



Republic of Zambia

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

SCIENCE SYLLABUS

GRADES 10 – 12



Prepared and Published by Curriculum Development Centre

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LUSAKA

2013

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VISION

Quality, life-long education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems.

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PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic

education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leader's civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.

The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize, analyse and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the learners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.

Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

It is my sincere hope that this Outcome Based syllabus will greatly improve the quality of education provided at Grade 8 and 9 as defined and recommended in various policy documents including Educating Our Future`1996 and the `Zambia Education Curriculum Framework `2013.

Chishimba Nkossa
Permanent Secretary

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATIO

ACKNOWLEDGEMENTS

The syllabus presented here is a result of broad-based consultation involving several stakeholders within and outside the education system.

Many individuals, institutions and organizations were consulted to gather their views on the existing syllabus and to accord them an opportunity to make suggestions for the new syllabus. The Ministry of Education wishes to express heartfelt gratitude to all those who participated for their valuable contributions, which resulted in the development of this syllabus.

The Curriculum Development Centre worked closely with other sister departments and institutions to create this document. We sincerely thank the Directorate of Teacher Education and Specialized Services, the Directorate of Planning and Information, the Directorate of Human Resource and Administration, the Directorate of Open and Distance Education ,the Examinations Council of Zambia, the University of Zambia, schools and other institutions too numerous to mention, for their steadfast support.

We pay special tribute to co-operating partners especially JICA in collaboration with Hiroshima University and UNICEF for rendering financial and technical support in the production of this syllabus.

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Director-Standard and Curriculum
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

INTRODUCTION

This syllabus is designed for Grades 10-12. It is intended for pupils not taking Chemistry and Physics as separate subjects.

General Aims

The syllabus aims at providing, through well designed studies of experimental and practical science, a worthwhile educational experience for all the pupils taking the course, whether or not they go on to study science beyond secondary School level, thereby, contributing to pupils' general education by using the impact of known applications of science concepts and principles on society. This is intended to enable pupils acquire adequate understanding and knowledge so that they can:

- become confident citizens in a technological world, able to make appropriate decisions in scientific matters;
- recognise the usefulness and limitations of the scientific method and, furthermore, appreciate its applicability in everyday life;
- Suitably prepare for studies beyond secondary School level in Science.

The course also aims at developing the following in the pupils:

- abilities and skills that
 - are relevant to the course and practice of science;
 - are useful in everyday life;
 - encourage efficient and safe practice;
 - encourage effective communication;
- attitudes relevant to science; for example
- accuracy and precision;
- objectivity;
- integrity;
- enquiry;
- initiative; and
- inventiveness or creative thinking
- Critical thinking.

Furthermore, the course aims at stimulating interest in and cares for the environment and promotes awareness that the:

- study and practice of science are co-operative and cumulative activities that are subject to social, economical, technological, ethical and cultural influences and limitations;
- Applications of science can be both beneficial and detrimental to the individual, to the community, society and the environment.

In addition to the content objectives, objectives under the following should be achieved by pupils:

- Knowledge with understanding

They should demonstrate knowledge and understanding in relation to the following:

- Scientific phenomena, facts, laws, definitions, concepts, theories;
- Scientific vocabulary, terminology, conventions; symbols, quantities and units;
- Scientific instruments and apparatus, including techniques of operations and aspects of safety;
- Scientific quantities and their determination;
- Scientific and technological applications with their social, economic and environmental implications.

- Handling information and solving problems

In words or using symbolic, graphical and numerical forms they should be able to:

- locate, select, organise and present information from a variety of sources;
- translate information from one form to another;
- manipulate numerical and other data;
- use information to identify patterns, reports trends and draw inferences;
- present reasonable explanations for phenomena, patterns and relationships;
- make predictions and propose hypotheses; and
- Solve problems.

- **Experimental skills and investigations**

As the pupils study Science they should be able to:

- follow a sequence of instructions;
- use techniques, apparatus and materials;
- make and record observations, measurements and estimates;
- interpret and evaluate observations and experimental results;
- plan an investigation, select techniques, apparatus and materials; and
- Evaluate methods and suggest possible improvements.

General Structure of the syllabus

This syllabus is divided into 13 units. The sequence of the Units is not intended to suggest a teaching order. It is hoped that teachers will be flexible when planning their lessons.

Each of the units is described under the headings of “Content”, “knowledge”, skills and “Values”. The column headed “Content” is intended as an extension and illustration of the specific outcomes and is not to be regarded as exhaustive. The teacher can extend it by relating the factual contents and specific outcomes of the syllabus to social, economic and industrial life at both national and local levels as appropriate as possible.

It is envisaged that an experimental approach will be adopted and that pupils spend adequate time on individual experimental work.

MATHEMATICAL REQUIREMENTS

The study of Science through this syllabus strengthens the applications of mathematical skills. It is assumed that the pupils are competent in the following mathematical techniques:

- taking accurate accounts of numerical work and handling calculations so that significant figures are neither lost unnecessarily nor carried beyond what is justified;

- making approximate evaluation of numerical expressions;
- formulating simple algebraic equations as mathematical models and be able to solve them;
- changing the subject of a formula;
- expressing small changes or errors as percentages;
- calculating areas of various shapes;
- dealing with vectors in all simple forms;
- plotting results graphically after selecting appropriate variables and scales;
- interpreting, analysing and translating graphical information;
- making calculations involving additions, subtraction, multiplication and division of quantities;
- expressing small fractions as percentages and vice versa;
- calculating an arithmetic mean;
- transforming decimal notation to power of ten notation (standard form);
- use tables or calculators to evaluate logarithms (for calculations), squares, square roots and reciprocals;
- Changing the subject of an equation. (these may involve simpler operations that may include positive and negative indices and square roots);
- Substituting physical quantities into an equation using consistent units so as to calculate one quantity (e.g. the units of a rate constant K);
- solving simple algebraic equations;
- comprehending and using the symbols/notations;
- testing tabulation pairs of values for direct proportionality by graphical method or by constancy of ratio;

ASSESSMENT

Continuous assessment will be emphasised by using various methods of testing according to topics at various levels. The examinations council of Zambia will prepare detailed procedures on how continuous assessment will be conducted by the teachers. The examination council will also develop examination syllabus to provide teachers with guidelines on the objectives to be tested. The scheme of assessment will consist of school based assessment and final examination which will include a practical that will be conducted by the examinations of council of Zambia.

School based assessment will be in the form of tests. Tests will be in the form of diagnostic, aptitude, achievement, oral, practice attitude and performance, learners.

TIME AND PERIOD ALLOCATION

Time allocation for this syllabus is will require at least six-40 minutes periods per week

SECTION A: PHYSICS

GRADE 10

General Outcomes:

- Develop an understanding of General Physics
- Develop investigative skills
- Demonstrate an understanding of mechanics

Key competences

- Demonstrate ability to measure length, time, mass, weight and volume
- Show skills and knowledge to calculate density, speed, velocity, acceleration and force
- Demonstrate ability to use different sources of energy
- Demonstrate ability to use simple machines to do work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1GENERAL PHYSICS	10.1.1 International System of Units (SI).	10.1.1.1 Distinguish between basic and derived quantities	<ul style="list-style-type: none"> • The difference between basic and derived quantities: Basic quantities; mass, length, time etc Derived quantities: force, acceleration, velocity etc • Basic and Derived units: Basic units: metre(m), kilogram(Kg), seconds(S) , Kelvin(K) • Derived unit: Newton(N),metre per square second(m/s^2) 	<ul style="list-style-type: none"> • Comparing basic quantities and derived quantities. • Identifying basic and derived units of quantities 	<ul style="list-style-type: none"> • Asking questions about physical quantities • Participating in group actively
		10.1.1.2 Identify basic units and derived units 10.1.1.3 Distinguish between basic and derived quantities			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.1.2 Length and time	<p>10.1.2.1 Demonstrate the use of various measuring instruments to determine length</p> <p>10.1.2.2 Demonstrate the use of clocks and devices for measuring an interval of time</p> <p>10.1.2.3 Identify factors that affect the period of a simple pendulum</p>	<ul style="list-style-type: none"> • Use of measuring instruments: such as rules, vernier calipers and micrometer screw gauge to measure the physical quantity length • Use of devices for measuring time: Using clocks to measure time intervals and period of pendulum • A simple pendulum: Factors affecting the period of pendulum such as length and amplitude 	<ul style="list-style-type: none"> • Measuring lengths of different objects • Measuring an interval of time using clocks • Communicating factors affecting the period of pendulum 	<ul style="list-style-type: none"> • Participating in group actively • Asking questions for more understanding • Applying the use of clocks and devices to determine the period of pendulum
	10.1.3 Mass and weight	<p>10.1.3.1 Distinguish between mass and weight</p> <p>10.1.3.2 Demonstrate how to measure mass and weight</p>	<ul style="list-style-type: none"> • Differences between mass and weight in terms of units, measuring instrument and quantities • Instruments for measuring mass and weight: Using Triple beam balances and spring balances to measure mass and weight 	<ul style="list-style-type: none"> • Comparing mass with weight • Measuring mass and weight of objects 	<ul style="list-style-type: none"> • Asking questions for more understanding • Appreciating the use of beam and spring balances

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>10.1.3.3 Demonstrate how to locate the centre of mass of an object</p> <p>10.1.3.4 Describe qualitatively the effect of the position of the centre of mass on the stability of an object.</p>	<ul style="list-style-type: none"> • Locating the center of mass of an object: Use of lamina to locate centre of mass of an object • Stability of objects in terms of the position of the centre of mass e.g. equilibrium (stable, unstable and neutral) 	<ul style="list-style-type: none"> • Investigating the centre of mass of object • Communicating conditions for stability of objects, e.g. base, position of centre of mass 	<ul style="list-style-type: none"> • Participating in group actively in locating the centre of mass
10.2 MECHANICS	10.2.1 Linear motion	<p>10.2.1.1 Describe the terms used in mechanics.</p> <p>10.2.1.2 Demonstrate the use of equations of uniformly accelerated motion to solve problems</p> <p>10.2.1.3 Interpret graphical representation of distance-time, Displacement-time, speed-time, velocity-time and acceleration-time.</p>	<ul style="list-style-type: none"> • Terms used : such as distance, displacement, speed, velocity, acceleration • Use of the following equations of motion; $v = u + at$, $s = (v + u)t/2$, $s = ut + \frac{1}{2} at^2$ $v^2 = u^2 + 2as$ • Graphical representation of motion in terms of ; rest, constant speed and constant acceleration 	<ul style="list-style-type: none"> • Comparing distance with displacement; speed with velocity • Classifying appropriate equation(s) of motion to solve particular numerical problems • Plotting and interpreting graphs 	<ul style="list-style-type: none"> • Participating in a group actively • Appreciating the use of equations of motion to solve problems • Appreciating graphs

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>10.2.1.4 Investigate the consequences of over speeding</p> <p>10.2.1.5 Describe the acceleration of free fall for a body near the earth.</p> <p>10.2.1.6 Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance</p>	<ul style="list-style-type: none"> • Consequences of over speeding e.g. brake failure resulting into car crush, loss of control • Acceleration of free fall for a body near the earth it is constant (approximately 10m/s^2) • The falling motion of bodies in a uniform gravitational field: falling terminal velocity 	<ul style="list-style-type: none"> • Predicting which object in motion would be damaged the most e.g. a slow moving vehicle or a fast moving vehicle, if they hit an obstacle • Calculating acceleration of a body due gravity • Communicating the cause and effect relationship of terminal velocity 	<ul style="list-style-type: none"> • Appreciating speed limits, road humps, speed traps etc • Appreciating the use of parachutes from height

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.2 Forces	10.2.2.1 Explain what force is.	<ul style="list-style-type: none"> • The definition of force: Force as “Pull” or “push” • Effects of forces :change in shape, change in size, change direction, change of motion • Resistance to change in state of motion (Newton’s 1st law) 	<ul style="list-style-type: none"> • Communicating the effects of a force using a spring, trolley, Ticker Tape Timer etc. • Investigating the relationship between mass and acceleration, e.g. higher inertia is due to larger mass 	<ul style="list-style-type: none"> • Participating in a group actively • Appreciating the use of safety belts on vehicles
		10.2.2.2 Explain the effect of forces on bodies.			
10.2.2.3 Describe the inertia law					
		10.2.2.4 Demonstrate the relationship between force and acceleration	<ul style="list-style-type: none"> • The relationship between force and acceleration: A constant force produces a constant acceleration 	<ul style="list-style-type: none"> • Describing the relationship between mass and acceleration 	<ul style="list-style-type: none"> • Appreciating Newton’s first law of motion
		10.2.2.5 Demonstrate the relationship between mass and acceleration.	<ul style="list-style-type: none"> • The relationship between mass and acceleration: Increase in mass results in reduction in acceleration (mass is inversely proportional to acceleration for a constant force) 	<ul style="list-style-type: none"> • Organising the data of investigation in a table 	<ul style="list-style-type: none"> • Giving a presentation of group work. • Knowing the safety rules of an investigation

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.2.6 Perform calculations on force. 10.2.2.7 Investigate the effect of force on a spring. 10.2.2.8 Demonstrate the effects of friction on the motion of a body. 10.2.2.9 Describe the motion in a circular path due to a perpendicular force.	<ul style="list-style-type: none"> • How to calculate force: Using formula; Force = mass \times acceleration • Hooke's law ($F \propto e$) including graphs. • Effects of friction e.g. heat, tear and wear • Centripetal force: ($F = m(v^2/r)$) and centrifugal force 	<ul style="list-style-type: none"> • Calculating force, mass and acceleration • Communicating the effects of friction • Describing circular motion 	<ul style="list-style-type: none"> • Appreciating the use of the formula to find force • Applying the restoration force in devices • Participating in class discussion
	10.2.3 Moment of Forces.	10.2.3.1 Perform calculations based on the principle of moments. 10.2.3.2 Investigate the everyday application of moments.	<ul style="list-style-type: none"> • Mass, weight and distance of a uniform object e.g. metre rule, metal bar, plank etc based on the principle • Application of moments e.g. opening a door or window, opening a bottle with an opener, a see-saw, on, tightening a nut with a spanner etc 	<ul style="list-style-type: none"> • Experimenting the principle of moments • Calculating mass, weight and perpendicular distances 	<ul style="list-style-type: none"> • Participating in a group actively • Justifying why handles of certain objects are long. e.g. a spanner, wheelbarrow etc

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.4 Work, Energy and Power.	10.2.4.1 Explain the meaning of the terms work, energy and power.	<ul style="list-style-type: none"> The definition of Work, Energy and Power: Work(force x distance in direction of force) Energy(ability to do work) Power(rate of doing work) The units of work, energy and power : Work(joule), Energy(joule)and Power (watt) 	<ul style="list-style-type: none"> Communicating work, energy and power Communicating the SI units for work, energy and power 	<ul style="list-style-type: none"> Justifying importance of conserving sources of energy Cooperating in group activities
		10.2.4.2 Identify the units of measurement for work, energy and power			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.4.5 Explain qualitatively and quantitatively the terms gravitational potential and kinetic energy.	<ul style="list-style-type: none"> Potential and Kinetic Energy: Gravitational potential energy (energy due to position), Kinetic energy (energy due to motion) NB: Gravitational potential energy ($E_P = mgh$) and kinetic energy ($E_K = 1/2mv^2$) 	<ul style="list-style-type: none"> Communicating the knowledge on potential (E_P) and kinetic (E_K) energy 	<ul style="list-style-type: none"> Participating actively in groups
		10.2.4.6 Describe sources of renewable and non-renewable energy. 10.2.4.7 Explain the effects of the use of energy sources on the environment.	<ul style="list-style-type: none"> Renewable and non-renewable energy: Renewable sources of energy: (solar, wind, hydroelectric, geothermal, bio-gas) Non-renewable energy (chemical/fuel, nuclear energy) Effects of use of energy sources on the environment: e.g. air pollution, water pollution, deforestation, land degradation etc 	<ul style="list-style-type: none"> Communicating renewable and non-renewable resources 	<ul style="list-style-type: none"> Participating actively in groups Being aware that some energy sources are non-renewable

