Republic of Zambia

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

SCIENCE SYLLABUS

GRADES 10 – 12

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Contents

VISION

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

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 analyze and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the leaners 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 Nkosha
Permanent Secretary
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATION.

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 and UNICEF for rendering financial technical support in the production of the syllabus.

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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 High 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", "Objectives" and "Notes". The column headed "Notes" is intended as an extension and illustration of the objectives and is not to be regarded as exhaustive. The teacher can extend it by relating the factual contents and objectives of the syllabus to social, economic and industrial life at both national and local levels as appropriate as possible.
It is envisage 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;

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Assessment

Continuous assessment will be emphasised by using various methods of testing according to topics and themes 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 consists of school based assessment and final examination 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

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SECTION A: PHYSICS

Grade 10+

General Outcomes:	**Key competences**
• Develop an understanding of General Physics • Develop investigative skills • Demonstrate an understanding of mechanics	• 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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1 General Physics	10.1.1 International System of Units (SI).	10.1.1.1 Distinguish between basic and derived quantities	• The difference between basic and derived quantities: Basic quantities; mass, length, time etc Derived quantities: force, acceleration, velocity etc	• ***Comparing*** basic quantities and derived quantities.	• ***Asking*** questions about physical quantities
		10.1.1.2 Identify basic units and derived units.	• 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)	• I***dentifying*** basic and derived units of quantities	• **Participating** in group actively
		10.1.1.3 Recognise prefixes, multiples and submultiples of fundamental and derived units.	• Fundamental and derived units: Prefixes, multiples and submultiples of basic and derived unit	• ***Expressing*** numbers in scientific notation	
		10.1.1.4 Use scientific notation and significant figures in numerical problems.	• Scientific notation: numbers written using powers of ten and significant figures: important figures	• ***Specifying*** number of significant figures	• ***Applying*** numbers in standard form
	10.1.2 Length and time	10.1.2.1 Demonstrate the use of various measuring instruments to	• Use of measuring instruments: such as rules, vernier calipers and micrometer screw	• ***Measuring*** lengths of different objects	• ***Participating*** in group actively

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		determine length 10.1.2.2 Demonstrate the use of clocks and devices for measuring an interval of time 10.1.2.3 Identify factors that affect the period of a simple pendulum	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	• ***Measuring*** an interval of time using clocks • ***Communicating*** factors affecting the period of pendulum	• ***Asking*** questions for more understanding • ***Applying*** the use of clocks and devices to determine the period of pendulum
	10.1.3 Mass and, weight	10.1.3.1 Distinguish between mass and weight 10.1.3.2 Demonstrate how to measure mass and weight 10.1.3.3Demonstrate how to locate the centre of mass of an object	• 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 • Locating the center of mass of an object: Use of lamina to locate centre of mass of an object	• ***Comparing*** mass with weight • ***Measuring*** mass and weight of objects • ***Investigating*** the centre of mass of objects • ***Communicating***	• ***Asking*** questions for more understanding • ***Appreciating*** the use of beam and spring balances • ***Participating*** in group

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.1.3.4 Describe qualitatively the effect of the position of the centre of mass on the stability of an object.	• Stability of objects in terms of the position of the centre of mass e.g. equilibrium(stable ,unstable and neutral)	conditions for stability of objects, e.g. base, position of centre of mass	actively in locating the centre of mass
10.2 Mechanics	10.2.1 Linear motion	10.2.1.1 Describe the terms used in mechanics. 10.2.2.2 Demonstrate the use of equations of uniformly accelerated motion to solve problems 10.2.2.3 Interpret graphical representation of distance-time, Displacement - time, speed-time, velocity-time and acceleration-time. 10.2.2.4 Investigate the	• Terms used : such as distance, displacement, speed, velocity, acceleration • Use of the following equations of motion; $v = u + at$, $s = (v + u)t/_2$, $s = ut + ½ at^2$ $v^2 = u^2 + 2as$ • Graphical representation of motion in terms of ; rest, constant speed and constant acceleration • Consequences of over speeding e.g. brake failure resulting into car crush, loss	• ***Comparing*** distance with displacement; speed with velocity • ***Classifying*** appropriate equation(s) of motion to solve particular numerical problems • ***Plotting*** and ***interpreting*** graphs • ***Predicting*** which object in motion would be damaged the most e.g. a slow	• ***Participating*** in a group actively • ***Appreciating*** the use of equations of motion to solve problems • ***Appreciating*** graphs

