoration Prevention of corrosion 	<ul style="list-style-type: none"> Setting out experiments to electroplate an iron nail Discussing reasons for electroplating in groups 	<ul style="list-style-type: none"> Iron sheet/nail Copper sulphate solution Copper electrode

OXIDATION AND REDUCTION	<ul style="list-style-type: none"> define oxidation define reduction list the raw materials used in the extraction of iron and their sources 	<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/CaCO_3, iron ore/haematite/Fe_2O_3 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"> describe reactions in the blast furnace state the functions of the raw materials 	<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 	<ul style="list-style-type: none"> Heating sample of Iron (III) Oxide on a charcoal block 	<ul style="list-style-type: none"> Iron oxide charcoal

	<ul style="list-style-type: none"> describe how iron and slag separate 			
ORGANIC CHEMISTRY	<ul style="list-style-type: none"> define the term hydrocarbon name the members of the homologous series with 3 carbon atoms draw the displayed structures of methane, ethane, propane, ethene, propene 	<ul style="list-style-type: none"> Hydrocarbons: <ul style="list-style-type: none"> 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"> outline the production of biogas identify factors affecting the production of biogas state the use of biogas 	<ul style="list-style-type: none"> Biogas production: <ul style="list-style-type: none"> role of bacteria temperature pH Fuel 	<ul style="list-style-type: none"> Preparing a model of a bio digester 	<ul style="list-style-type: none"> Model of bio digester Samples of organic waste (plant and animal waste)

FORM 4

8.2.1 BIOLOGY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
CELLS AND LEVELS OF ORGANISATION Ecosystems	<ul style="list-style-type: none"> explain the term ecosystem list components of an ecosystem 	<ul style="list-style-type: none"> Organisms and their environment Physical and biological components 	<ul style="list-style-type: none"> Discussing the term ecosystem Identifying components of an ecosystem Examining various ecosystems e.g. garden, pond, forest 	<ul style="list-style-type: none"> Multi-media
	<ul style="list-style-type: none"> explain natural ecosystem construct food chains, food webs and pyramids of biomass 	<ul style="list-style-type: none"> Natural ecosystem Food chains, food webs and pyramids of biomass Energy flow 	<ul style="list-style-type: none"> Engaging in field trips to observe natural ecosystem Illustrating food chains, food 	<ul style="list-style-type: none"> Multimedia

	<ul style="list-style-type: none"> • explain how energy is lost in food chains and food webs • describe the carbon and nitrogen cycles • describe an artificial ecosystem • explain bio-diversity • identify problems caused by limited bio-diversity 	<ul style="list-style-type: none"> • Carbon and nitrogen cycles • Garden, pond and plantation • Bio-diversity • Soil infertility, pests and diseases 	<ul style="list-style-type: none"> • webs and pyramids of biomass • Discussing energy input and energy flow • Explaining the carbon and nitrogen cycles • Visiting plantations, pond, garden • Discussing bio-diversity • Explaining problems caused by limited bio-diversity 	<ul style="list-style-type: none"> • Multimedia
NUTRITION	<ul style="list-style-type: none"> • explain the term balanced diet • list components of a balanced diet • describe the functions of the components of a balanced diet in the body 	<ul style="list-style-type: none"> • Balanced diet • Components of a balanced diet • Functions of carbohydrates, fats, proteins, vitamins (A, C, D), mineral salts (iodine, calcium, iron), water, roughage 	<ul style="list-style-type: none"> • Discussing balanced diet • Identifying components of a balanced diet • Discussing functions of the nutrients in the body 	<ul style="list-style-type: none"> • Food samples • Multimedia

	<ul style="list-style-type: none"> • explain the term deficiency disease • state causes of deficiency diseases • Describe the tests for starch, simple sugars, protein and fats 	<ul style="list-style-type: none"> • Deficiency diseases • Kwashiorkor, goitre, rickets, scurvy, anaemia and night blindness • Food tests 	<ul style="list-style-type: none"> • Explaining deficiency diseases • Watching videos and pictures of people suffering from deficiency diseases • Listing causes of various deficiency diseases • Carrying out experiments to test for starch, simple sugars, protein and fats • Watching videos on the food tests to observe colour changes 	<ul style="list-style-type: none"> • Iodine solution • Benedict solution/Clinistix • Ethanol • Sodium hydroxide, copper sulphate
Respiratory system	<ul style="list-style-type: none"> • describe aerobic and anaerobic respiration • state word equations for aerobic and 	<ul style="list-style-type: none"> • Aerobic and anaerobic respiration • Word equations: glucose + oxygen → carbon 	<ul style="list-style-type: none"> • Discussing aerobic and anaerobic respiration • Writing down word equation 	<ul style="list-style-type: none"> • Multimedia • Small animals • Germinating seeds