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>10.2.4.8 Demonstrate energy transformation from one form to another</p> <p>10.2.4.9. Describe the conservation of energy</p> <p>10.2.4.10. Demonstrate the calculation of efficiency of energy conversion using the appropriate formula</p> <p>10.2.4.11. Demonstrate calculation of power using the appropriate formula</p>	<ul style="list-style-type: none"> Transformation of energy: e.g. chemical energy(Battery) to electric energy (wire)to light energy(bulb) Law of conservation of energy Calculation of efficiency of energy: Using the formula (Efficiency = energy output/ energy input x 100%) Calculation of power: Using the formula (Power = work done/ time) 	<ul style="list-style-type: none"> Observing the effects of energy sources on the environment Demonstrating energy transformations Describing the law of conservation of energy Calculating efficiency Calculating power from the formula 	<ul style="list-style-type: none"> Asking questions for more understanding Applying the law of conservation of energy Justifying why the difference between energy input and energy output
	10.2.6 Simple Machines	<p>10.2.6.1 Describe what a simple machine is</p> <p>10.2.6.2 Identify the different types of simple machines.</p>	<ul style="list-style-type: none"> The definition of a simple machine: Enables a large load to be overcome by a small effort Types of simple machines: e.g. Levers, pulleys, gears, inclined planes, wheel and axle 	<ul style="list-style-type: none"> Communicating the knowledge on simple machines and types 	<ul style="list-style-type: none"> Cooperating in group activities Listening to other learners with respect

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>10.2.6.3 Describe the distances moved by the effort and the load in a simple machine</p> <p>10.2.6.4 Explain the terms of Mechanical advantage (MA), Velocity Ratio (VR) and Efficiency.</p>	<ul style="list-style-type: none"> • The relationship between the distance and effort & load in a simple machine: Distance moved by effort and distance moved by the load in the same time • The definition of Mechanical advantage (MA), Velocity Ratio (VR) and Efficiency 	<ul style="list-style-type: none"> • Relating the distance moved by the effort to the distance moved by the load 	<ul style="list-style-type: none"> • Appreciating the use of simple machines in doing work e.g. bottle opener
		<p>10.2.6.5 Perform calculations involving simple machines</p>	<ul style="list-style-type: none"> • Mechanical advantage (MA = Load/Effort) Velocity Ratio (VR = distance moved by effort / distance moved by load) Efficiency (; Efficiency = (MA/VR) x 100%) 	<ul style="list-style-type: none"> • Calculating MA, VR and efficiency of a simple machine 	<ul style="list-style-type: none"> • Applying the formula to compare MA of different simple machines

GRADE 11

General Outcomes:

- Demonstrate an understanding of thermal physics
- Develop investigative skills
- Demonstrate an understanding of wave motion
- Demonstrate an understanding of sound
- Demonstrate an understanding of Light
- Demonstrate an understanding of magnetism

Key competences

- Demonstrate ability to show how pressure varies with volume and temperature
- Show skills and knowledge on the construction of thermometers
- Demonstrate ability to show heat transfer in solids ,liquids ,and gases

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.3 THERMAL PHYSICS	11.3.1 Simple Kinetic Theory of Matter.	11.3.1.1 Explain What the kinetic theory is	<ul style="list-style-type: none"> The definition of kinetic theory: Matter is made up of discrete individual particles that are continuous in random motion Structure of matter (solid, liquid, gases) and intermolecular forces: e.g. cohesive and adhesive 	<ul style="list-style-type: none"> Predicting the cause of continuous random motion of the discrete individual particles 	<ul style="list-style-type: none"> Cooperating in group activities Being aware of the cohesive and adhesive forces in matter
		11.3.1.2 Describe qualitatively the molecular model of matter. 11.3.1.3. Explain changes of state in terms of the kinetic theory of matter 11.3.1.4 Apply kinetic theory to explain rates of diffusion, Brownian motion, evaporation and cooling effect of evaporation	<ul style="list-style-type: none"> Change of state of matter in relation to kinetic theory Use of kinetic theory as in Rate of diffusion, Brownian motion, evaporation and cooling effect of evaporation in terms of kinetic theory 	<ul style="list-style-type: none"> Interpreting the intermolecular forces i.e. cohesive and adhesive in a much simpler way Experimenting on Brownian motion 	<ul style="list-style-type: none"> Cooperating in group activities Being aware of the cohesive and adhesive forces in matter

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.1.5 Apply the kinetic theory to explain gas pressure	<ul style="list-style-type: none"> • Kinetic theory in gas pressure (compressing a gas in a cylinder) 	<ul style="list-style-type: none"> • Collecting the data in an experiment • Formulating conclusion of experiment 	<ul style="list-style-type: none"> • Asking questions for more understanding
	11.3.2 Measurement of Temperature	<p>11.3.2.1 Explain what temperature is</p> <p>11.3.2.2 Describe physical properties of substances which change with temperature.</p> <p>11.3.2.3 Measure the temperature with thermometers</p> <p>11.3.2.4 Describe suitability of alcohol and mercury for use in liquid-in-glass thermometers.</p>	<ul style="list-style-type: none"> • Temperature: as average kinetic energy of the particles of a substance • Physical properties: such as density, electrical resistance etc. • Measurement of temperature and Calibration of thermometers • Suitability in terms of colour, expansion, conductivity. 	<ul style="list-style-type: none"> • Communicating information on temperature • Experimenting the thermal expansion of matter (liquid, solid, gases) 	<ul style="list-style-type: none"> • Asking questions for more understanding • Cooperating in groups activities • Appreciating the use of thermometers in determining temperature • Justifying the use of a specific thermometer

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.3.2.5 Describe the relationship between the Celsius and Kelvin scales.</p> <p>11.3.2.6 Describe the structure and use of a thermocouple thermometer</p> <p>11.3.2.7 Demonstrate the measurement of temperature using an appropriate thermometer</p>	<ul style="list-style-type: none"> Relationship between Celsius and Kelvin scale ($K = t + 273$) Structure of thermal couple: consisting different metals, two junctions, sensitive galvanometer Appropriate use of thermometers: Liquid in glass thermometers and thermocouple 	<ul style="list-style-type: none"> Measuring temperature and demonstrating the calibration of thermometers Communicating the suitability of the use of a thermometer Comparing Celsius and Kelvin scale Observing the structure of a thermocouple 	<ul style="list-style-type: none"> Appreciating the use of thermocouples
	11.3.3 Expansion of Solids, Liquids and Gases.	11.3.3.1 Describe qualitatively the thermal expansion of solids, liquids and gases.	<ul style="list-style-type: none"> The thermal expansion of matter: in terms of linear, area and volume expansion 	<ul style="list-style-type: none"> Experimenting the thermal expansion of solids, liquids and gases 	<ul style="list-style-type: none"> Appreciating the knowledge about expansion of solids, liquids and gases. Cooperating in group activities

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.3.3.2 Explain the effects of expansion of water on aquatic life.</p> <p>11.3.3.3 Demonstrate that solids, liquids and gases expand at different rates.</p>	<ul style="list-style-type: none"> • Effects of Anomalous expansion of water • Different rates of expansions of matter 	<ul style="list-style-type: none"> • Communicating the effects of expansion on of water on aquatic life during extreme cold seasons. • Comparing the rates of expansion of matter 	<ul style="list-style-type: none"> • Appreciating the knowledge about expansion of solids, liquids and gases.
		<p>11.3.3.4 Demonstrate how to determine the boiling and melting point of different substances.</p> <p>11.3.3.5 Explain effects of pressure on the melting and boiling points.</p>	<ul style="list-style-type: none"> • Boiling and melting points of substances graphical representation and interpretation • Effects of pressure on melting and boiling point of substances: such as increase in pressure lowers the melting point) Boiling point(increased pressure increases the boiling point) 	<ul style="list-style-type: none"> • Experimenting the boiling and melting points of matters • Collecting the data on temperature and time interval 	<ul style="list-style-type: none"> • Cooperating in group activities • Asking questions for more understanding

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.3.5.6 Investigate effects of impurities on the melting and boiling Points of substances</p> <p>11.3.3.7 Demonstrate the effect of varying pressure on volume of a gas</p>	<ul style="list-style-type: none"> • Effects of impurities on the melting and boiling points of substances: such as Impurities lower the melting point and increase the boiling point of a substance • Boyles law: use of equation $PV = a \text{ constant}$ at constant pressure 	<ul style="list-style-type: none"> • Investigating the effect of impurities on melting and boiling points • Organising and analysing the data on graphs 	<ul style="list-style-type: none"> • Asking questions for more understanding • Being aware of the effects of pressure on boiling and melting points
		<p>11.3.3.8 Describe the relationship between temperature and volume of a gas</p> <p>11.3.3.9 Explain the Kelvin scale from the relationship between temperature and volume.</p>	<ul style="list-style-type: none"> • Charles law: as temperature against volume of a gas $V_1/T_1 = V_2/T_2$ • Kelvin Scale; volume-temperature change (constant pressure) Graphical extrapolation 	<ul style="list-style-type: none"> • Organising data in the tables to verify the gas laws 	<ul style="list-style-type: none"> • Participating in groups discussion • Asking more questions for more understanding • Applying the use of graphs to relate variables

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.3.10 Demonstrate the use of the ideal gas equation to solve simple numerical problems.	<ul style="list-style-type: none"> The ideal gas equation ($P_1V_1/T_1 = P_2V_2/T_2$) and numerical problems 	<ul style="list-style-type: none"> Calculating the numerical problems based on gas laws 	<ul style="list-style-type: none"> Appreciating the use the equation $PV/T = \text{constant}$
	11.3.5 Heat transfer by Conduction, Convection and Radiation.	<p>11.3.5.1 Explain methods of heat transfer.</p> <p>11.3.5.2 Use kinetic theory to explain heat transfer.</p> <p>11.3.5.3 Demonstrate heat conduction in different substances.</p> <p>11.3.5.4 Demonstrate the uses of bad and good conductors of heat.</p> <p>11.3.5.5 Demonstrate convection in liquids and gases.</p>	<ul style="list-style-type: none"> Heat transfer methods :Conduction, convection and radiation Relationship between kinetic theory and heat transfer Heat conduction in different substances Uses of conductors Good conductors; pans, kettle, pots etc. Bad conductors; plastic handles, wooden handles etc. Heat transfer in fluids through Convection current 	<ul style="list-style-type: none"> Verifying the methods of heat transfer by experimentation Identifying the relationship between kinetic theory to heat transfer 	<ul style="list-style-type: none"> Participating in group activities during experiments. Being aware of the different methods of heat transfer

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.5.6 Demonstrate the differences between bad and good absorbers of radiant energy	<ul style="list-style-type: none"> • Differences between good and bad absorbers of heat: e.g. shiny(white or silver) and dull(black surfaces 	<ul style="list-style-type: none"> • Communicating uses of bad and good conductors in everyday life • Observing heat transfer in fluids 	<ul style="list-style-type: none"> • Cooperating in group activities • Asking questions for more understanding • Appreciating the knowledge about good and bad emitters
		11.3.5.7 Demonstrate the differences between good and bad heat emitters.	<ul style="list-style-type: none"> • Differences between good and bad emitters of heat such as shining (white or silver) and dull (black surfaces 	<ul style="list-style-type: none"> • Experimenting good and bad absorbers of radiant heat • Inferring good and bad emitters of heat. 	
		11.3.5.8 Explain every day's applications of knowledge on conduction, convection and radiation.	<ul style="list-style-type: none"> • Application of knowledge on the processes of heat transfer: e.g. thermos flask, electric kettle ,land and sea breeze, greenhouse effect 	<ul style="list-style-type: none"> • Investigating the daily applications of the methods of heat transfer 	<ul style="list-style-type: none"> • Appreciating the knowledge about heat transfer and its application

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.4 WAVE MOTION	11.4.1 Simple ideas of the Wave Motion Theory.	11.4.1.1 Demonstrate wave motion.	<ul style="list-style-type: none"> Wave motion: e.g. vibrations in ropes, Springs Different types of waves: Transverse(water and light waves) and Longitudinal(sound waves)in terms of direction of oscillation Scientific terms: Amplitude (A), period(T),frequency (f), wavelength (λ) and wave front 	<ul style="list-style-type: none"> Designing experiments to demonstrate wave motion by using ropes, strings Communicating terms associated with waves 	<ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activities Being aware of the terms associated with wave motion
		11.4.1.2 Distinguish between longitudinal and transverse waves.			
		11.4.1.3 Describe the terms associated with waves	11.4.1.4 Apply the wave equation in solving wave motion problems	<ul style="list-style-type: none"> The wave equation: Displacement-time and displacement – distance graphs of a wave. (Use the equation $v = f\lambda$.) Use of waves in our daily life: radio, television, ultrasonic etc. 	<ul style="list-style-type: none"> Calculating numerical problems using the formula “$v = f\lambda$” Communicating knowledge on the daily application of waves
		11.4.1.5 Explain the use of waves in everyday life.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT			
			KNOWLEDGE	SKILLS	VALUES	
	11.4.3 Electromagnetic Spectrum	11.4.3.1 Describe main components of electromagnetic spectrum.	<ul style="list-style-type: none"> • Main components of electromagnetic spectrum: such as Gamma, X-rays, ultra violet, visible light, infrared, microwaves and radio waves • Properties of electromagnetic waves: e.g. transverse in nature, same speed in vacuum (approximately, $c = 3.0 \times 10^8$ m/s) etc. 	<ul style="list-style-type: none"> • Communicating all components of electromagnetic spectrum • Communicating properties of electromagnetic spectrum 	<ul style="list-style-type: none"> • Being aware of the components of electromagnetic waves and their properties. 	
		11.4.3.2 Describe the properties of electromagnetic waves				
		11.4.3.3 Identify the sources of each of the rays in the electromagnetic spectrum.	<ul style="list-style-type: none"> • Sources of Components of electromagnetic spectrum: e.g. sun radioactive materials, oscillating electrical circuit etc. 	<ul style="list-style-type: none"> • Analysing the sources of each of the electromagnetic rays waves 		<ul style="list-style-type: none"> • Appreciating the knowledge about the existence of electromagnetic radiation.
		11.4.3.4 Describe the method of detection of each of the main components of the electromagnetic spectrum.	<ul style="list-style-type: none"> • The method for detecting electromagnetic radiation 	<ul style="list-style-type: none"> • Communicating knowledge on how to detect the rays 		<ul style="list-style-type: none"> • Cooperating in group activities • Participating in groups actively

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.4.3.5 Explain the use of each of the waves in the electromagnetic radiation spectrum.</p> <p>11.4.3.6 Explain the harmful effects of ultra violet radiation, gamma rays and x-rays to life.</p>	<ul style="list-style-type: none"> • Uses of electromagnetic waves • Harmful effects of electromagnetic waves e.g. skin cancer etc. 	<ul style="list-style-type: none"> • Communicating the uses of electromagnetic waves • Investigating the harmful effects radiation 	<ul style="list-style-type: none"> • Appreciating the knowledge about the existence of electromagnetic radiation. • Cooperating in group activities • Participating in groups actively
11.5 SOUND	11.5.1 Properties of Sound	<p>11.5.1.1 Explain how sound is produced.</p> <p>11.5.1.2 Describe what rarefactions and compressions are.</p> <p>11.5.1.3 Describe the approximate range of audible frequencies.</p> <p>11.5.1.4 Investigate that sounds requires a medium for transmission.</p>	<ul style="list-style-type: none"> • Production of sound using vibrating objects • Sound wave essentials: rarefactions (“stretches”) and compressions (“Squashes”) • Range of audible sound frequencies (20Hz to 20000Hz) • Effects of sound waves traveling through air and a vacuum 	<ul style="list-style-type: none"> • Experimenting on sound production • Communicating knowledge about wave motion • Designing experiment that sound requires a medium for its propagation through experimentation 	<ul style="list-style-type: none"> • Cooperating in group activities • Participating in groups actively • Asking questions for more understanding