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		consequences of over speeding 10.2.2.5Describe the acceleration of free fall for a body near the earth. 10.2.2.6 Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance	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	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	• ***Appreciating*** speed limits , road humps, speed traps etc • ***Appreciating*** the use of parachutes from height
	10.2.3 Forces	10.2.3.1 Explain what force is. 10.2.3.2 Explain the effect of forces on bodies. 10.2.3.3 Describe the	• 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 1^{st} law)	• ***Communicating*** the effects of a force using a spring, trolley, Ticker Tape Timer etc. • ***Investigating*** the relationship between mass and acceleration, e.g.	• ***Participating*** in a group actively • ***Appreciating*** the use of safety belts on vehicles • ***Appreciating***

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		inertia law 10.2.3.4 Demonstrate the relationship between force and acceleration 10.2.3.5 Demonstrate the relationship between mass and acceleration.	• The relationship between force and acceleration: A constant force produces a constant acceleration • The relationship between mass and acceleration: Increase in mass results in reduction in acceleration (mass is inversely proportional to acceleration for a constant force	higher inertia is due to larger mass • ***Describing*** the relationship between mass and acceleration • ***Organising*** the data of investigation in a table	Newton's first law of motion • ***Giving*** a presentation of group work. • ***Knowing*** the safety rules of an investigation

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.3.6 Perform calculations on force. 10.2.3.7 Investigate the effect of force on a spring. 10.2.3.8 Demonstrate the effects of friction on the motion of a body. 10.2.3.9 Describe the motion in a circular path due to a perpendicular force.	• How to calculate force: Using formula; Force = mass ×acceleration • Hooke's law (F α e) including graphs. • Effects of friction e.g. heat, tear and wear • Centripetal force: ($F=m(v^2/r)$) and centrifugal force	• ***Calculating*** force, mass and acceleration • ***Communicating*** the effects of friction • ***Describing*** circular motion	• ***Appreciating*** the use of the formula to find force • ***Applying*** the restoration force in devices • ***Participating*** in class discussion
	10.2.4 Moment of forces.	10.2.4.1 Perform calculations based on the principle of moments. 10.2.4.2 Investigate the everyday application of	• 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	• ***Experimenting*** the principle of moments • ***Calculating*** mass ,weight and perpendicular distances	• ***Participating*** in a group actively • ***Justifying*** why handles of certain objects are long. e.g. a

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		moments.			spanner , wheelbarrow etc
	10.2.5 Work, Energy and Power.	10.2.5.1 Explain the meaning of the terms work, energy and power. 10.2.5.2 Identify the units of measurement for work, energy and power 10.2.5.3 Calculate work using the appropriate formula 10.2.5.4 Identify the different forms of energy	• 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) • The formulae of work: Work = (Force) x (distance moved in the line of action of the force) • Different forms of energy: e.g. mechanical (Kinetic and gravitational potential energy), Chemical, electrical energy etc • Potential and Kinetic Energy: Gravitational potential energy(energy due to position), Kinetic energy(energy due to	• ***Communicating*** work, energy and power • ***Communicating*** the SI units for work, energy and power • ***Calculating*** work, energy and power using appropriate formulae • ***Comparing*** different forms of energy • ***Communicating*** the knowledge on	• ***Justifying*** importance of conserving sources of energy • Cooperating in group activities • **Appreciating** the use of clean energy (pollution free energy) • **Cooperating** in group activities