	anaerobic respiration	dioxide + water + energy • glucose → lactic acid + less energy	• Carrying out experiments to show release of energy and carbon dioxide from animals and germinating seeds.	
TRANSPORT SYSTEMS:	• describe adaptations of plant leaves to reduce transpiration	• Reduction of surface area, thickness of cuticle, distribution of stomata, presence of hairs	• 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	• Plant samples • Potometer Multimedia
	• describe the structure of blood vessels • draw and label the structure of blood vessels	• Veins, arteries and capillaries • Structure of blood vessels • Lumen, valves, thickness	• Discussing the structure of blood vessels • Illustrating the structure of veins, capillaries and arteries	• Models • Multimedia

	<ul style="list-style-type: none"> outline the differences among blood vessels. 		<ul style="list-style-type: none"> Watching video simulations on the structure of blood vessels Listing the differences among blood vessels 	
REPRODUCTIVE SYSTEMS	<ul style="list-style-type: none"> explain asexual reproduction in plants identify methods of asexual reproduction in plants state advantages and disadvantages of asexual reproduction outline the differences between sexual and asexual reproduction in plants 	<ul style="list-style-type: none"> 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"> 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"> Multimedia

	<ul style="list-style-type: none"> • describe methods of contraception • advantages and disadvantages of different methods 	<ul style="list-style-type: none"> • Natural methods, barrier methods, hormonal methods and spermicides 	<ul style="list-style-type: none"> • Discussing contraceptive methods, • Stating examples • Identifying advantages and disadvantages 	<ul style="list-style-type: none"> • Pictures • Samples • Multimedia
HEALTH DISEASES AND	<ul style="list-style-type: none"> • explain the term immunity • describe passive, active, natural and artificial immunity • explain how infants acquire immunity • describe how HIV/AIDS is spread • describe effects of HIV on the body • explain how the spread of HIV/AIDS can be controlled 	<ul style="list-style-type: none"> • Immunity • Passive, active, natural and artificial immunity • Breastfeeding, immunisation schedule • HIV/AIDS • Inability to resist infection • Methods of controlling the spread of HIV/AIDS 	<ul style="list-style-type: none"> • 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 • Discussing methods of controlling the spread of HIV/AIDS 	<ul style="list-style-type: none"> • Resource persons • Multimedia • Resource persons • Multimedia

8.2.2 CHEMISTRY

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
SEPARATION	<ul style="list-style-type: none"> Describe paper chromatography 	<ul style="list-style-type: none"> Paper chromatography: solvent, mixture of dyes, solvent front, initial position of dye and solvent, 	<ul style="list-style-type: none"> Carrying out an experiment to separate mixtures using paper chromatography 	<ul style="list-style-type: none"> Filter paper
MATTER	<ul style="list-style-type: none"> Describe the reactions of metals with water, steam, air and dilute acids Write equations for the reaction of metals with oxygen, dilute acids and water List metals in order of decreasing reactivity Predict the reactivity of a metal from its position in the reactivity series 	<ul style="list-style-type: none"> 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"> Metals Dilute acids

ACIDS AND BASES	<ul style="list-style-type: none"> Identify apparatus used in a titration Describe an acid /base titration procedure Calculate moles and concentrations of solutions from titrations 	<ul style="list-style-type: none"> Acid-base titrations 	<ul style="list-style-type: none"> Titrating dilute sodium hydroxide against hydrochloric acid 	<ul style="list-style-type: none"> Dilute acids NaOH(aq) Phenolphthalein
INDUSTRIAL PROCESSES	<ul style="list-style-type: none"> List the raw materials used to manufacture ammonia Describe the manufacture of ammonia State the conditions needed for the production of ammonia List the raw materials used to manufacture sulphuric acid Describe the manufacture of sulphuric acid 	<ul style="list-style-type: none"> 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 Raw materials: sulphur dioxide from burning iron pyrites/sulphur, oxygen from air Pressure: 1 atm 	<ul style="list-style-type: none"> Describing the Haber process Conducting educational tours to Sable Chemicals <p>Discussing the contact process</p>	<ul style="list-style-type: none"> Flow chart of the Haber Process