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.5 Determine the speed of sound in air. 11.5.1.6 Describe the relative speed of sound in solid, liquid and gas. 11.5.1.7 Demonstrate the characteristics of sound waves.	<ul style="list-style-type: none"> • Speed of sound in air (approximately 330m/s) • Respective speeds of sound in solids, liquids and gases • The characteristics of sound waves: Loudness of sound and its amplitude Pitch of sound and its frequency 	<ul style="list-style-type: none"> • Communicating knowledge about the speeds of sound in different medium. 	<ul style="list-style-type: none"> • Being aware of the fact that sound travels at different speeds in different media • Giving presentation • Listening to others with respect
		11.5.1.8 Describe the factors which influence the quality of sound 11.5.1.9 Describe what ultrasonic is 11.5.1.10 Describe the uses of ultrasonic.	<ul style="list-style-type: none"> • Factors which influence the quality of sound: such as overtones or wave form of a note • Ultrasonic: as fundamental frequency of Sounds above human hearing range • Uses of ultrasonic: cleaning, quality control, pre-natal scanning etc. 	<ul style="list-style-type: none"> • Identifying factors that influence the quality of sound • Communicating the uses of ultrasonic 	<ul style="list-style-type: none"> • Appreciating uses of ultrasonic • Listening to others with respect

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.11 State how to minimise sound pollution	<ul style="list-style-type: none"> Measures to minimize sound pollution: such as sound proof structures 	<ul style="list-style-type: none"> Investigating measures to minimize sound pollution 	<ul style="list-style-type: none"> Being aware of the fact that sound can pollute the environment
11.6 LIGHT	11.6.1 Rectilinear Propagation of Light	<p>11.6.1.1 Describe the rectilinear propagation of light.</p> <p>11.6.1.2 Investigate the formation of shadows and eclipse.</p> <p>11.6.1.3 Describe reflection of light.</p> <p>11.6.1.4 Investigate the laws of reflection of light</p>	<ul style="list-style-type: none"> The nature of light: Straight line propagation of light Formation of shadows(umbra, penumbra) and eclipses(earth in umbra and penumbra) Reflection of light on smooth and rough surfaces: as being regular and diffuse Laws of reflection: as angle of incidence = angle of reflection and incident ray, reflected ray and the normal all lie in the same plane. 	<ul style="list-style-type: none"> Experimenting the nature of light (light travels in a straight line) Predicting the formation of shadows and eclipse Experimenting the laws of reflection 	<ul style="list-style-type: none"> Appreciating the existence of light Cooperating in group activities Asking questions for more understanding Giving presentation Listening to others with respect

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.6.1.5 Demonstrate the formation of images by plane mirrors.</p> <p>11.6.1.6 Identify the position of an image using plane mirrors.</p>	<ul style="list-style-type: none"> Image in a plane mirror (virtual, laterally inverted ,position, position and size) The position of an image: through Construction of ray diagrams 	<ul style="list-style-type: none"> Investigating the characteristics of an image formed by plane mirrors using ray diagrams 	<ul style="list-style-type: none"> Appreciating image formed by plane mirror
	11.6.2 Refraction of Light	<p>11.6.2.1 Describe what refraction of light is</p> <p>11.6.2.2 Explain the terms of refraction of light</p> <p>11.6.2.3 Verify the laws of refraction of light.</p> <p>11.6.2.4 Describe what refractive index is.</p>	<ul style="list-style-type: none"> Refraction of light: as Bending of light rays after passing through different media Incident ray, refracted ray ,normal ray and emergent ray) Laws of refraction: as The ratio $\frac{\sin I}{\sin r}$ is a constant value(snells law) The incident ray ,the normal, and the refracted ray all lie in the same plane Refractive index: as Measure of bending of light 	<ul style="list-style-type: none"> Experimenting the refraction of light Collecting data on the laws of refraction Calculating the refractive index 	<ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activities Participating in group activities actively Applying the knowledge of refraction in daily life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.5 Investigate the refractive index of a glass block. 11.6.2.6 Calculate refractive index of a substance (n) using real and apparent depth. 11.6.2.7 Explain the term ‘critical angle’.	<ul style="list-style-type: none"> Refractive index of glass Using the formula; refractive index of substance = real depth/apparent depth” Critical angle: as angle of incidence at which the angle of refraction is 90° 	<ul style="list-style-type: none"> Comparing the refractive index to critical angle 	<ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activities Participating in group activities actively Applying the knowledge of refraction in daily life
		11.6.2.8 Describe the relationship between critical angle and refractive index 11.6.2.9 Explain how total internal reflection occurs.	<ul style="list-style-type: none"> The relationship between critical angle and refractive index: $n = \sin 90^\circ / \sin c$, Angle of incidence greater than critical angle Internal reflection: all the light reflected inside the more denser medium 	<ul style="list-style-type: none"> Communicating the relationship between Critical angle and refractive index 	<ul style="list-style-type: none"> Cooperating in group activities Participating in group activities actively

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.10 Explain how total internal reflection is used.	<ul style="list-style-type: none"> • Use of internal reflection: optic fibre for communication 	<ul style="list-style-type: none"> • Observing the total internal reflection 	<ul style="list-style-type: none"> • Appreciating use of fibre glass
	11.6. 3 Lenses.	11.6.3.1 Describe different types of lenses. 11.6.3.2 Explain the action of lenses on beams of light. 11.6.3.3 Demonstrate how to determine the focal length, 11.6.3.4 Demonstrate how to obtain images formed by converging lenses 11.6.3.5 Describe the uses of lenses in everyday life.	<ul style="list-style-type: none"> • Types of lenses; Convex(thin converging) and concave (diverging) • Types of rays: Converge and diverge rays of light • Focal length: NB: use of formula: “$1/f = 1/u + 1/v$” • Characteristics of image: in terms of the position, size and nature of images formed by converging lenses. magnification=v/u” • Use of lens: in correcting defects in vision: short sight-concave lens, long sight-convex lens, LCD, Camera etc. 	<ul style="list-style-type: none"> • Communicating different types of lenses • Experimenting to find out what happens to light when passed through lenses. • Inferring the focal length • Predicting the images formed by converging lenses • Investigating the uses of lenses 	<ul style="list-style-type: none"> • Asking questions for more understanding • Cooperating in group activities • Participating in group activities actively • Giving presentation of group activity • Listening to others with respect • Accept responsibility of group work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.7 MAGNETISM	11.7.1 Simple phenomenon of magnetism.	11.7.1.1 Describe properties of magnets	<ul style="list-style-type: none"> • Fundamental properties of magnet: such as repulsion, attraction direction N-S, pole, etc. • Domain theory of magnetism • Induced magnetism: Transfer of magnetic properties without contact 	<ul style="list-style-type: none"> • Communicating knowledge on magnetism theory • Investigating induced magnetism 	<ul style="list-style-type: none"> • Cooperating in group activities • Asking questions for more understanding • Participating in group activities actively
		11.7.1.2 Explain the domain theory of magnetism			
		11.7.1.4 Demonstrate the making of a magnet	<ul style="list-style-type: none"> • Magnetisation: using stroking and electrical method • Demagnetisation: using methods such as Electrical method, hammering, heating etc. • Magnetic field lines: Use of Magnetic compass to plot field lines. • Magnetic properties of Iron (susceptible) and steel (retentive). 	<ul style="list-style-type: none"> • Demonstrating on the making on magnets • Experimenting on the plotting of magnetic field • Differentiating between magnetic and non-magnetic materials 	<ul style="list-style-type: none"> • Cooperating in group activities • Asking questions for more understanding • Participating in group activities actively
		11.7.1.5 Demonstrate the demagnetisation of a magnet			
		11.7.1.6 Demonstrate the plotting of magnetic field lines.			
		11.7.1.7 Distinguish the magnetic properties of iron and steel.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.7.1.8 Explain the use of magnetic screening and magnetic keepers.</p> <p>11.7.1.9 Describe the uses of magnets.</p>	<ul style="list-style-type: none"> • The use of magnetic screening and magnetic keepers : Magnetic screening (shielding equipment) and magnetic keepers.(prevent loss of magnetic strength) • Use of magnets in our life: circuit breakers, speakers ,electromagnets 	<ul style="list-style-type: none"> • <i>Experimenting</i> on magnetisation and demagnetisation • <i>Observing</i> magnetic field lines using a compass and/ or iron filings • <i>Formulating</i> the pattern of magnetic field lines 	<ul style="list-style-type: none"> • <i>Applying</i> the use of magnets in everyday life • <i>Appreciating</i> the uses of magnets

GRADE 12

General Outcomes:

- Demonstrate an understanding about Static electricity
- Develop investigative skills
- Demonstrate an understanding of Current Electricity
- Demonstrate an understanding about electromagnetic induction
- Demonstrate an understanding of basic electronics
- Demonstrate an understanding about atomic physics

Key competences

- Demonstrate ability to measure current and voltage
- Show skills and knowledge to dispose cells and battery
- Demonstrate ability to save electricity
- Demonstrate ability to cost use of electricity

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.8 STATIC ELECTRICITY	12.8.1 Static Electricity	12.8.1.1 Demonstrate the existence of static charges 12.8.1.2 Explain how to detect electric charges.	<ul style="list-style-type: none"> • Existence of static charge: Positive and negative charges • Detection of charge: charging by contact, testing the sign of charge using gold - leaf electroscope etc. • Properties and uses of static charges: -Properties; like charges repel, unlike charges attract (Law of electrostatics) -Uses: dust precipitators, ink jet printers, photocopiers. 	<ul style="list-style-type: none"> • Experimenting the existence of charges by rubbing some materials • Detecting charge using an electroscope • Communicating properties and uses of static charge 	<ul style="list-style-type: none"> • Cooperating in group activities • Asking questions for more understanding • Participating in groups actively • Applying the safety rules of experiment
		12.8.1.4 Describe the electric charging and discharging of objects. 12.8.1.5 Explain the relationship between current and static electricity.	<ul style="list-style-type: none"> • Electric charging and discharging of objects by friction and induction • Relationship between current and static electricity in terms of effects as static electricity produces same effect as current electricity. 	<ul style="list-style-type: none"> • Experimenting charging and discharging of objects • Communicating knowledge on the relationship between current and static electricity 	<ul style="list-style-type: none"> • Asking questions for more understanding • Participating in groups actively • Knowing the safe rules of experiment

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.8.1.6 Investigate effects of static charges on the environment.	<ul style="list-style-type: none"> Effects of static charges on an environment: e.g. lightning etc 	<ul style="list-style-type: none"> Investigating the effects of static charges on the environment e.g. lightning 	<ul style="list-style-type: none"> Being aware of the effects of charges
12.9 CURRENT ELECTRICITY	12.9.1 Electric charge, current, and potential difference.	<p>12.9.1.1 Describe the terms associated with electricity</p> <p>12.9.1.2 Identify the units of electric charge and current.</p> <p>12.9.1.3 Demonstrate how to measure an electric current.</p> <p>12.9.1.4 Describe what potential difference is.</p> <p>12.9.1.5 Describe what the volt is.</p> <p>12.9.1.6 Differentiate between potential difference (PD) and electromotive force (EMF)</p>	<ul style="list-style-type: none"> Scientific Terms: such as Electric charge, potential difference and electric current Units of electric charge and current: as Coulomb and ampere ($I = Q/t$) Measure an electric current in the circuit: Ammeter Potential difference: as energy required to move a unit charge between two points in a circuit Volt: as joules per coulomb Difference between PD and EMF in terms of work done per unit of charge in driving charge in a circuit and through a component 	<ul style="list-style-type: none"> Measuring an electric current using an ammeter. Communicating the SI units for voltage Communicating the concept of the energy dissipated Measuring potential difference using a voltmeter 	<ul style="list-style-type: none"> Participating in groups actively Cooperating in group work Appreciating the use of electrical appliance Appreciating the safety rules during an experiments

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.1.7 Describe the basic concept of EMF. 12.9.1.8 Demonstrate the measuring of potential difference (PD) and electromotive force (EMF).	<ul style="list-style-type: none"> The maximum PD of a cell Measurement of PD and EMF: Connecting terminals across source of electric current /conductor 	<ul style="list-style-type: none"> Communicating basic concept of EMF Experimenting on measurement of PD 	<ul style="list-style-type: none"> Appreciating the safety rules during an experiments
	12.9.2 Electric cells.	12.9.2.1 Describe the structure of primary and secondary cells. 12.9.2.2 Demonstrate charging and discharging of the accumulator. 12.9.2.3 Identify methods of disposal of used cells	<ul style="list-style-type: none"> Structure of primary and secondary cells: Primary cells(dry cell), Secondary (lead acid accumulator) How to charge and discharge the accumulator: Charging when current is passed a in opposite direction to current supplies, discharging when in use (acid accumulator) Appropriate methods of disposing used cells. 	<ul style="list-style-type: none"> Communicating the structure of cells Investigating charging and discharging an acid accumulator Communicating appropriate methods of disposing off used cells 	<ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activities Participating in group activities actively Applying the knowledge of disposal of cells in dairy life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.3 Electrical resistance.	12.9.3.1 Explain the meaning of resistance	<ul style="list-style-type: none"> Resistance: opposition to the flow of charge Value of resistance in series and parallel (use formula $1/R = 1/R_1 + 1/R_2$) Relationship between current and potential difference: (Graph of p.d. against current for Ohmic and non-Ohmic conductors) 	<ul style="list-style-type: none"> Measuring the current and potential difference, using a voltmeter and an ammeter Collecting data for an experiment Organizing data in tables and their graphs on ohmic and non ohmic conductor Formulating the patterns in data 	<ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activities Participating in group activities actively Knowing the safe rules of an experiment
		12.9.3.2 Demonstrate how to determine resistance in a simple circuit. 12.9.3.3 Describe the relationship between current and potential difference in Ohmic and non Ohmic conductors.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.4 Heating effect of an electric current.	12.9.4.1 Demonstrate energy transformations in an electric circuit.	<ul style="list-style-type: none"> • Conversion of energy from electricity to heat. • Heating effect of an electric current in heating appliances. • Calculations of electrical energy: Use of formula ($E=VIt$, etc.) 	<ul style="list-style-type: none"> • Analysing energy changes from one form to the other • Investigating the heating effect of an electric current 	<ul style="list-style-type: none"> • Cooperating in group activities • Participating in group activities actively
		12.9.4.2 Investigate the heating effect of an electric current.			
		12.9.4.4 Describe the relationship of voltage, current and power.	<ul style="list-style-type: none"> • The relationship of voltage, current and power: $\text{Power}=\text{voltage} \times \text{current} (P=VI)$ • Cost of using electrical energy: use of kWh as a unit of electrical energy • Electrical components: e.g. switches (on /off power), fuses(Prevent appliances from damage), and the three pin-plugs (connecting appliance). 	<ul style="list-style-type: none"> • Calculating electrical energy using $E=VIt$ • Communicating relationship among power, voltage and current 	<ul style="list-style-type: none"> • Appreciating the use of electricity at home • Applying the safety precautions in the use of electricity Appreciating the use of energy saving bulbs
		12.9.4.5 Demonstrate how to calculate the cost of using electrical Energy			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.4.7 Explain the need for earthing metal cases and for double Insulation. 12.9.4.8 Describe the meaning of three wires found in the cable	<ul style="list-style-type: none"> • Safety precautions (prevent electric shocks, accidents) • Three types of Wires: Live (brown), earthing (green and yellow) and neutral (blue) 	<ul style="list-style-type: none"> • Investigating the safety precautions • Communicating the colouring of insulator 	<ul style="list-style-type: none"> • Asking questions for more understanding • Cooperating in group activities
		12.9.4.9 Describe the domestic electrical wiring system 12.9.4.10 Describe ways of conserving electrical energy in homes and industry.	<ul style="list-style-type: none"> • Household circuits: such as cooker circuit, ring circuit, lighting circuit • Ways of conserving electrical energy: using energy saving bulbs, switch and save etc. 	<ul style="list-style-type: none"> • Investigating the basic wiring system in a house • Communicating ways of conserving energy 	<ul style="list-style-type: none"> • Appreciating the use of electricity at home • Applying the safety precautions in the use of electricity