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.5.5Explain qualitatively and quantitatively the terms gravitational potential and kinetic energy. 10.2.5.6Describe sources of renewable and non- renewable energy. 10.2.5.7 Explain the effects of the use of energy sources on the environment. 10.2.5.8 Demonstrate energy transformation	motion) NB: Gravitational potential energy(E_P = mgh) and kinetic energy ($E_K = 1/2mv^2$) • 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 • 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	potential(E_P) and kinetic(E_K) energy • ***Communicating*** renewable and non-renewable resources • ***Observing*** the effects of energy sources on the environment • ***Demonstrating*** energy transformations • ***Describing*** the law of conservation of energy • ***Calculating*** efficiency	• ***Participating*** actively in groups • ***Being*** aware that some energy sources are non-renewable • ***Asking*** questions for more understanding • ***Applying*** the law of conservation of energy

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		from one form to another 10.2.5.9. Describe the conservation of energy 10.2.5.10. Demonstrate the calculation of efficiency of energy conversion using the appropriate formula 10.2.5.11. Demonstrate calculation of power using the appropriate formula	(Efficiency = energy output/ energy input x 100%) • Calculation of power: Using the formula (Power = work done/ time)	• ***Calculating*** power from the formula	• ***Justifying*** why the difference between energy input and energy output
	10.2.6 Simple machines	10.2.6.1 Describe what a simple machine is 10.2.6.2 Identify the different types of simple machines.	• 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	• ***Communicating*** the knowledge on simple machines and types	• ***Cooperating*** in group activities • ***Listening*** to other learners with respect

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.6.3Describe the distances moved by the effort and the load in a simple machine 10.2.6.4 Explain the terms of Mechanical advantage (MA), Velocity Ratio (VR) and Efficiency. 10.2.6.5 Perform calculations involving simple machines	• 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: Mechanical advantage (MA = Load/Effort) Velocity Ratio (VR = distance moved by effort / distance moved by load) Efficiency (; Efficiency = (MA/VR) x 100%)	• ***Relating*** the distance moved by the effort to the distance moved by the load • ***Calculating*** MA, VR and efficiency of a simple machine	• ***Appreciating*** the use of simple machines in doing work e.g. bottle opener • ***Applying*** the formula to compare MA of different simple machines

Grade 11

General Outcomes:	**Key competences**
• 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	• 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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.3Thermal physics	11.3.1Simple kinetic theory of Matter.	11.3.1.1 Explain What the kinetic theory is 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. 11.3.1.5 Apply the kinetic theory to explain gas pressure.	• 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 • 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 • Kinetic theory in gas pressure(compressing a gas in a cylinder)	• ***Predicting*** the cause of continuous random motion of the discrete individual particles • ***Interpreting*** the intermolecular forces i.e. cohesive and adhesive in a much simpler way • ***Experimenting*** on the Brownian motion, diffusion, evaporation and cooling. • ***Collecting*** the data in an experiment • ***Formulating*** conclusion of experiment	• ***Cooperating*** in group activities • ***Being*** aware of the cohesive and adhesive forces in matter • ***Asking*** questions for more understanding • ***Asking*** more questions for more understanding

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.3.2 Measurement of temperature	11.3.2.1Explain what temperature is 11.3.2.2 Describe physical properties of substances which change with temperature. 11.3.2.3 Measure the temperature with thermometers 11.3.2.4Describe suitability of alcohol and mercury for use in liquid-in-glass thermometers. 11.3.2.5Describe the relationship between the Celsius and Kelvin scales. 11.3.2.6Describe the structure and use of a thermocouple thermometer 11.3.2.7Demonstrate the measurement of temperature using an appropriate thermometer.	• 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. • 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.	• ***Communicating*** information on temperature • ***Experimenting*** the thermal expansion of matter(liquid, solid, gases) • ***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 • ***Measuring*** temperature correctly using appropriate thermometers	• ***Asking*** questions for more understanding • ***Cooperating*** in groups activities • ***Appreciating*** the use of thermometers in determining temperature • ***Justifying*** the use of a specific thermometer • ***Appreciating*** the use of thermocouples