	<ul style="list-style-type: none"> State the conditions needed for the production of sulphuric acid 	<ul style="list-style-type: none"> Catalyst: vanadium (V) Oxide Temperature: 450 °C – 500 °C 		
OXIDATION AND REDUCTION	<ul style="list-style-type: none"> List down alloys of iron State the percentage composition of alloys of iron Explain the uses and properties of alloys of iron 	<ul style="list-style-type: none"> Alloy formation <ul style="list-style-type: none"> mild steel stainless steel cast iron 	<ul style="list-style-type: none"> Discussing the uses of alloys of iron 	<ul style="list-style-type: none"> Mild steel Stainless steel utensils Cast iron objects
ORGANIC CHEMISTRY	<ul style="list-style-type: none"> State the homologous series to which ethanol belongs Draw the displayed structural formula of ethanol Describe the production of concentrated ethanol List uses of ethanol Define the term global warming List the causes of global warming 	<ul style="list-style-type: none"> Ethanol <ul style="list-style-type: none"> Fermentation pH role of yeast temperature 30 °C – 35 °C Fractional distillation Beverage, medical purpose, fuel, solvent Global warming Combustion Deforestation 	<ul style="list-style-type: none"> Fermenting sugar solution and maize meal solution (maheu) Discussing effects of combustion, veld fires and deforestation 	<ul style="list-style-type: none"> Sugar solution Maize meal solutions Yeast/malt Fractional distillation apparatus Multimedia

8.2.3 PHYSICS

TOPIC	OBJECTIVES Learners will be able to:	CONTENT (knowledge, skills, values and attitudes)	SUGGESTED ACTIVITIES AND NOTES	SUGGESTED RESOURCES
MEASUREMENTS	<ul style="list-style-type: none"> Express quantities in terms of S.I units Derive other units from base units 	<ul style="list-style-type: none"> Derived units SI units <ul style="list-style-type: none"> newton, joule, watt, volts, ampere 	<ul style="list-style-type: none"> Expressing derived quantity units in terms of base units 	<ul style="list-style-type: none"> Print and electronic media
FORCE	<ul style="list-style-type: none"> Define pressure Calculate pressure Calculate pressure in fluids Describe effect of depth on pressure Describe atmospheric pressure Describe the construction and use of a simple manometer 	<ul style="list-style-type: none"> Pressure $P = F/A$ Pressure in fluids $P = h$ Atmospheric pressure manometer 	<ul style="list-style-type: none"> Determining pressure of solid objects Demonstrating variation of pressure with depth Demonstrating atmospheric pressure Constructing and using a simple manometer to determine fluid pressure 	<ul style="list-style-type: none"> Solid objects of different cross-sectional area Container with holes at different depth Water barometer Oil, water

	<ul style="list-style-type: none"> • Explain the function and operation of simple fluid systems 	<ul style="list-style-type: none"> • Fluid system: siphon and hydraulic systems (car braking system and hydraulic jack) 	<ul style="list-style-type: none"> • Demonstrating the operation of a siphon, hydraulic jack and car braking system 	Siphon hydraulic jack
	<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
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 solar water heater 	<ul style="list-style-type: none"> • A curved reflective surface • Black container • 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
MAGNETISM	<ul style="list-style-type: none"> • describe hydro and thermal power generation 	<ul style="list-style-type: none"> • hydro and thermal power generation 	<ul style="list-style-type: none"> • Outlining the energy conversions involved in hydro and thermal power generation 	<ul style="list-style-type: none"> • Model hydro and thermal power generations

ELECTRICITY	<ul style="list-style-type: none"> • Describe electrical hazards and safety precautions • Describe wiring of a three-pin plug • Explain the use of a two-pin plug • Describe uses of electricity in the home • Calculate cost of electricity • Discuss different methods of saving electricity • Explain the use of solar photo voltaic systems 	<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 • Heating • Lighting • Powering electrical devices • Meter reading costs per unit • Energy saving bulbs, solar panels, biogas 	<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"> • Charts • Three pin plugs, fuse • Radio • Different fuse ratings • Switches • Three pin plugs • Two pin plugs
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		<ul style="list-style-type: none"> • Alternative sources of energy, switch off appliances not in use • low power rating appliances • solar photo voltaic cells 		
Robot construction and programming	<ul style="list-style-type: none"> • construct and code 	<ul style="list-style-type: none"> • Robot design and construction 	<ul style="list-style-type: none"> • Constructing robots 	<ul style="list-style-type: none"> • ICT tools • Robotic kits • Resource persons