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.5 Magnetic effects of electric currents.	12.9.5.1 Explain magnetic field patterns of electric currents.	<ul style="list-style-type: none"> • Lines of force (Magnetic flux) : patterns of electric currents 	<ul style="list-style-type: none"> • <i>Experimenting</i> the magnetic field patterns of electric currents 	<ul style="list-style-type: none"> • <i>Asking</i> questions for more understanding
		12.9.5.2 Describe the applications of the magnetic effect of an electric current.	<ul style="list-style-type: none"> • Applications of electromagnets: electric bells relay switches etc. 	<ul style="list-style-type: none"> • <i>Communicating</i> use of electromagnets 	<ul style="list-style-type: none"> • <i>Cooperating</i> in group activities
		12.9.5.3 Explain the behaviour of an electric current in a magnetic field.	<ul style="list-style-type: none"> • The behaviour of an electric current in a magnetic field: Displacement of current carrying wire current or electron beam 	<ul style="list-style-type: none"> • <i>Investigating</i> the displacement of a current carrying wire in a field 	<ul style="list-style-type: none"> • <i>Asking</i> questions for more understanding
		12.9.5.4 Describe the application of a current placed in a magnetic field.	<ul style="list-style-type: none"> • Applications of current in a magnetic field: e.g. D.C. motors, galvanometers, ammeter etc. 	<ul style="list-style-type: none"> • <i>Inferring</i> the attraction and repulsion of forces between parallel currents 	<ul style="list-style-type: none"> • <i>Cooperating</i> in group activities
		12.9.5.5 Describe the nature of forces between parallel currents.	<ul style="list-style-type: none"> • Nature of forces: attraction and repulsion of forces between parallel currents. 	<ul style="list-style-type: none"> • <i>Investigating</i> the effects of magnetic fields 	<ul style="list-style-type: none"> • <i>Participating</i> in group activities actively
		12.9.5.6 Describe the effect of magnetic fields on human health and environment.	<ul style="list-style-type: none"> • Effects of magnetic fields: hearing impairment, radar interference in communication etc 		<ul style="list-style-type: none"> • <i>Applying</i> the effects of magnetic field

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.10 ELECTROMAGNETIC INDUCTION	12.10.1 The phenomenon of electromagnetic induction.	12.10.1.1 Investigate the phenomenon of electromagnetic induction.	<ul style="list-style-type: none"> • Electromagnetic induction: (induced EMF / current in a wire moving cutting magnetic flux) Faraday's law • Factors affecting magnitude and direction of induced EMF: speed of either magnet or coil, strength of magnet, number of turns of a coil 	<ul style="list-style-type: none"> • Experimenting the induction of an EMF/current using a magnet, a coil and ammeter • Collecting data • Organising the data in a table • Analysing the factors that affect the magnitude of the induced current/EMF 	<ul style="list-style-type: none"> • Asking questions for more understanding • Cooperating in group activities • Participating in group activities actively • Knowing the safe rules of experiment
		12.10.1.2 Describe the factors affecting magnitude and direction of induced EMF.	<ul style="list-style-type: none"> • Direction of induced current: Lenz and Fleming right hand law. 		
		12.10.1.3 State the direction of current produced by an induced EMF.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.2 The simple A.C. and D.C. generators.	12.10.2.1 Describe simple A.C. and D.C. generators.	<ul style="list-style-type: none"> Generators: simple A.C. generator (an alternator with slip-rings) and simple D.C. dynamo with a commutator 	<ul style="list-style-type: none"> Communicating A.C. and D.C. generators 	<ul style="list-style-type: none"> Cooperating in group activities
		12.10.2.2 Compare the simple A.A. generator with a simple D.C. generator in terms of structure and its nature.	<ul style="list-style-type: none"> Structure and its nature of simple A.C and D.C generators 	<ul style="list-style-type: none"> Comparing the structure and nature of an A.C. and D.C. generators 	<ul style="list-style-type: none"> Participating in group activities actively Appreciating the use of the generators and batteries
		12.10.2.3 Describe the action of a diode in rectification.	<ul style="list-style-type: none"> Action of diodes: change A.C. to D.C. by allowing current to flow in one way 	<ul style="list-style-type: none"> Communicating rectification of alternating current using diodes 	<ul style="list-style-type: none"> Cooperating in group activities
		12.10.2.4 Explain conversion of an A.C. generator to a D.C. generator.	<ul style="list-style-type: none"> Conversion of A.C. generator to D.C. generator by use of commutator 	<ul style="list-style-type: none"> Comparing the direction of current produced by a D.C. generator to the one produced from batteries 	<ul style="list-style-type: none"> Participating in group activities actively
		12.10.2.5 Contrast the current produced by the D.C. generator with that produced from batteries.	<ul style="list-style-type: none"> The direction of Current from D.C generator(varies) and from batteries(constant) 		<ul style="list-style-type: none"> Appreciating the use of the generators and batteries

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.3 Transformers.	12.10.3.1 Demonstrate the principles of mutual induction.	<ul style="list-style-type: none"> Principles of mutual induction: changing current in one coil gives rise to current in the other The structure : primary (in- put) and secondary(output) coils Operation: changing of AC voltages 	<ul style="list-style-type: none"> Designing investigations to verify mutual induction Communicating step up and step down transformers 	<ul style="list-style-type: none"> Participating in group activities actively
		12.10.3.2 Describe the structure and operation of iron core transformers.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>12.10.3.4 Calculate the efficiency of a transformer given data.</p> <p>12.10.3.5 Explain advantages of high alternating potential difference power transmission.</p> <p>12.10.3.6 Describe the implications of underground power transmission compared to overhead lines.</p> <p>12.10.3.7 Describe the effects of improper management of transformers</p>	<ul style="list-style-type: none"> • Calculation of efficiency: [Efficiency = $(V_s I_s)/(V_p I_p) \times 100\%$] • Advantage of high alternating potential difference power transmission: as in reducing power losses in cables. • Environmental and cost implications of underground power transmission • Effects of improper management of Transformers such as overheating, low/high voltage 	<ul style="list-style-type: none"> • Calculating the efficiency of a transformer • Communicating knowledge on the environmental and cost implications of underground power transmission 	<ul style="list-style-type: none"> • Asking questions for more understanding • Cooperating in group activities • Participating in group activities actively • Appreciating the use of the formula • Being aware of the environmental and cost implications of underground power transmission

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.11 BASIC ELECTRONICS	12.11.1 Thermionic emission and electrons.	12.11.1.1 Describe What thermionic emission is	<ul style="list-style-type: none"> • Thermionic emission: release of electrons from a heated cathode • Properties of cathode rays: e.g. Deflected by electric and magnetic fields travel in straight in lines etc. 	<ul style="list-style-type: none"> • <i>Investigating</i> properties of cathode rays by using a CRO 	<ul style="list-style-type: none"> • <i>Asking</i> questions for more understanding • <i>Cooperating</i> in group activities • <i>Participating</i> in group activities actively
		12.11.1.2 Investigate properties of cathode rays 12.11.1.3 Distinguish between direction of flow of electrons and flow of conventional current. 12.11.1.4 Describe applications of electron beams.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.1.5 Describe the basic structure and an action of cathode-ray oscilloscope. 12.11.1.6 Describe the uses of cathode-ray oscilloscope.	<ul style="list-style-type: none"> • Basic structure and action of CRO: electron gun, Control grid, anode Y-plates ,X-plates, fluorescent screen • Uses of CRO: e.g. measuring(peak voltage, time, frequency),TV etc 	<ul style="list-style-type: none"> • Communicating the devices that make use of electron beams in their operation • Investigating the basic structure of a CRO. • Measuring quantities using a CRO 	<ul style="list-style-type: none"> • Appreciating the use of the cathode rays in specific devices • Being aware of the structure of a CRO
12.12. ATOMIC PHYSICS	12.12.1 Nuclear atom	12.12.1.1 Describe the structure of the atom. 12.12.1.2 Describe the composition of the nucleus in terms of protons and neutrons. 12.12.1.3 Explain mass number and atomic number.	<ul style="list-style-type: none"> • Atomic structure (nucleus and electrons) • Composition of the nucleus (protons and neutrons) • Mass number and Atomic number: mass (Nucleon) number, A, and atomic (proton), number, Z. 	<ul style="list-style-type: none"> • Communicating an atomic structure • Communicating knowledge on the existence of protons and neutrons in the nucleus of an atom 	<ul style="list-style-type: none"> • Appreciating the use of a CRO in measuring some quantities • Asking questions for more understanding • Cooperating in group activities

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.2 Radioactivity.	12.12.2.1 Describe the nature of radioactivity.	<ul style="list-style-type: none"> • Nature of radioactivity (randomness and spontaneity) • Characteristics of three kinds of radioactive radiations: Alpha (α), Beta (β) and Gamma (γ) radiations in terms of penetration, ionization, deflection, charge, relative mass and nature of particles) 	<ul style="list-style-type: none"> • <i>Investigating</i> the nature of radioactivity • <i>Investigating</i> radiation using a G.M counter 	<ul style="list-style-type: none"> • <i>Asking</i> questions for more understanding • <i>Cooperating</i> in group activities
		12.12.2.2 Describe the characteristics of the three kinds of radioactive radiations: alpha, beta and gamma.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>12.12.2.5 Describe what radioactive decay is.</p> <p>12.12.2.6 Describe what nuclear fusion and fission is.</p>	<ul style="list-style-type: none"> • Radioactive decay as disintegration of nucleus by alpha, beta and gamma emissions. • Nuclear fusion and fission: Nuclear fusion as process of joining very light nuclei together and fission as splitting process of nucleus 	<ul style="list-style-type: none"> • Comparing nuclear fission to nuclear fusion 	<ul style="list-style-type: none"> • Awareness of radioactive substances
		<p>12.12.2.7 Demonstrate how to determine half-life of a radioactive material.</p> <p>12.12.2.8 Explain uses of radioactive substances.</p>	<ul style="list-style-type: none"> • Half life of a radioactive material: Time taken for activity to reduce by half of the original substance (Decay curves) • Uses of radioactive substances: e.g. medical, industrial, agricultural uses 	<ul style="list-style-type: none"> • Calculating half life of a radioactive material by using decay curves • Communicating the uses of radioactive substances 	<ul style="list-style-type: none"> • Communicating knowledge on safety precautions • Appreciating the use of decay curves to determine half life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.2.9 Describe the safety precautions necessary when handling or storing radioactive substances.	<ul style="list-style-type: none"> • Use of protective materials: such as gloves, goggles, overalls and lead shields 	<ul style="list-style-type: none"> • Demonstrating safety precautions when handling dangerous chemicals 	<ul style="list-style-type: none"> • Applying safety precautions when dealing with radioactive substances
		<p>12.12.2.10. Explain the effects of radioactive substances on the environment and health.</p> <p>12.12.2.11. Investigate management practices which safeguard the environment from radioactive contamination.</p>	<ul style="list-style-type: none"> • Effect of radioactive substances: such as radiation pollution and health hazards • Appropriate management safe guard practices 	<ul style="list-style-type: none"> • Investigating management practices which safeguard the environment from radioactive contamination 	<ul style="list-style-type: none"> • Participating in group activities actively • Applying safety precautions when dealing with radioactive substances

SECTION B: CHEMISTRY

GRADE 10

General Outcomes:

- Develop an understanding of Chemistry and its branches
- Develop investigative skills about Chemistry
- Demonstrate an understanding of the particulate nature of matter
- Develop investigative skills about states of matter
- Demonstrate an understanding of Experimental Techniques and its application in everyday life
- Develop investigative skills in experimental techniques
- Demonstrate an understanding of atoms, elements, molecules and compounds.
- Develop investigative skills about the nature of substances.
- Demonstrate an understanding of the importance, production, use, and effect on the environment of common elements and simple compounds

Key competences

- Demonstrate the ability to measure time ,temperature, mass and volume
- Show basic skills and knowledge in constructing balanced chemical equations with state symbols
- Demonstrate investigative skills in experimental techniques

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1 INTRODUCTION TO CHEMISTRY	10.1.1 Introduction to Chemistry	10.1.1.1 Describe Chemistry.	<ul style="list-style-type: none"> The study of matter and their chemical changes Branches such as: Analytical, Biochemistry, Inorganic, Physical and Organic 	<ul style="list-style-type: none"> <i>Classifying</i> of chemistry into its branches <i>Identifying</i> different branches of chemistry 	<ul style="list-style-type: none"> <i>Asking</i> questions for more understanding <i>Awareness</i> of chemistry branches
		10.1.1.2 Classify the branches of chemistry			
		10.1.1.4 Describe the challenges of chemical industrial activities	<ul style="list-style-type: none"> Safety rules in the lab 		
		10.1.1.5 Demonstrate an appreciation of safety in the laboratory.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.2 THE PARTICULATE NATURE OF MATTER	10.2.1 Matter and the Kinetic theory	10.2.1.1 Describe matter	<ul style="list-style-type: none"> Anything that has mass and occupies space Atoms ,molecules ,ions Kinetic theory: in terms of particle arrangement and movement. Solid, liquid, gas 	<ul style="list-style-type: none"> <i>Classifying</i> the basic units and states of matter 	<ul style="list-style-type: none"> <i>Appreciating</i> the basic units of matter and its existence in three states
		10.2.1.2 Classify the basic units of matter 10.2.1.3 Classify the states of matter.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.2 Diffusion	10.2.2.1 Describe diffusion 10.2.2.2 Demonstrate diffusion in fluids 10.2.2.3 Describe the factors that affect the rate of diffusion	<ul style="list-style-type: none"> • Movement of particles from region of higher concentration to region of lower concentration • Liquids and gases (Brownian motion) • Factors of diffusion E.g. molecular mass, temperature, concentration 	<ul style="list-style-type: none"> • Demonstrating the movement of particles in fluids • Comparing movement of particles in fluids and factors affecting their speed of movement 	<ul style="list-style-type: none"> • Appreciating diffusion • Asking more questions to learn more • Fostering teamwork
10.3 EXPERIMENTAL TECHNIQUES	10.3.1 Measuring of quantities	10.3.1.1 Demonstrate how different quantities are measured. 10.3.1.2 Identify different measuring apparatus used in chemistry. 10.3.1.3 Identify various measuring instrument and other apparatus used in chemistry	<ul style="list-style-type: none"> • Quantities such as time, temperature, mass and volume • Measuring apparatus such as stopwatch or stop clock, thermometers, balances, burettes, pipettes, volumetric flask, measuring cylinder, and gas syringes • Other apparatus: spatula, stands and clamp, test-tubes, burners, , glass rods, evaporating dish, funnel beaker, conical flask etc. 	<ul style="list-style-type: none"> • Demonstrating accurate measurement of values of various quantities • Identifying different measuring apparatus 	<ul style="list-style-type: none"> • Applying safety rules in use of apparatus