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.3.3Expansion of solids, liquids and gases.	11.3.3.1Describe qualitatively the thermal expansion of solids, liquids and gases. 11.3.3.2 Explain the effects of expansion of water on aquatic life. 11.3.3.3Demonstrate that solids, liquids and gases expand at different rates. 11.3.3.4Demonstrate how to determine the boiling and melting point of different substances. 11.3.3.5Explain effects of pressure on the melting and boiling points. 11.3.5.6Investigate effects of impurities on the melting and boiling Points of substances. 11.3.3.7 Demonstrate the	• The thermal expansion of matter: in terms of linear, area and volume expansion • Effects of Anomalous expansion of water • • Different rates of expansions of matter • Boiling and melting point 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) • Effects of impurities on the melting and boiling points of substances: such as Impurities	• ***Experimenting*** the thermal expansion of solids, liquids and gases • ***Communicating*** the effects of expansion on of water on aquatic life during extreme cold seasons. • ***Comparing*** the rates of expansion of matter. • ***Experimenting*** the boiling and melting points of matters • ***Collecting*** the data on temperature and time interval • ***Investigating*** the effect of impurities	• ***Appreciating*** the knowledge about expansion of solids, liquids and gases. • ***Cooperating*** in group activities • ***Asking*** questions for more understanding • ***Being*** aware of the effects of pressure on boiling and melting points • **Participating** in groups discussion

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		effect of varying pressure on volume of a gas 11.3.3.8 Describe the relationship between temperature and volume of a gas 11.3.3.9 Explain the Kelvin scale from the relationship between temperature and volume. 11.3.3.10Demonstrate the use of the ideal gas equation to solve simple numerical problems.	lower the melting point and increase the boiling point of a substance • Boyles law: use of equation PV=a constant at constant pressure • 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 • The ideal gas equation ($P_1V_1/T_1=P_2V_2/T_2$) and numerical problems.	on melting and boiling points • ***Organising*** and ***analysing*** the data on graphs • ***Organising*** data in the tables to verify the gas laws • ***Calculating*** the numerical problems based on gas laws	• Asking more questions for more understanding • ***Applying*** the use of graphs to relate variables • ***Appreciating*** the use the equation PV/T=constant

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.3.5Heat transfer by conduction, convection and radiation.	11.3.5.1 Explain methods of heat transfer. 11.3.5.2 Use kinetic theory to explain heat transfer. 11.3.5.3 Demonstrate heat conduction in different substances. 11.3.5.4 Demonstrate the uses of bad and good conductors of heat. 11.3.5.5Demonstrate convection in liquids and gases. 11.3.5.6 Demonstrate the differences between bad and good absorbers of radiant energy 11.3.5.7 Demonstrate the differences between good and bad heat emitters.	• 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 • Differences between good and bad absorbers of heat: e.g. shiny(white or silver) and dull(black surfaces • Differences between good and bad emitters	• ***Verifying*** the methods of heat transfer by experimentation • ***Identifying*** the relationship between kinetic theory to heat transfer • ***Communicating*** uses of bad and good conductors in everyday life • ***Observing*** heat transfer in fluids • ***Experimenting*** good and bad absorbers of radiant heat • ***Inferring*** good and bad emitters of heat.	• ***Participating*** in group activities during experiments. • ***Being*** aware of the different methods of heat transfer • ***Cooperating*** in group activities • **Asking** questions for more understanding • ***Appreciating*** the knowledge about