9.0 ASSESSMENT

The Heritage-based Combined Science learning area at Lower Secondary school level (Form 1-4) shall be assessed through School Based Continuous Assessment (SBCA) and Summative Assessment (SA). These assessments shall be guided by the principles of inclusivity, practicability, authenticity, transparency, flexibility, validity and reliability. The principles are crucial for creating a supportive and effective learning environment that fosters growth and development in learners at secondary level. In addition to SBCA and SA those aspects that cannot be assessed through the continuous and summative modes will be assessed through learner profiling. The aspect to be profiled will include soft skills among others. Arrangements, accommodations and modifications must be visible to enable candidates with special needs to access assessments. This section covers the assessment objectives, the assessment model, the scheme of assessment, and the specifications for continuous assessment.

9.1 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.

9.1.1 KNOWLEDGE AND COMPREHENSION

Learners should be able to demonstrate knowledge and understanding of:

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

9.1.2 HANDLING INFORMATION AND SOLVING PROBLEMS

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

- extract information relevant to a particular context from data presented in diagrammatic, symbolic, graphical, numerical or verbal form;
- use data to recognize patterns, formulate hypotheses and draw conclusions;
- translate information from one form to another;
- communicate logically and concisely;
- explain facts, observations and phenomena in terms of scientific laws, theories and models;

- explain technological applications of science and evaluate their associated personal, social, economic, and environmental implications;
- make logical decisions based on the examination of evidence and arguments;
- apply scientific principles, formulae and methods to solve qualitative and quantitative problems;
- suggest explanations of unfamiliar facts, observations and phenomena;

9.1.3 EXPERIMENTAL SKILLS

Learners should be able to:

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

9.2 Assessment Model

Assessment of learners at Lower secondary school level for Combined Science will be both Continuous and Summative as illustrated in Figure 1. Continuous Assessment will include recorded activities from the School Based Project and other activities done by the learners for assessment while summative will include terminal examinations, end of week, month, term, year or check points assessments.