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.3.2 Criteria of purity	10.3.2.1 Describe the differences between a pure substance and a mixture	<ul style="list-style-type: none"> • In terms of melting points and boiling points • Sharp melting for pure substance and melting over a range of temperatures for a mixture. 	<ul style="list-style-type: none"> • Differentiating between melting points and boiling points • Demonstrating determination of purity of substances • Comparing pure and impure substances 	<ul style="list-style-type: none"> • Appreciating purity of substances
		10.3.2.2 Demonstrate how to determine the purity of a substance			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.3.3 Separating mixtures	<p>10.3.3.1 Distinguish between physical and chemical changes</p> <p>10.3.3.2 Demonstrate different methods of separating mixtures</p> <p>10.3.3. Interpret simple paper chromatograms.</p>	<ul style="list-style-type: none"> • In terms of mass changes, irreversibility/reversibility, chemical substance formed and energy involved. • Methods such as decantation, filtration, crystallisation, simple and fractional distillation, magnetism, chromatography, evaporation, sublimation, floatation, use of separating funnel and centrifugation • Uses such as R_f values and distances covered by components (restricted to paper chromatography) 	<ul style="list-style-type: none"> • <i>Analysing</i> the components in the mixture • <i>Identifying</i> appropriate methods for separating different mixtures 	<ul style="list-style-type: none"> • <i>Applying</i> separation techniques in everyday life

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.4 ATOMS, ELEMENTS, COMPOUNDS AND MOLECULES	10.4.1 Atomic structure and Periodic Table	10.4.1.1 Describe an atom and its structure.	<ul style="list-style-type: none"> As the smallest particle of an element which takes part in a chemical reaction. Structure: use Bohr model (nucleus at the centre surrounded by electron shells)	<ul style="list-style-type: none"> Communicating atoms, elements molecules and compounds Calculating relative atomic mass 	<ul style="list-style-type: none"> Awareness of the atomic structure
		10.4.1.2 Describe the relative charges and approximate relative masses of protons, neutrons and electrons	<ul style="list-style-type: none"> Charges as: +1, 0, -1 Masses as: 1, 1, 1/1840 		
		10.4.1.3 Describe the proton (atomic) number and nucleon (mass) number and nuclide notation	<ul style="list-style-type: none"> As number of protons: Z, number of nucleons: A (protons + neutrons) and nuclide notation $\frac{A}{Z}X$ 	<ul style="list-style-type: none"> Calculating relative atomic mass 	<ul style="list-style-type: none"> Asking more questions to learn more Fostering teamwork

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.1.4 Describe an element 10.4.1.5 Identify elements using their chemical symbols 10.4.1.6 Describe the basis of the Periodic Table	<ul style="list-style-type: none"> As substance made up of same chemical atoms. Symbols of the elements with atomic number 1 up to 20 and other common elements in the local environment Group determined by valence electrons Period determined by number of shells 	<ul style="list-style-type: none"> Communicating elements and the periodic table 	<ul style="list-style-type: none"> Appreciating elements from the environment
		10.4.1.7 Describe isotopes 10.4.1.8 Calculate relative atomic mass of an element given the % abundances of isotopes and from mass spectrum.	<ul style="list-style-type: none"> As atoms with same number of protons but different numbers of neutrons, including radioactive and non-radioactive isotopes As sum of the products of the percentages and their mass numbers 	<ul style="list-style-type: none"> Calculating relative atomic mass of an element 	<ul style="list-style-type: none"> Asking more questions to learn more Fostering teamwork

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>10.4.1.9 Describe the use of radioactive isotopes</p> <p>10.4.1.10 Demonstrate the build-up of electrons in shells</p>	<ul style="list-style-type: none"> • Such as in medical treatment of cancer, industrial use as tracers • Electronic configuration of atoms (spdf configuration is NOT required) 	<ul style="list-style-type: none"> • Communicating the uses of isotopes 	<ul style="list-style-type: none"> • Awareness of the uses of isotopes
	10.4.2 Bonding	<p>10.4.2.1 Describe a compound</p> <p>10.4.2.2 Describe the formation of ions (radicals).</p> <p>10.4.2.3 Describe the formation of ionic (electrovalent) bonds.</p>	<ul style="list-style-type: none"> • As substance formed from two or more elements chemically combined • Cations by electron loss, anions by electron gain. • Electrovalent bonding as loss and gain of electrons between metallic and non-metallic atoms. Ionic bonds as electrostatic force between cations and anions. Such as NaCl, CaCl₂ and MgO 	<ul style="list-style-type: none"> • Classifying ionic compounds and covalent compounds 	<ul style="list-style-type: none"> • Appreciating the use of ionic compounds and covalent compounds

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.4 Describe the formation of covalent bonds	<ul style="list-style-type: none"> • Covalent bonding as sharing of electrons between non-metallic atoms. Covalent bonds as shared pairs of electrons. Such as H₂, Cl₂, H₂O, NH₃, CH₄, HCl, C₂H₆ • Such as double bonds in O₂, C₂H₄ and CO₂, Triple bond in N₂ and C₂H₂ 	<ul style="list-style-type: none"> • Communicating the formation of covalent bonds • Inferring the arrangements of simple multiple covalent molecules • Demonstrating bond formation using models 	<ul style="list-style-type: none"> • Asking more questions to learn more • Fostering teamwork
		10.4.2.5 Describe the electronic arrangement in simple multiple covalent molecules			
		10.4.2.6 Describe the uses of ionic and covalent compounds	<ul style="list-style-type: none"> • As refractory materials for ionic compounds (CaO) and polar and nonpolar solvents for covalent compounds. • As the smallest particle of an element or compound which exists independently. 	<ul style="list-style-type: none"> • Communicating the uses of ionic and covalent compounds 	<ul style="list-style-type: none"> • Asking more questions to learn more • Fostering teamwork • Appreciating ionic and covalent compounds
		10.4.2.7 Describe a molecule			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.8 Describe valency and valence electrons.	<ul style="list-style-type: none"> Valency as combining power of an atom or radical. Valence electrons as the number of electrons in the outer most shell. 	<ul style="list-style-type: none"> Demonstrating the deducing of valency 	<ul style="list-style-type: none"> Asking more questions to learn more Fostering teamwork
		10.4.2.9 Demonstrate how to deduce valency of an element.	<ul style="list-style-type: none"> From the formula of a compound, ionic charge, valence electrons. 		
		10.4.2.10 Formulate chemical formulae of compounds.	<ul style="list-style-type: none"> Using valency and chemical symbols of elements, charges on ions, models, relative numbers of atoms present, diagrammatic representation 	<ul style="list-style-type: none"> Formulating chemical formulae Differentiating chemical formulae Investigating properties of ionic and covalent compounds 	<ul style="list-style-type: none"> Asking more questions to learn more Fostering teamwork Appreciating ionic and covalent compounds
		10.4.2.11 Identify the differences in properties of ionic and covalent compounds.	<ul style="list-style-type: none"> Differences such as volatility, electrical conductivity, density, melting point, boiling point and basic units. 		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.4.2.12 Describe metallic bonding 10.4.2.13 Describe the electrical and thermal conductivity of metals	<ul style="list-style-type: none"> As lattice of positive ions in a 'sea' of delocalised electrons Due to free electron movement/delocalised electrons 	<ul style="list-style-type: none"> Communicating metallic bonding and thermal conductivity 	<ul style="list-style-type: none"> Asking more questions to learn more
	10.4.5 Chemical formulae and equations	10.4.4.1 Demonstrate how to construct word equations. 10.4.4.2 Formulate and balance chemical equations. 10.4.4.3 Construct net ionic equations from balanced chemical equations.	<ul style="list-style-type: none"> Equation showing reactants and products separated by a full curled arrow (\rightarrow). Number of atoms of each element being equal on both sides of the equation. Balancing can be done by inspection. Equations may include state symbols (s-solid, l – liquid, g – gas, aq – aqueous). Only ionic aqueous reactants/products must be broken down into their respective ions then cancel out spectator ions to come up with net ionic equation. 	<ul style="list-style-type: none"> Demonstrating construction of word equations Formulating balanced chemical and ionic equations. 	<ul style="list-style-type: none"> Appreciating the conservation of matter.

GRADE 11

General Outcomes:

- Demonstrate an understanding of acids, bases and salts.
- Develop investigative skills about acids, bases and salt.
- Demonstrate an understanding of the importance, production, use, and effect on the environment of acids, bases and salts.
- Demonstrate an understanding of the Mole Concept
- Develop investigative skills about quantitative analysis.
- Demonstrate an understanding of chemical reactions and energy changes
- Develop investigative skills about various types of reactions.
- Demonstrate an understanding of the Periodic Table
- Develop investigative skills about the Periodic Table

Key Competences

- Demonstrate the skills and knowledge in relating number of valence electrons to the Group number and the number of shells to the Period.
- Demonstrate skills in classifying salts according to their solubility.
- Demonstrate ability to classify oxides as acidic, basic, neutral and amphoteric.
- Demonstrate ability to use tests in identifying aqueous cations, anions and gases.
- Demonstrate basic skills and knowledge in calculating stoichiometric reacting moles.
- Show ability to identify factors that affect rates of chemical reactions.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.5 ACIDS, BASES AND SALTS	11.5.1 Characteristic properties of acids and bases	11.5.1.1 Describe acids, bases or alkalis in terms of ions they contain or produce in aqueous solution.	<ul style="list-style-type: none"> Acid as compound that produces hydrogen ions as the only positively charged ions in aqueous solutions, Base generally as an oxide or hydroxide of a metal including ammonium hydroxide Alkalis as soluble bases that produce hydroxide ions in aqueous solution as the only negatively charged ions. Strength as degree of ionisation, Concentration as the number of ions per volume of solution. 	<ul style="list-style-type: none"> Identifying acids and bases. Investigating the acidity and alkalinity of substances in everyday life 	<ul style="list-style-type: none"> Applying the uses of acids and bases
		11.5.1.2 Describe the meaning of weak, strong, dilute and concentrated acids and alkalis			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.3 Describe the P ^H scale 11.5.1.4 Describe neutrality, acidity and alkalinity in terms of P ^H value 11.5.1.5 Determine the P ^H value of a solution. 11.5.1.6 Demonstrate the characteristic properties of acids 11.5.1.7 Demonstrate the characteristic properties of bases 11.5.1.8 Illustrate the importance of acid-base reactions	<ul style="list-style-type: none"> As scale ranging from 0 to 14 showing the degree of acidity and alkalinity. The P^H values: 7 for neutrality, below 7 for acidity and above 7 for alkalinity 	<ul style="list-style-type: none"> Identifying acids and bases. Investigating the acidity and alkalinity of substances in everyday life 	<ul style="list-style-type: none"> Applying the uses of acids and bases

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.9 State the uses of acids and bases.	<ul style="list-style-type: none"> Such as control of P^H in agriculture, making of soap, in car batteries 	<ul style="list-style-type: none"> Identifying acids and bases. Investigating the acidity and alkalinity of substances in everyday life 	<ul style="list-style-type: none"> Applying the uses of acids and bases
	11.5.2 Preparation of salts	<p>11.5.2.1 Describe a salt</p> <p>11.5.2.2 Classify salts according to their nature and solubility in water</p> <p>11.5.2.3 Demonstrate the preparation of an insoluble salt.</p> <p>11.5.2.4 Demonstrate the preparation soluble salts.</p>	<ul style="list-style-type: none"> As a compound formed when the hydrogen ions of an acid are fully or partially replaced by a metal or ammonium ions. Or a compound made of positive metallic/ammonium ions and any negative ion of an acid. As acid, basic and normal salts. Solubility rules of salts Using precipitation method and separated by filtration. E.g. Barium sulphate, Silver chloride By reaction of acids with bases, suitable metals and carbonates/bicarbonates. Separated by crystallisation and filtration. E.g. Zinc sulphate, copper (II) sulphate 	<ul style="list-style-type: none"> Classifying of salts Demonstrating the preparation of soluble and insoluble salts Differentiating hydrated and anhydrous salts Experimenting on preparation of salts 	<ul style="list-style-type: none"> Awareness of salts Applying safety rules in preparation of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.5.2.5 Demonstrate the preparation of ammonium, potassium and sodium salts.</p> <p>11.5.2.6 Demonstrate the existence of hydrated salts and differentiate from anhydrous salts</p>	<ul style="list-style-type: none"> Using titration method (use of indicator for ease detection of end point) Hydrated salts as salts containing water of crystallisation. Anhydrous salts as salts not containing water of crystallisation. 	<ul style="list-style-type: none"> Classifying of salts Demonstrating the preparation of soluble and insoluble salts Differentiating hydrated and anhydrous salts Experimenting on preparation of salts 	<ul style="list-style-type: none"> Awareness of salts Applying safety rules in preparation of salts
		11.5.2.7 Describe the behaviour of salts with reference to the atmosphere.	<ul style="list-style-type: none"> As hygroscopic, efflorescent, deliquescent. 	<ul style="list-style-type: none"> Classifying of salts Demonstrating the preparation of soluble and insoluble salts Differentiating hydrated and anhydrous salts Experimenting on the behaviour of salts 	<ul style="list-style-type: none"> Awareness of salts Applying safety rules in preparation of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.6.3 Types of oxides	11.5.3.1 Describe the various types of oxides.	<ul style="list-style-type: none"> Acidic oxides as oxides with acidic properties such as SO₂ and CO₂. Basic oxides as oxides with basic properties such as CaO and MgO. Neutral oxides as oxides with neither acidic nor basic properties such as CO, H₂O. Amphoteric oxides as oxides with both acidic and basic properties ZnO, Al₂O₃ and PbO. 	<ul style="list-style-type: none"> Classifying different types of oxides 	<ul style="list-style-type: none"> Awareness of different types of oxides. Applying acid-base reactions
	11.6.4 Identification of ions and gases (Qualitative analysis)	11.6.4.1 Demonstrate the identity of aqueous cations and anion.	<ul style="list-style-type: none"> Cations being aluminum, ammonium, calcium, copper (II), iron (II), iron (III), and zinc using aqueous sodium hydroxide and aqueous ammonia. Anions being carbonate, chloride, iodide, nitrate and sulphate using various reagents. Refer to Qualitative notes 	<ul style="list-style-type: none"> Observing and interpreting results of reactions of ions with different test reagents. Analysing chemical composition of salts. 	<ul style="list-style-type: none"> Awareness about composition of salts