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			of heat such as shinning (white or silver) and dull (black surfaces • Application of knowledge on the processes of heat transfer: e.g. thermos flask, electric kettle ,land and sea breeze, greenhouse effect	• ***Investigating*** the daily applications of the methods of heat transfer	good and bad emitters • ***Appreciating*** the knowledge about heat transfer and its application
11.4 Wave motion	11.4.1 Simple ideas of the wave motion theory.	11.4.1.1 Demonstrate wave motion. 11.4.1.2 Distinguish between longitudinal and transverse waves. 11.4.1.3Describe the terms associated with waves 11.4.1.4 Apply the wave equation in solving wave motion	• 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 • The wave equation: Displacement-time and	• ***Designing*** experiments to demonstrate wave motion by using ropes, strings • ***Communicating*** terms associated with waves • ***Calculating*** numerical problems using the formula "v = fλ" • ***Communicating*** knowledge on the daily application of waves	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Being*** aware of the terms associated with wave motion • ***Appreciating*** the use of the formula to calculate the speed of a wave

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		problems 11.4.1.5 Explain the use of waves in everyday life.	displacement – distance graphs of a wave. (Use the equation v = fλ.) • Use of waves in our daily life: radio, television, ultrasonic etc.		• ***Participating*** in group activities
	11.4.3Electromagnetic spectrum	11.4.3.1Describe main components of electromagnetic spectrum. 11.4.3.2Describe the properties of electromagnetic waves 11.4.3.3Identify the sources of each of the rays in the electromagnetic spectrum.	• 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 x 10^8m/s) etc. • Sources of Components of electromagnetic spectrum: e.g. sun radioactive materials, oscillating electrical	• ***Communicating*** all components of electromagnetic spectrum • ***Communicating*** properties of electromagnetic spectrum • ***Analysing*** the sources of each of the electromagnetic rays waves • ***Communicating*** knowledge on how to detect the rays • ***Communicating*** the uses of electromagnetic waves • ***Investigating*** the	• ***Being*** aware of the components of electromagnetic waves and their properties. • ***Appreciating*** the knowledge about the existence of electromagnetic radiation. • ***Cooperating*** in group activities • ***Participating*** in groups actively

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.4.3.4 Describe the method of detection of each of the main components of the electromagnetic spectrum. 11.4.3.5 Explain the use of each of the waves in the electromagnetic radiation spectrum. 11.4.3.6 Explain the harmful effects of ultra violet radiation, gamma rays and x-rays to life.	circuit etc. • The method for detecting electromagnetic radiation • Uses of electromagnetic waves • Harmful effects of electromagnetic waves e.g. skin cancer etc.	harmful effects radiation	
11.5 Sound	11.5.1 Properties of sound	11.5.1.1Explain how sound is produced. 11.5.1.2 Describe what rarefactions and compressions are. 11.5.1.3 Describe the approximate range of audible frequencies. 11.5.1.4Investigate that	• 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	• ***Experimenting*** on sound production • ***Communicating*** knowledge about wave motion • ***Designing*** experiment that sound requires a medium for its	• ***Cooperating*** in group activities • ***Participating*** in groups actively • **Ask*ing*** questions for more understanding

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		sounds requires a medium for transmission. 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. 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. 11.5.1.11State how to minimise sound pollution	traveling through air and a vacuum • 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 • 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. • Measures to minimize sound pollution: such as sound proof	propagation through experimentation • ***Communicating*** knowledge about the speeds of sound in different medium. • ***Identifying*** factors that influence the quality of sound • ***Communicating*** the uses of ultrasonic • ***Investigating*** measures to minimize sound pollution	• ***Being*** aware of the fact that sound travels at different speeds in different media • ***Giving*** presentation • ***Listening*** to others with respect • ***Appreciating*** uses of ultrasonic