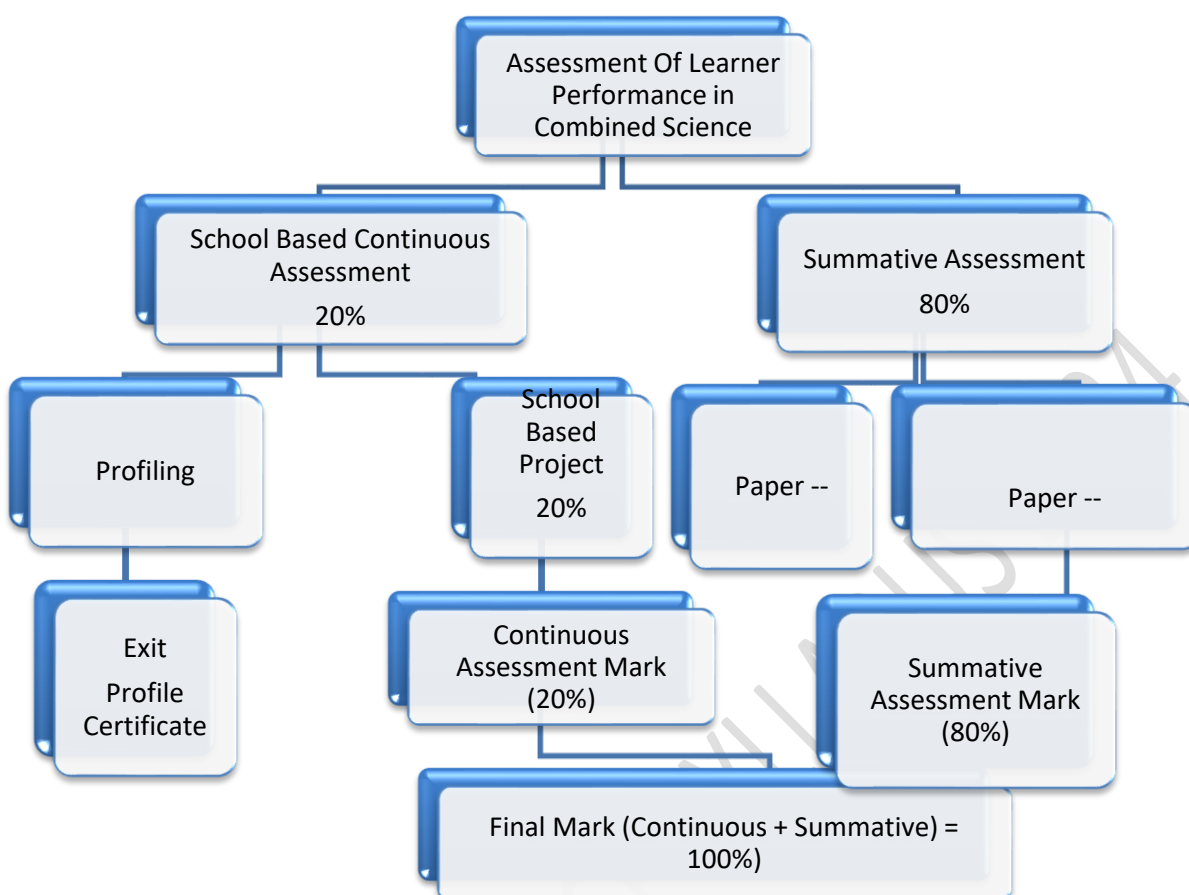


Fig. 1 Assessment Model

In addition, learners shall be profiled and learner profile records established. Learner profile certificates shall be issued for checkpoints assessment in schools as per the dictates of the Teacher's Guide to Learning and Assessment. The aspects to be profiled shall include learner's prior knowledge, values and skills, and subsequently the new competences acquired at any given point.

9.3 Scheme of Assessment

Learners at Lower secondary level will be assessed using both School Based Continuous Assessment and Summative Assessment. From Form 1 -4, learners will do a school-based project per form, per year and per learning area which will contribute 20% to the end of term and year mark. Public examination candidates at secondary level are expected to complete two (2) school-based projects per learning area at form 3 and 4 levels, which will contribute 20% to the final mark at Form 4.

FORM OF ASSESSMENT		WEIGHTING
School Based Continuous Assessment		20%
Summative Assessment		80%
Total		100%

9.4: School – Based Project: Continuous Assessment Scheme

The Table given below shows the Learning and Assessment Scheme for the School Based Project.

Project Execution Stages	Project Stage Description	Timelines	Marks
1	Problem Identification	January	5
2	Investigation of related ideas to the problem/innovation	February	10
3	Generation of possible solutions	March	10
4	Selecting the most suitable solution	April-May	5
5	Refinement of selected solution	June	5
6	Presentation of the final solution	July	10
7	Evaluation of the solution and Recommendations	August-September	5
	TOTAL		50

The learning and assessment scheme shows the stages that shall be executed by pupils and the timeline at which each stage shall be carried out. Possible marks, totalling 50, are highlighted to indicate how much can be allocated.

9.5 Description of the Summative Assessment

Summative assessment consists of three (3) papers of different weighting

Paper	Paper type	Marks	Duration	Weighting
1	Multiple Choice	40	1 hours	24%
2	Structured questions	100	2 hours	32%
3	Practical	40	1 hour 30 mins	24%
TOTAL				80%

Paper 1

Duration: 1 hour

The paper consists of 40 multiple choice questions. It will be set to cover all topics of the syllabus

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.

9.6 Skills weighting and the Specification Grid (*The percentages vary with the nature of the learning area as such there is need for customisation of the same*)

Skill	Paper 1	Paper 2	Paper 3
Knowledge	40%	40%	25%
Application and Analysis	40%	40%	50%
Problem solving	20%	20%	25%
TOTAL	100%	100%	100%

9.7 ASSESSMENT INSTRUMENTS/TOOLS:

THE FOLLOWING ARE SUGGESTED TOOLS

Form of Assessment	Suggested Assessment Tools/instruments
Profiling	Check list Observation schedules Rating Scale
Continuous Assessment	Practical activities School based continuous projects
Summative Assessment	Tests Exercises