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.4.2 Demonstrate the identity of gases.	<ul style="list-style-type: none"> Gases being ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide. Refer to Qualitative notes 	<ul style="list-style-type: none"> Identifying gases 	<ul style="list-style-type: none"> Appreciating different types of gases.
11.6 THE MOLE CONCEPT	11.6.1 Relative masses	11.6.1.1 Describe Relative Atomic Mass and relative molecular mass. 11.6.1.2 Calculate the relative formula mass of a compound	<ul style="list-style-type: none"> RAM as relative mass of an element's isotopes as compared to carbon-12 RMM as relative mass of a molecule as compared to carbon-12 As the sum of the relative atomic masses of all the atoms in the compound. 	<ul style="list-style-type: none"> Comparing the relative atomic masses and relative molecular masses Calculating relative molecular mass of compounds 	<ul style="list-style-type: none"> Appreciating the relative atomic masses and the relative molecular masses
	11.6.2 The mole	11.6.2.1 Describe a mole. 11.6.2.2 Determine the physical masses (m) of any substance using the molar mass (Mr) and the physical volume (v) of any gas at r.t.p and vice versa.	<ul style="list-style-type: none"> As number or quantities of particles e.g. atoms, ions, molecules, electrons equivalent to 6.02×10^{23} (Avogadro's constant) Apply $n = \frac{m}{M_r}$ and $n = \frac{v}{V_m}$ where n = number of moles 	<ul style="list-style-type: none"> Analysing chemical substances quantitatively 	<ul style="list-style-type: none"> Applying mole concept Asking questions to learn more Awareness of the mole concept Fostering team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.6.2.3 Describe the relationship of Avogadro's law to reacting moles and volumes of gases at r.t.p and s.t.p.</p> <p>11.6.2.4 Determine the concentration of a solution and apply dilution law.</p>	<ul style="list-style-type: none"> • As Molar gas volume (V_m) of any gas at rtp is 24dm^3 or 22.4 dm^3 at stp. • Concentration as mol/dm^3 / g/dm^3. The number of moles of solute before dilution is the same as after dilution, $M_1V_1 = M_2V_2$. 	<ul style="list-style-type: none"> • Demonstrating acid-base titrations • Problem solving in mole concept 	<ul style="list-style-type: none"> • Applying mole concept • Asking questions to learn more • Awareness of the mole concept • Fostering team work
		11.6.2.5 Illustrate calculations involving stoichiometric reacting moles and volumes of gases and solutions.	<ul style="list-style-type: none"> • Using molar mass and molar volume of a gas using the mole concept. (Questions on gas laws and conversions of gaseous volumes to different temperatures and pressures will not be required). Proportional stoichiometric masses and the given quantities 	<ul style="list-style-type: none"> • Problem solving in mole concept 	<ul style="list-style-type: none"> • Applying mole concept • Asking questions to learn more • Awareness of the mole concept • Fostering team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>11.6.2.6 Describe and calculate the percentage yield in a reaction and the percentage purity of a substance</p> <p>11.6.2.7 Determine limiting reagent in a given reaction</p>	<ul style="list-style-type: none"> • % yield as actual amount obtained divided by theoretical amount x 100% • % purity as amount of substance divided by total amount of the mixture x 100% • Using proportional stoichiometric masses and the given quantities 	<ul style="list-style-type: none"> • Problem solving in mole concept 	<ul style="list-style-type: none"> • Applying mole concept • Asking questions to learn more • Awareness of the mole concept • Fostering team work
		<p>11.6.2.8 Demonstrate calculations involving different types of acid–base titration reactions.</p>	<ul style="list-style-type: none"> • Using titration law 	<ul style="list-style-type: none"> • Demonstrating acid-base titrations 	<ul style="list-style-type: none"> • Applying mole concept • Asking questions to learn more • Awareness of the mole concept • Fostering team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT			
			KNOWLEDGE	SKILLS	VALUES	
11.7 CHEMICAL REACTIONS	11.7.1 Rates of chemical reactions	11.7.1.1 Describe rate of a chemical reaction.	<ul style="list-style-type: none"> • As speed of a chemical reaction. • Factors such as temperature, concentration, surface area, catalyst, pressure, light. • Such as graphical representations for rate of chemical reactions. 	<ul style="list-style-type: none"> • Demonstrating factors that control the rate of chemical reactions. • Comparing experimental results at different conditions 	<ul style="list-style-type: none"> • Applying safety rules and the factors that affect the rate of chemical reactions. Awareness of slow and spontaneous reactions. 	
		11.7.1.2 Demonstrate the factors that affect the rates of chemical reactions				11.7.1.3 Interpret data on the rate of chemical reactions.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.8 THE PERIODIC TABLE	11.8.1 Groups and Periods	11.8.1.1 Describe the Periodic Table 11.8.1.2 Identify vertical columns and horizontal rows. 11.8.1.3 Demonstrate how to use the Periodic Table to classify elements	<ul style="list-style-type: none"> As a tool for classifying elements. Vertical columns as Groups and horizontal rows as Periods As metallic and non-metallic 	<ul style="list-style-type: none"> Identifying of vertical columns and horizontal rows of the periodic table. Classifying elements as metallic and non-metals 	<ul style="list-style-type: none"> Appreciating the Periodic Table Applying the classification of elements
	11.8.2 Groups and Periodic trends	11.8.2.1 Describe trends in various Groups given information about the elements 11.8.2.2 Describe the physical and chemical properties of elements in Group I, II, VII and VIII. 11.8.2.3 Describe the importance of halogens	<ul style="list-style-type: none"> As chemical relativity of group I, II, and VII, elements Properties such as solubility, effect of heat on compounds, melting points, boiling points and displacement reactions. For Group VII consider atomicity, colour changes, changes in physical states, for Group I including description as a collection of soft metals. Such as fluoride in toothpaste, chlorine in water treatment, antiseptic, bromide in photographic film 	<ul style="list-style-type: none"> Identifying characteristics of representative elements from Groups. Classifying elements according to their Groups and Periods 	<ul style="list-style-type: none"> Awareness of elements and their positions on the Periodic Table Appreciating positioning of elements on the Periodic Table Appreciating the uses of elements on the Periodic Table

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.8.2.4 Describe the harmful effects of halides. 11.8.2.5 Describe the use of the noble gases in providing an inert atmosphere	<ul style="list-style-type: none"> Such as drugs, pesticides, CFCs in ozone layer depletion (CFCs) The significance of their non-reactivity in providing an inert atmosphere. Such as argon in electrical lamps, helium in balloons 	<ul style="list-style-type: none"> Communicating harmful effects of halides and uses of noble gases 	<ul style="list-style-type: none"> Awareness of harmfulness of halides Appreciating of uses of noble gases
	11.8.3 Transition metals	11.8.3.1 Describe transition metals. 11.8.3.2 Describe general properties of transition metals. 11.8.3.3 Describe the uses of transition metals	<ul style="list-style-type: none"> As a block elements between Group II and Group III of the Periodic Table As variable valencies, high densities, high melting points, form coloured compounds, catalysts. <p>Note: Electronic configuration of transition metals will not be required</p> <ul style="list-style-type: none"> Uses such as catalysts, alloys, engineering materials <p>NB: Heavy metals are no longer used to make paint for health reasons</p>	<ul style="list-style-type: none"> Investigating the physical and chemical properties of transition elements. Identifying transition metals 	<ul style="list-style-type: none"> Appreciating transition metals

GRADE 12

General Outcomes:

- Demonstrate an understanding of metals
- Develop investigative skills about some properties and uses of metals.
- Demonstrate an understanding of Non- metals.
- Develop investigative skills about some industrial uses of non-metals Demonstrate an understanding of Organic Chemistry
- Develop investigative skills about organic compounds

Key competences:

- Demonstrate ability to determine the reactivity series of metals
- Demonstrate ability to prepare and test gases
- Demonstrate ability to identify organic compounds

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.10 METALS	12.10.1 General properties of a metals	12.10.1.1 Describe diagrammatic representations of pure metals 12.10.1.2 Describe the physical properties of metal 12.10.1.3 Describe the chemical properties of metals	<ul style="list-style-type: none"> • Similar nuclei positive ions in a 'sea' of delocalised electrons. • Similar In terms of density, melting points, boiling points, appearance • All metals are electropositive as illustrated in the reaction with air, water / steam, dilute non- oxidizing acids, aqueous solutions of other metal ions. 	<ul style="list-style-type: none"> • <i>Identifying</i> properties of metals. 	<ul style="list-style-type: none"> • <i>Appreciating</i> metals
	12.10.2 Reactivity and Electro Chemical Series	12.10.2.1 Describe the reactivity series of metals	<ul style="list-style-type: none"> • As arrangement of metals in the order of either their increasing or decreasing order of reactivity as being potassium, sodium, calcium, magnesium, aluminium, zinc, iron, lead, (hydrogen), copper and silver 	<ul style="list-style-type: none"> • <i>Comparing</i> methods of extracting metals. 	<ul style="list-style-type: none"> • <i>Awareness</i> of methods of extracting metals and dangers some metals pose.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.2.2. Explain the apparent non reactivity of aluminium.	<ul style="list-style-type: none"> • Due to the presence of adhesive oxide/coat. Reactivity of aluminium due to adhesive coat • From a set of experimental results Such as reduction of oxides of metals by other metals. • 	<ul style="list-style-type: none"> • Demonstrating reactivity of aluminium and order of reactivity 	<ul style="list-style-type: none"> • Appreciating of aluminium
		12.10.2.3 Demonstrate an order of reactivity.			
		12.10.2.4 Describe the effects of heat on hydroxides, carbonates, nitrates of metals and ammonium compounds.	<ul style="list-style-type: none"> • As related to the reactivity/stability of the metallic ion present in the compound. Compounds of more reactive metals difficulty to decompose while compounds of less reactive metals easily decompose. 	<ul style="list-style-type: none"> • Demonstrating effects of heat on salts 	<ul style="list-style-type: none"> • Asking questions to learn more • Awareness of the heat on salts Fostering team work

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.2.5 Describe the extraction of copper, iron and zinc from their ores. 12.10.2.6 Describe the uses of copper, iron, zinc and aluminium 12.10.2.7 Explain the harmful effects of some metals.	<ul style="list-style-type: none"> • Chemical reduction. Chemical reducing agents being Carbon, carbon monoxide, and hydrogen. • Such as electrical wires, construction, aircraft parts. • Such as lead poisoning (brain damaging), sodium ions in raising high blood pressure, alzhermia by aluminium 	<ul style="list-style-type: none"> • <i>Comparing</i> methods of extracting metals. 	<ul style="list-style-type: none"> • <i>Asking</i> questions to learn more • <i>Awareness</i> of the importance of metals • <i>Fostering</i> team work
	12.10.3 Alloys	12.10.3.1 Describe alloys. 12.10.3.2 Describe diagrammatic representations of alloys.	<ul style="list-style-type: none"> • As mixture of two or metals/carbon such as steel, brass, bronze • Different nuclei positive ions in a 'sea' of delocalised electrons 	<ul style="list-style-type: none"> • <i>Identifying</i> characteristics of alloys • <i>Comparing</i> structures of alloys and pure metals. 	<ul style="list-style-type: none"> • <i>Appreciating</i> alloys.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.3.3 Explain the advantages of using alloys over pure metals.	<ul style="list-style-type: none"> Such as alloys exhibiting better properties compared to a pure metal (conductor, strength, weight ratio, hardness). 	<ul style="list-style-type: none"> Identifying characteristics of alloys Comparing structures of alloys and pure metals. 	<ul style="list-style-type: none"> Appreciating alloys.
		12.10.3.4 Identify common uses of alloys	<ul style="list-style-type: none"> Such as cutlery, food packaging, aircraft. 		
	12.10.4 Corrosion	12.10.4.1 Describe corrosion	<ul style="list-style-type: none"> As chemical wearing of metals resulting from attack by atmospheric oxygen in presence of moisture. 	<ul style="list-style-type: none"> Identifying corrosion. 	<ul style="list-style-type: none"> Appreciating ways of minimizing corrosion.
		12.10.4.2 Relate corrosion to the reactivity of metals.	<ul style="list-style-type: none"> As more reactive metals easily corrode while less reactive metals do not easily corrode. 	<ul style="list-style-type: none"> Applying methods of reducing corrosion. 	
		12.10.4.3 Describe different methods of preventing corrosion.	<ul style="list-style-type: none"> Such as sacrificial protection, painting, greasing/oiling, alloying and galvanising. 	<ul style="list-style-type: none"> Relating sacrificial protection methods to reactivity series. 	

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.11 NON -METALS	12.11.1 General properties of non-metals.	12.11.1.1 Describe the physical and chemical properties of non-metals.	<ul style="list-style-type: none"> In terms of density, melting points, boiling points, oxidizing agent (electronegative elements) 	<ul style="list-style-type: none"> Identifying the physical and chemical properties of non-metals 	<ul style="list-style-type: none"> Appreciating non-metals.
	12.11.2. Hydrogen	12.11.2.1. Demonstrate the laboratory preparation, collection and test for hydrogen. 12.11.2.2 Describe the physical and chemical properties of hydrogen 12.11.2.3 Describe industrial manufacture of hydrogen.	<ul style="list-style-type: none"> By action of moderate reactive metals on water/steam and dilute acids and collect by upward delivery method, puts out a lighted splint with a ‘pop’ sound. In terms of colour, odour, density/”weight”, solubility and chemical (effect on litmus, inflammability, combustion)(COWSLIPS) By cracking, electrolysis of water (brine) and from natural gas 	<ul style="list-style-type: none"> Demonstrating laboratory preparation of hydrogen. 	<ul style="list-style-type: none"> Appreciating physical and chemical properties of hydrogen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.2.6 Describe the uses of hydrogen.	<ul style="list-style-type: none"> Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding. 	<ul style="list-style-type: none"> Communicating the uses of hydrogen 	<ul style="list-style-type: none"> Appreciating physical and chemical properties of hydrogen and its uses.
	12.11.3. Oxygen	<p>12.11.3.1 Demonstrate the laboratory preparation, collection and test for oxygen.</p> <p>12.11.3.2 Describe the physical and chemical properties of oxygen.</p> <p>12.11.3.3 Describe the industrial manufacture of oxygen.</p>	<ul style="list-style-type: none"> By catalytic decomposition of hydrogen peroxide and thermal catalytic decomposition of potassium chlorate, collected above water and re-lights the glowing splint Such as colour, odour, solubility ,combustion By fractional distillation of liquid air 	<ul style="list-style-type: none"> Demonstrating laboratory preparation of oxygen. Observing the reaction. Communicating the uses of oxygen 	<ul style="list-style-type: none"> Appreciating physical and chemical properties of oxygen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.2.6 Describe the uses of hydrogen.	<ul style="list-style-type: none"> • Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding. 	<ul style="list-style-type: none"> • Communicating the uses of hydrogen 	<ul style="list-style-type: none"> • Appreciating physical and chemical properties of hydrogen and its uses.
	12.11.3. Oxygen	<p>12.11.3.1 Demonstrate the laboratory preparation, collection and test for oxygen.</p> <p>12.11.3.2 Describe the physical and chemical properties of oxygen.</p> <p>12.11.3.3 Describe the industrial manufacture of oxygen.</p>	<ul style="list-style-type: none"> • By catalytic decomposition of hydrogen peroxide and thermal catalytic decomposition of potassium chlorate, collected above water and re-lights the glowing splint • Such as colour, odour, solubility ,combustion • By fractional distillation of liquid air 	<ul style="list-style-type: none"> • Demonstrating laboratory preparation of oxygen. • Observing the reaction. • Communicating the uses of oxygen 	<ul style="list-style-type: none"> • Appreciating physical and chemical properties of oxygen and its uses.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.3.4 Describe the uses of oxygen in industry and in natural processes. 12.11.3.5 Explain the importance of ozone layer and dangers of its depletion.	<ul style="list-style-type: none"> Such as burning, welding, in blast furnace and respiration It traps radiation, if depleted by CFCs causes skin cancer, respiratory diseases 	<ul style="list-style-type: none"> Communicating the uses of oxygen 	<ul style="list-style-type: none"> Appreciating uses of oxygen
		12.11.3.6 Demonstrate the chemical test for water. 12.11.3.7 Describe the importance of water	<ul style="list-style-type: none"> Using white anhydrous copper (II) sulphate which turns blue. For laundry, drinking, as solvent. 	<ul style="list-style-type: none"> Demonstrating the chemical testing of water Communicating the importance 	<ul style="list-style-type: none"> Appreciating importance of water

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.4 Nitrogen	12.11.4.1 Describe industrial manufacture of nitrogen.	<ul style="list-style-type: none"> • By fractional distillation of liquid air • As non- reactive insoluble gas hence used as refrigerant, food packaging. Manufacture of ammonia gas. 	<ul style="list-style-type: none"> • Demonstrating laboratory preparation of ammonia. • Observing colour changes. 	<ul style="list-style-type: none"> • Appreciating physical and chemical properties of nitrogen and ammonia and their uses.
		12.11.4.2 Explain the characteristics and importance of Nitrogen as a gas. 12.11.4.3 Demonstrate the preparation collection and test for ammonia in the laboratory 12.11.4.4 Describe the manufacture of ammonia.			