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			structures		
11.6Light	11.6.1 Rectilinear propagation of light	11.6.1.1Describe the rectilinear propagation of light. 11.6.1.2Investigate the formation of shadows and eclipse. 11.6.1.3Describe reflection of light. 11.6.1.4 Investigate the laws of reflection of light 11.6.1.5 Demonstrate the formation of images by plane mirrors. 11.6.1.6 Identify the position of an image using plane mirrors.	• 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. • Image in a plane mirror (virtual, laterally inverted ,position, position and size) • The position of an image: through Construction of ray diagrams	• ***Experimenting*** the nature of light (light travels in a straight line) • ***Predicting*** the formation of shadows and eclipse • ***Experimenting*** the laws of reflection • ***Investigating*** the characteristics of an image formed by plane mirrors using ray diagrams	• ***Appreciating*** the existence of light • ***Cooperating*** in group activities • ***Asking*** questions for more understanding • ***Giving*** presentation • ***Listening*** to others with respect • ***Appreciating*** image formed by plane mirror

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.6.2 Refraction of light	11.6.2.1 Describe what refraction of light is 11.6.2.2 Explain the terms of refraction of light 11.6.2.3 Verify the laws of refraction of light. 11.6.2.4 Describe what refractive index is. 11.6.2.5Investigate the refractive index of a glass block. 11.6.2.6Calculate refractive index of a substance (*n*) using real and apparent depth. 11.6.2.7 Explain the term 'critical angle'.	• 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 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 • 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	• ***Experimenting*** the refraction of light • ***Collecting*** data on the laws of refraction • ***Calculating*** the refractive index • ***Comparing*** the refractive index to critical angle • ***Observing*** the total internal reflection	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively • ***Applying*** the knowledge of refraction in daily life • ***Appreciating*** the knowledge on total internal reflection • ***Appreciating*** use of fibre glass

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.8 Describe the relationship between critical angle and refractive index. 11.6.2.9 Explain how total internal reflection occurs. 11.6.2.10 Explain how total internal reflection is used.	is 90^o • the relationship between critical angle and refractive index*:* n = sin 90^o/ sin c, Angle of incidence greater than critical angle • Internal reflection: all the light reflected inside the more denser medium • Use of internal reflection: optic fibre for communication		
	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. 11.6.3.3Demonstrate how to determine the focal	• 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	• ***Communicating*** different types of lenses • ***Experimenting*** to find out what happens to light when passed through lenses.	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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.	magnification=v/u" • Characteristics of image: in terms of the position, size and nature of images formed by converging lenses. • Use of lens: in correcting defects in vision: short sight-concave lens, long sight-convex lens, LCD, Camera etc.	• ***Inferring*** the focal length • ***Predicting*** the images formed by converging lenses • ***Investigating*** the uses of lenses	• ***Giving*** presentation of group activity • ***Listening*** to others with respect • ***Accept*** responsibility of group work

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.7 Magnetism	11.7.1 Simple phenomenon of magnetism.	11.7.1.1Describe properties of magnets 11.7.1.2Explain the domain theory of magnetism 11.7.1.3 Demonstrate induced magnetism. 11.7.1.4 Demonstrate the making of a magnet 11.7.1.5 Demonstrate the demagnetization 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. 11.7.1.8 Explain the use of magnetic screening and magnetic keepers. 11.7.1.9Describe the uses of magnets.	• 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 • 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). • 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	• ***Communicating*** knowledge on magnetism theory • ***Investigating*** induced magnetism • ***Experimenting*** on magnetization and demagnetization • ***Observing*** magnetic field lines using a compass and/ or iron filings • ***Formulating*** the pattern of magnetic field lines • ***Communicating*** information on the uses of magnets	• ***Cooperating*** in group activities • ***Asking*** questions for more understandin g • ***Participating*** in group activities actively • ***Applying*** the use of magnets in everyday life • ***Appreciating*** the uses of magnets

Grade 12

General Outcomes:	Key competences
• 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	• 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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT