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.4.5 Describe the physical and chemical properties of ammonia. 12.11.4.8 Describe the thermal dissociation of ammonium salts.	<ul style="list-style-type: none"> • In terms of colour, odour, density/"weight", solubility and as reducing agent, a base/alkali, a complexing reagent. • Such as ammonium chloride, ammonium nitrate, ammonium carbonate. 	<ul style="list-style-type: none"> • Demonstrating laboratory preparation of ammonia. • Observing colour changes. 	<ul style="list-style-type: none"> • Appreciating physical and chemical properties of nitrogen and ammonia and their uses.
		12.11.4.9 Describe the uses ammonia 12.11.4.10 Describe the manufacture of nitric acid 12.11.4.10 Explain the importance of nitrogenous fertilizers 12.11.4.11 Describe the effects of nitrogenous fertilizers on the environment	<ul style="list-style-type: none"> • In manufacture of fertilizers, explosives, nitric acid • by Ostwald Process • Nitrogen for growth. Include Phosphorous for root development and potassium for seed formation (NPK). • Such as eutrophication and acidic soils 		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.7 Carbon and carbonates	12.11.7.1 Describe allotropes 12.11.7.2 Describe the physical properties of the allotropes of carbon. 12.11.7.3 Describe the formation and properties of carbon monoxide.	<ul style="list-style-type: none"> As different forms of an element existing in the same physical state. In terms crystalline and non-crystalline allotropes of carbon. By incomplete combustion of carbon and carbon compounds, reduction of carbon dioxide by carbon. In terms of colour, odour, density, solubility, poisonous. Reacts as reducing agent. 	<ul style="list-style-type: none"> Demonstrating laboratory preparation of carbon dioxide. Observing colour changes. 	<ul style="list-style-type: none"> Appreciating physical and chemical properties of carbon dioxide and limestone and their uses.
		12.11.7.4 Demonstrate the laboratory preparation, collection and the test for carbon dioxide.	<ul style="list-style-type: none"> By reaction of dilute acids with carbonates or bicarbonates, collected by downward delivery method/ above water, forms white precipitate with limewater. 		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.7.4 Describe the physical and chemical properties of carbon dioxide. 12.11.7.5 Describe the uses of carbon dioxide.	<ul style="list-style-type: none"> • In terms of colour, odour, density, solubility. Reactions with limewater/alkalis, water and carbon. • Such as in fire extinguishers, carbonated drinks, dry ice, baking, photosynthesis 	<ul style="list-style-type: none"> • Demonstrating laboratory preparation of carbon dioxide. • Observing colour changes. 	<ul style="list-style-type: none"> • Awareness of Global warming • Appreciating physical and chemical properties of carbon dioxide and limestone and their uses.
		12.11.7.6 Describe the manufacture of lime from limestone. 12.11.7.7 Describe the uses of lime and slaked lime. 12.11.7.8 Describe the uses of limestone. 12.11.7.9 Describe the greenhouse effect	<ul style="list-style-type: none"> • By thermal dissociation of limestone • Such as in neutralizing acidic soils, lime as a drying agent for ammonia. • Such as in manufacturing of lime, cement, glass, iron. • As global warming due to increase of carbon dioxide in the atmosphere 		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.12 ORGANIC CHEMISTRY	12.12.1 Saturated and unsaturated Hydrocarbons	<p>12.12.1.1 Describe an organic compound.</p> <p>12.12.1.2 Describe hydrocarbon</p> <p>12.12.1.3 Illustrate and name the structures of the aliphatic alkanes up to five carbon atoms.</p> <p>12.12.1.4 Demonstrate the structures of isomers and their names.</p> <p>12.12.1.5 Describe fractional distillation of petroleum (crude oil)</p>	<ul style="list-style-type: none"> • As a compound of carbon other than oxides and carbonates • As a binary compound of carbon and hydrogen. • Involve concept of catenation (Chain), use the general formula C_nH_{2n+2}, Named by IUPAC system, all should end with <i>ane</i>, • Use idea of branched (side chains) and unbranched butane and pentane and nomenclature follows IUPAC system. • As different fractions of crude oil collected at different boiling temperatures. 	<ul style="list-style-type: none"> • Identifying alkanes and alkenes. • Comparing properties of alkanes and alkenes • Observing colour changes. 	<ul style="list-style-type: none"> • Appreciating economic values of alkanes and alkenes. • Awareness of organic compounds.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>12.12.1.6 Describe the uses of the fractions of crude oil</p> <p>12.12.1.7 Describe the chemical properties of alkanes.</p> <p>12.12.1.8 Account for the apparent non reactivity of alkanes as compared to other organic compounds.</p> <p>12.12.1.9 Illustrate unsaturation in alkenes.</p>	<ul style="list-style-type: none"> • Such as domestic fuel, road construction. NB: leaded fuel is no longer recommended due to harmful effects • Such as combustion, cracking, substitution, steam reforming. • Lack of a specific site of chemical attack (functional group) and they are saturated. • Using the concept of catenation and models. 	<ul style="list-style-type: none"> • Identifying alkanes and alkenes. • Comparing properties of alkanes and alkenes • Observing colour changes. 	<ul style="list-style-type: none"> • Appreciating economic values of alkanes and alkenes. • Awareness of organic compounds.
		<p>12.12.1.10 Describe and name the structures of the alkenes up to 5 carbon atoms.</p>	<ul style="list-style-type: none"> • Use the concept of catenation and the general formula C_nH_{2n}. Structures must contain one carbon to carbon double bond. Named using the IUPAC system all should end with- <i>ene</i>. 	<ul style="list-style-type: none"> • Identifying alkanes and alkenes. • Comparing properties of alkanes and alkenes • Observing colour changes. 	<ul style="list-style-type: none"> • Appreciating economic values of alkanes and alkenes. • Awareness of organic compounds.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.1.11 Demonstrate the structures of isomers of alkenes. 12.12.1.12 Describe the chemical properties of alkenes.	<ul style="list-style-type: none"> Using the unbranched structures of butene and pentene (positional isomers). Such as combustion, addition reactions (hydrogenation, hydration, hydrohalogenation, halogenation, addition polymerisation). 	<ul style="list-style-type: none"> Identifying alkanes and alkenes. Comparing properties of alkanes and alkenes Observing colour changes. 	<ul style="list-style-type: none"> Appreciating economic values of alkanes and alkenes. Awareness of organic compounds.
		12.12.1.13 Illustrate the differences and similarities between saturated and unsaturated Hydrocarbons. 12.12.1.14 Describe the chemical tests for unsaturated hydrocarbons (alkenes) 12.12.1.15 Describe the uses of alkenes.	<ul style="list-style-type: none"> Using structures and bromine solution to distinguish between saturated and unsaturated hydrocarbons. As alkenes decolourise bromine solution rapidly. As in formation of polymers (Petrochemical industries) 	<ul style="list-style-type: none"> Identifying alkanes and alkenes. Comparing properties of alkanes and alkenes Observing colour changes. 	<ul style="list-style-type: none"> Appreciating economic values of alkanes and alkenes. Awareness of organic compounds.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.2 Alcohols (Alkanols)	12.12.2.1 Describe the chemical composition of an alcohol.	<ul style="list-style-type: none"> As an organic compound with a hydroxyl group with general formula $C_nH_{2n+1}OH$ Using concept of catenation (Chain). Named following IUPAC nomenclature and all should end with- <i>ol</i>). 	<ul style="list-style-type: none"> Identifying composition of alcohols Comparing structures of alcohols 	<ul style="list-style-type: none"> Appreciating economic values of alcohols. Awareness of organic compounds.
		12.12.2.2 Describe and name structures of primary alcohols up to five carbon atoms.			
		12.12.2.4 Describe the formation of alcohols.	<ul style="list-style-type: none"> By hydration of alkenes, hydrolysis of esters and fermentation for ethanol. 		
		12.12.2.5 Describe the chemical properties of alcohols	<ul style="list-style-type: none"> Such as combustion, esterification, dehydration and oxidation 		
		12.12.2.6 Describe the uses of alcohols	<ul style="list-style-type: none"> Uses such as fuel, antiseptic, organic solvent, alcoholic beverages 		

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.3 Carboxylic acids (alkanoic acids)	12.12.3.1 Describe and name structures of carboxylic acids up to five carbon atoms.	<ul style="list-style-type: none"> Using concept of catenation (Chain), organic compounds with a carboxylic group (COOH), general formula $C_nH_{2n+1}COOH$, all should end with- <i>oic acid</i>. 	<ul style="list-style-type: none"> Identifying structures of carboxylic acids. 	<ul style="list-style-type: none"> Appreciating the properties and economic uses of carboxylic acids.
		12.12.3.2 Describe the formation of carboxylic acids	<ul style="list-style-type: none"> By the oxidation of alcohols and hydrolysis of esters 		
		12.12.3.3 Demonstrate the chemical properties of carboxylic acids. 12.12.3.4 Describe the uses of carboxylic acids	<ul style="list-style-type: none"> Such as reaction with bases, carbonates, metals and alcohols (esterification). Such as formation of esters. 	<ul style="list-style-type: none"> Demonstrating the chemical properties of carboxylic acids 	<ul style="list-style-type: none"> Appreciating the properties and economic uses of carboxylic acids.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.4 Esters (Alkanoates)	12.12.4.1 Describe and name the structures of esters up to five carbon atoms.	<ul style="list-style-type: none"> Using the concept of catenation (Chain), Organic compounds with an ester link $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{O}- \end{array}$ and all should end with <i>-oate</i>. Such as combustion and hydrolysis. 	<ul style="list-style-type: none"> Identifying structures and characteristic properties of esters. 	
		12.12.4.2 Describe the chemical properties of esters			
	12.12.4.3 Describe the uses of esters and relate the uses to properties.	<ul style="list-style-type: none"> Such as in perfumes, food flavourants because of having pleasant smell. 	<ul style="list-style-type: none"> Describing the chemical properties of esters 	Appreciating the properties and economic uses of esters.	
12.12.5 Homologous series	12.12.5.1 Describe homologous series	12.12.5.2 Describe the general characteristics of homologues (members).	<ul style="list-style-type: none"> As a collection of organic compounds belonging to the same family with the same general formula (consider alkanes, alkenes, alcohols, acids, esters). Such as members of each homologous series have the same general formula and similar chemical properties. Physical properties (states, melting point, boiling point, density, solubility) of members show gradual changes as molecular mass changes. Adjacent members differ by CH_2 and have a general method of preparing members. 	<ul style="list-style-type: none"> Identifying different homologous series. 	<ul style="list-style-type: none"> Awareness of homologous series.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.6 Macromolecules (Polymers)	12.12.6.1 Describe macromolecules (polymers)	<ul style="list-style-type: none"> As giant molecules formed by combination of many small molecules (monomers). As human made giant molecules (polymers). By addition polymerisation E.g. polyethene, polyvinylchloride, polypropene, polystyrene. As thermoplastics and Thermosets 	<ul style="list-style-type: none"> Classifying macromolecules Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> Awareness of polymers. Appreciating economic use of polymers.
		12.12.6.2 Describe synthetic macromolecules.			
12.12.6.3 Describe the formation of polyalkenes.					
12.12.6.4 Classify plastics					
		12.12.6.5 Describe the formation of nylon and Terylene.	<ul style="list-style-type: none"> By condensation polymerisation, Nylon: from a diamine and dioic acid structures represented as: <p>Terylene</p> $-\overset{\text{O}}{\parallel}{\text{C}}-\text{[shaded box]}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{[white box]}-\text{O}-$ <p>Nylon</p> $-\overset{\text{O}}{\parallel}{\text{C}}-\text{[shaded box]}-\overset{\text{O}}{\parallel}{\text{C}}-\underset{\text{H}}{\text{N}}-\text{[white box]}-\underset{\text{H}}{\text{N}}-$	<ul style="list-style-type: none"> Classifying macromolecules Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> Awareness of polymers. Appreciating economic use of polymers.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		<p>12.12.6.6 Differentiate between the structure of Nylon and Terylene.</p> <p>12.12.6.7 Describe typical uses of plastics and synthetic fibres.</p>	<ul style="list-style-type: none"> • Terylene: from diol and dioic acid. Structures represented as: Nylon as polyamide and Terylene as polyester. • Plastics used as in carrier bags, buckets, pipes Nylon and terylene as in clothing, tents, strings, ropes. 	<ul style="list-style-type: none"> • Classifying macromolecules • Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> • Awareness of polymers. • Appreciating economic use of polymers.
		<p>12.12.6.8 Describe the biodegradability of synthetic fibres.</p> <p>12.12.6.9 Describe natural macromolecules</p>	<ul style="list-style-type: none"> • As non-biodegradable (cannot be broken down by microorganisms) • Such as Carbohydrates, proteins and fats (lipids). 	<ul style="list-style-type: none"> • Classifying macromolecules • Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> • Awareness of polymers. • Appreciating economic use of polymers.

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.6.10 Describe composition of carbohydrates 12.12.4.11 Identify linkages in starch, proteins and fats 12.12.4.12 Relate linkages in synthetic and natural polymers.	<ul style="list-style-type: none"> Carbohydrates contain carbon, hydrogen and oxygen in the form $C_xH_{2y}O_y$ where x is a multiple of six. In starch – glycosidic, $-O-\square-O-\square-$ Proteins – amide, fats – ester linkages Such as difference and similarities between nylon and proteins. Terylene and fats. 	<ul style="list-style-type: none"> Classifying macromolecules Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> Awareness of polymers. Appreciating economic use of polymers
		12.12.4.13 Describe hydrolysis of fats (saponification). 12.12.4.14 Identify the products of the hydrolysis of starch and proteins.	<ul style="list-style-type: none"> As formation of soaps and glycerine (glycerol). Using chromatography to identify the amino acids from proteins, simple sugars from starch. 	<ul style="list-style-type: none"> Classifying macromolecules Identifying linkages in different macromolecules 	<ul style="list-style-type: none"> Awareness of polymers. Appreciating economic use of polymers

SCIENCE PRACTICAL DATA (PHYSICS)

The importance of practical work in Physics cannot be over emphasized. Practical work develops manipulative skills in the learner and gives the learner the opportunity to experiment the scientific method. Needless to mention practical Physics is essential for this syllabus because:

- a) There is need to expose learners to practical applications of Physics.
- b) Learners should understand, interpret and apply scientific methods in a variety of ways including the theoretical and practical approaches.
- c) The study of Physics should be linked with environmental education requirements by quoting local phenomena in relation to Physics studies.

There are scientific processes and skills to which learners must be exposed. Examples of these are observing, experimenting, classifying, measuring, estimating, calculating, predicting and problem solving. Learners should also be exposed to scientific attitude like accuracy, curiosity and creativity.

KEY QUANTITIES, SYMBOLS AND UNITS IN PHYSICS.

The pages 96 – 98 comprise the symbols and units which may from time to time be used during the study of Physics. The candidate is expected to have the knowledge of how to apply the symbols and units in physics.

The list is not exhaustive; therefore the teacher and the learner are expected to discover more as they go through this course.

LIST OF SUGGESTED APPARATUS AND EQUIPMENT FOR THE SYLLABUS

1.0 Measurements and Mechanics

Venier callipers, micrometer screw gauges, measuring cylinders, metre rules, displacement cans, beakers, conical flasks, different masses such as 50g, 100g, 200g, 1kg, ticker tape timers, pipettes, burettes, spring balances, beam balances, capillary tubes and pulleys.

2.0 Thermal physics

Mercury barometers, clinical and laboratory thermometer, six's maximum and minimum thermometers, manometers, calorimeter, thermos flasks, thermocouple thermometers and hypsometer.

3.0 Light

Plane mirrors, converging and diverging lenses, rectangular and triangular prisms, optical pins, colour discs, colour filters, optical camera, light ray boxes, coloured bulbs, projectors such as slide projectors and film projectors.

4.0 Sound

Sonometers, tuning forks, stop watches, stop clocks, sources of sound such as guitars and drums.

5.0 Magnetism

Bar magnets, horseshoe magnets, iron and steel bars, iron filings and plotting compasses.

6.0 Wave motion

Ripple tanks, springs and spiral springs, ropes and strings.

7.0 Electric current/static electricity

Ammeters, voltmeters, rheostats, capacitors, connecting wires, lead-acid accumulators, dry cells, resistors, tapping keys, switches, fuses, semi-conductors, semi-conductor diodes, electric bells, resistance wires, ebonite and polythene rods, three-pin-plugs, electric bulbs, switch boards and gold leaf electroscopes.

8.0 Basic electronics

Cathode ray tubes, maltese cross tube, resistors, light dependant rays (LDRs), thermistors, diodes, capacitors, transistors, TV sets, radios, electronics teaching kits and computers.

9.0 Nuclear physics

Geiger muller tube, time scales, rate metres, cloud chambers, bubble chamber alpha emitting radioactive sources and extra high tension (EHT) power supply unit.

KEY QUANTITIES, SYMBOLS AND UNITS.

Quantity	Symbols	Unit
Mass	m	kg
Length	l	m
Time	t	s
Electric current	I	A
Thermodynamic temperature	T	K
Amount of substance	n	mol
Distance	d	m
Displacement	s, x	m
Area	An	m ²
Volume	V	m ³

Density	ρ	kgm^{-3}
Speed	u, v	ms^{-1}
Velocity	u, v	ms^{-1}
Acceleration	and	ms^{-2}
Acceleration of free-fall	g	ms^{-2}
Force	F	N
Weight	W	N
Momentum	P	Ns
Work	W	J
Energy	E, U, W	J
potential energy	E_p	J
Kinetic energy	E_k	J
Heat energy	Q	J
Change of internal-energy	ΔU	J
Power	P	W
Pressure	P	Pa
Torque	T	Nm
Gravitational constant	G	$\text{Nkg}^{-2}\text{ms}^2$
Period	T	s
Frequency	f	Hz
Wave length	λ	m
Speed of electromagnetic-waves	c	ms^{-1}
Avogadro constant number	N_A	mol^{-1}
Celsius temperature	θ	$^{\circ}\text{C}$
Half - life	$t^{1/2}$	s
Decay constant	λ	s^{-1}
Specific heat capacity	c	$\text{JK}^{-1}\text{KG}^{-1}$

Electromotive force	E	V
Resistance	R	Ω
Resistivity	ρ	Ωm

DATA AND FORMULAE

Speed of light in free space	$C = 3.00 \times 10^8 \text{ ms}^{-1}$
Elementary charge	$e = 1.60 \times 10^{-19} \text{ coulomb}$
The Planck constant	$h = 6.63 \times 10^{-34} \text{ Js}$
Molar gas constant	$R = 8.31 \text{ JK}^{-1} \text{ mol}^{-1}$
The Avogadro constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
Gravitational constant	$G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$
Acceleration of free fall	$g = 9.81 \text{ ms}^{-2}$
The Boltzmann constant	$k = 1.38 \times 10^{-23} \text{ JK}^{-1}$
Uniformly accelerated motion	$s = ut + \frac{1}{2} at^2$
	Or
	$v^2 = u^2 + 2as$
Work done on/by a gas	$W = P\Delta V$
gravitational potential	$E_p = mgh$
Energy in motion	$E = mc^2$
Refractive index	$n = \frac{\sin i}{\sin r}$
Resistors in series	$R = R_1 + R_2 + R_3 + \dots$
Resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots +$

Electric potential

$$V = Q/4\pi\epsilon_0 r$$

Capacitors in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$$

Capacitors in parallel
pressure of an ideal gas

$$C = C_1 + C_2 + C_3 + \dots$$
$$P = \frac{1}{3} \frac{NMC^2}{V}$$

alternating current/voltage
hydrostatic pressure
energy of charged capacitor

$$X = x_0 \sin \omega t$$
$$P = \rho gh$$
$$w = \frac{1}{2} QV$$

radio-active decay

$$x = x_0 \exp(-\lambda t)$$

Decay constant

$$\lambda = \frac{0.693}{t_{1/2}}$$

SCIENCE PRACTICAL DATA (CHEMISTRY)

The following points should be considered during practical in chemistry:

- (i) The student should have the knowledge of volumetric analysis in relation to one set of titrations. The student is expected to comprehend acid-alkali titrations using ordinary methyl orange, screened methyl orange, phenolphthalein or any other suitable indicator. Other titrations using different reagents may be set as well e.g. redox titration.
- (ii) Other experiments involving the determinations of quantity, temperature change and rates of reactions are necessary. Experiments of this nature will rely on the use of ordinary apparatus in the laboratory.
- (iii) Experiments involving identification of an unknown substance or mixture could be set. A learner is expected to observe and investigate the expected outcome. This may comprise elementary chromatography and simple tests for oxidising and reducing agents. Detailed analysis is not necessary but a learner is expected to have the knowledge of the reactions of the cations with aqueous sodium hydroxide and aqueous ammonia which should include elementary cations like aluminium, ammonium, calcium, copper(II), iron (II), iron (III) and zinc.

A learner should also carry out the tests for the anions such as carbonate, chloride, iodide, nitrate and sulphate. Chemical tests for gases which should include ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide.

Organic substances and ions not mentioned above may be included in the practical sessions. A learner is expected to have sufficient knowledge in this area. Examination involving different salts with cations similar to the ones specified above may be set but candidates are expected to draw out their conclusions from the observations.

N.B. No note books, course books, information booklets and text books will be allowed in the practical examination.

A learner shall be expected to perform simple calculations as outlined by the chemistry syllabus. However non programmable calculators are allowed.

Practical techniques

Schools and students are reminded of the importance of accuracy in quantitative and qualitative exercises during the practical lessons.

- (i) A learner is expected to read the burette accurately and to the nearest volume of 0.1cm^3 . At least 3 titrations should be done by a student to ensure a correct result and marks. Only values that fall within ± 0.2 with respect to the supervisor's volume will score full marks.

- (ii) A student is expected to take note of the temperature readings to the nearest 0.5°C . Recommended thermometer range is -10°C to 110°C . The time should be recorded in seconds and the stop clock/stop watch will be the most convenient timing instrument.
 - (iii) Learner must show the ability to ignore certain values on the titration table and use only those that are consistent and compute the average of the consistent values. Consistent values must fall within 0.2 to one another.
- In case of qualitative exercises a learner should use around 1cm depth of a solution i.e. (about 2cm^3) in a test tube. Reagents should be added drop by drop and thoroughly mixing them, to ensure effective results for each test. The student should make sure that no further changes may occur if more reagents are added. A learner should take note of the stage at which the precipitate forms and also the colour changes. Furthermore the learner must take note of chemicals used to detect gases, if any, during the experiments. Observations must be recorded as stipulated in the qualitative notes. Equations are not required during practical.

APPARATUS

The following apparatus should be stocked for teaching and examination purposes. Each learner should be provided with the necessary apparatus to conduct the experiments.

Bunsen burner

Test-tubes

Measuring cylinder calibrated 25cm^3 or 50cm^3 .

Filter funnel.

Beaker (polystyrene, glass) volume of 250cm^3 .

Conical flasks with volume of 250cm^3 .

Burette with a volume of 50cm^3 .

Pipettes with volumes of 25cm^3 or 20cm^3

Pipette fillers.

Thermometers calibrated -10°C to 110°C at intervals of 1°C .

Stop clocks/stop watches which record time in seconds.

Wash bottles.

Pyrex test tubes are essential for heating purposes with capacities 125mm x 16mm.

Boiling tubes i.e. of dimension 150mm x 25mm.

Stirring rods for stirring or mixing purposes.

Electronic balances /triple beam balances.

REAGENTS

The following standard reagents should be stocked among others. These are of paramount importance during practical.

Hydrochloric acid 1.0 mol/dm³

Nitric acid 1.0 mol/dm³

Sulphuric acid 0.5 mol/dm³

Aqueous ammonia 1.0 mol/dm³

Aqueous sodium hydroxide 1.0mol/dm³

Lime water (a solution of calcium hydroxide)

Aqueous silver nitrate 0.05 mol/dm³

Aqueous potassium dichromate (VI) 0.1 mol/dm³

Aqueous potassium iodide 0.1 mol/dm³

Aqueous lead (II) nitrate 0.2 mol/dm³

Aqueous potassium permanganate (VII) approximate 0.02 mol/dm³

Barium nitrate 0.2 mol/dm³

In addition chemical substances such as aluminium foil, red litmus paper, blue litmus paper and universal indicators should be in stock.

QUALITATIVE ANALYSIS TESTS

Notes for use in qualitative analysis

Test for anions

Anions	Test	Test result
Carbonate (CO_3^{2-})	Add dilute acid	Effervescence occurs, carbon dioxide produced
Chloride (Cl^-) [in solution]	Acidify with dilute nitric acid , then add aqueous silver nitrate	White ppt.
Iodide (I^-)[in solution]	Acidify with dilute nitric acid , then add aqueous lead (II) nitrate	Yellow ppt.
Nitrate (NO_3^-)[in solution]	Add aqueous sodium hydroxide, then aluminum foil, warm carefully.	Ammonia produced
Sulphate (SO_4^{2-}) [in solution]	Acidify with dilute nitric acid, then add aqueous barium nitrate	White ppt.

Test for aqueous cations

Cations	Effect of aqueous sodium hydroxide	Effect of aqueous ammonia
Aluminium ions (Al^{3+})	White ppt.soluble in excess giving a colourless solution	White ppt., insoluble in excess
Ammonium ions (NH_4^+)	Ammonia produced on warming	-
Calcium ions (Ca^{2+})	White ppt., insoluble in excess	No change
Copper ions (Cu^{2+})	Light blue ppt., insoluble in excess	Light blue ppt., soluble in excess, giving a dark blue solution
Iron(II) ions (Fe^{2+})	Green ppt., insoluble in excess	Green ppt., insoluble in excess, turns reddish-brown on standing
Iron (III) ions (Fe^{3+})	Red-brown ppt., insoluble in excess	Red-brown ppt., insoluble in excess
Zinc ions (Zn^{2+})	White ppt.,soluble in excess giving a colourless solution	White ppt. soluble in excess giving a colourless solution.

Test for gases

Gas	Test	Test result
Ammonia	Introduce damp red litmus paper to the gas	Turns damp red litmus paper blue
Carbon dioxide	Bubble the gas through limewater	White precipitate formed
Chlorine (Cl_2)	Introduce damp blue litmus paper to the gas	Turns litmus paper red then bleaches it
Hydrogen (H_2)	Introduce a lighted splint into the gas	Puts out the lighted splint with a 'pop' sound
Oxygen (O_2)	Introduce a glowing splint into the gas	Glowing splint relighted
Sulphur dioxide (SO_2)	Bubble the gas through acidified potassium dichromate (VI)	Turns orange potassium dichromate green.

SCIENCE SCOPE AND SEQUENCE CHART (PHYSICS)

The following table shows the “Scope and Sequence” of Physics syllabus from G10 to G12.

Grade 10		Grade 11		Grade 12	
Measurements	SUBTOPIC	Thermal Physics	SUBTOPIC	Static electricity	SUBTOPIC
	10.1.1 International System of Units (SI).		11.3.1 Simple kinetic theory of Matter.		12.8.1 Static Electricity
	10.1.2 Length and time		11.3.2 Measurement of temperature	Current electricity	12.9.1 Electric charge, current, and potential difference.
	10.1.3 Mass and, weight		11.3.3 Expansion of solids, liquids and gases.		12.9.2 Electric cells.
	10.1.4 Density		11.3.4 Heat transfer by conduction, convection and radiation.		12.9.3 Electrical resistance
Mechanics	10.2.1 Scalars and vectors		11.3.5 Measurements of heat	12.9.4 Heating effect of an electric current	
	10.2.2 Linear motion			12.9.5 Magnetic effects of electric currents	
	10.2.3 Forces	Wave motion	11.4.1 Simple ideas of the wave motion	Electromagnetic	12.10.1 The phenomenon

Grade 10		Grade 11		Grade 12	
			theory.	induction	of electromagnetic induction
	10.2.4 Moment of forces		11.4.2 Propagation of waves		12.10.2 The simple A.C. and D.C. generators
	10.2.5 Work,		11.4.3 Electromagnetic spectrum		12.10.3 Transformers
	Energy and Power.			Basic electronics	
	10.2.6 Simple machines	Sound	11.5.1 Properties of sound		12.11.1 Thermionic emission and electrons
		Light	11.6.1 Rectilinear propagation of light.		12.11.2 Circuit components.
			11.6.2 Refraction of light		12.11.3 Simple electronic systems
	10.2.7 Pressure		11.6.3 Thin converging and diverging lenses.	12.11.4 Impact of electronics on society and industry.	
		Magnetism	11.7.1 Simple phenomenon of magnetism	12.12. Atomic physics	12.12.1 Nuclear atom
					12.12.2 Radioactivity

SCIENCE SCOPE AND SEQUENCE CHART (CHEMISTRY)

Topic	Grade 10		Grade 11		Grade 12
Introduction to Chemistry	SUBTOPIC	Acids, Bases and Salts	SUBTOPIC	Chemistry and Electricity	SUBTOPIC
	10.1.1 Introduction to Chemistry		11.5.1 Characteristic properties of acids and bases		12.9.1. Conductors
The Particulate nature of matter	10.2.1 Matter and the Kinetic theory	The mole concept	11.5.2 Preparation of salts	Metals	12.10.1 General properties of a metals
	10.2.2 Diffusion		11.6.3 Types of oxides		12.10.2 Reactivity and Electro Chemical Series
Experimental Techniques	10.3.1 Measuring of quantities	The mole concept	11.6.4 Identification of ions and gases (Qualitative analysis)	Non Metals	12.10.4 Corrosion
	10.3.2 Criteria of purity		11.6.1 Relative masses		12.10.5 Thermal stability of the compounds
	10.3.3 Separating mixtures		11.6.2 The mole		12.11.1 General properties of non-metals.
Atoms, elements, molecules	10.4.1 Atomic structure and Periodic Table	Chemical	11.6.3 Empirical and Molecular formulae		12.11.2. Hydrogen
	10.4.2 Bonding		11.7.1 Rates of chemical		12.11.3. Oxygen

Topic	Grade 10		Grade 11		Grade 12
and compounds		reactions and energy changes	reactions		
	10.4.4 Macromolecules		11.7.2. Chemical equilibrium		12.11.4 Nitrogen
	10.4.5 Chemical formulae and equations		11.7.3 Redox reactions		12.11.5. Chlorine
		11.7.4 Energetics of reactions	12.11.6 Sulphur		
		The Periodic Table	11.8.1 Group and the periodic trends		12.11.7 Carbon and carbonates
			11.8.2 Group properties	12.12.1 Saturated and unsaturated Hydrocarbons	
				Organic Chemistry	