			KNOWLEDGE	SKILLS	VALUES
12.8 Static electricity	12.8.1 Static Electricity.	12.8.1.1Demonstrate the existence of static charges 12.8.1.2Explain how to detect electric charges. 12.8.1.3 Describe the properties and uses of static charges 12.8.1.4 Describe the electric charging and discharging of objects. 12.8.1.5 Explain the relationship between current and static electricity. 12.8.1.6 Investigate effects of static charges on the environment.	• 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. • Electric charging and discharging of objects by friction and induction • Relationship between current and static electricity in terms of effects as static electricity producers same effect as current electricity. • Effects of static charges on an	• ***Experimenting*** the existence of charges by rubbing some materials • ***Detecting*** charge using an electroscope • ***Communicating*** properties and uses of static charge • ***Experimenting*** charging and discharging of objects • ***Communicating*** knowledge on the relationship between current and static electricity • ***Investigating*** the effects of static charges on the environment e.g. lightning	• ***Cooperating*** in group activities • ***Asking*** questions for more understanding • ***Participating*** in groups actively • ***Knowing*** the safe rules of experiment • ***Being*** aware of the effects of charges

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			environment: e.g. lightning etc		
12.9 Current electricity	12.9.1Electric charge, current, and potential difference.	12.9.1.1Describe the terms associated with electricity 12.9.1.2 Identify the units of electric charge and current. 12.9.1.3 Demonstrate how to measure an electric current. 12.9.1.4 Describe what potential difference is. 12.9.1.5 Describe what the volt is. 12.9.1.6 Differentiate between potential difference (PD) and electromotive force (EMF). 12.9.1.7 Describe the basic concept of EMF.	• 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	• ***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	• ***Participating*** in groups actively • Cooperating in group work • ***Appreciating*** the use of electrical appliance • ***Appreciating*** the safety rules during an experiments

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.1.8 Demonstrate the measuring of potential difference (PD) and electromotive force (EMF).	through a component • The maximum PD of a cell • Measurement of PD and EMF: Connecting terminals across source of electric current /conductor		
	12.9.2 Electric cells.	12.9.2.1Describe 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	• 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.	• ***Communicating*** the structure of cells • ***Investigating*** charging and discharging an acid accumulator • ***Communicating*** appropriate methods of disposing off used cells	• ***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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.3 Electrical resistance.	12.9.3.1Explain the meaning of resistance 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. 12.9.3.4 Describe what the internal resistance of a cell is. 12.9.3.5 Calculate the resistance in series and parallel circuits with Ohm's law.	• 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) • Internal resistance of a cell due to chemicals • Ohm's law in series and parallel circuits. (R = V/I)	• ***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	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively • ***Knowing*** the safe rules of an experiment
	12.9.4 Heating effect of an electric current.	12.9.4.1 Demonstrate energy transformations in an electric circuit. 12.9.4.2 Investigate the heating effect of an electric current.	• Conversion of energy from electricity to heat. • Heating effect of an electric current in	• ***Analysing*** energy changes from one form to the other • ***Investigating*** the heating effect of an electric current	• ***Asking*** questions for more understanding • ***Cooperating*** in group

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.4.3 Demonstrate how to calculate electrical energy. 12.9.4.4 Describe the relationship of voltage, current and power. 12.9.4.5 Demonstrate how to calculate the cost of using electrical Energy 12.9.4.6 Describe the use of switches, fuses, earthing and the three pin-plugs. 12.9.4.7 Explain the need for earthing metal cases and for double Insulation. 12.9.4.8Describe the meaning of three wires found in the cable 12.9.4.9 Describe the domestic electrical wiring system 12.9.4.10 Describe ways of conserving electrical	heating appliances. • Calculations of electrical energy: Use of formula (E= VIt, etc.) • The relationship of voltage, current and power: Power=voltage x current(P=VI) • Cost of using electrical energy: use of kWh as a unit of electrical energy • Electrical components: e.g. switches (on /off	• ***Calculating*** electrical energy using E=VIt • ***Communicating*** relationship among power, voltage and current • ***Calculating*** the cost of using electrical energy • ***Communicating*** the use of some named electrical components • ***Investigating*** the safety precautions • ***Communicating*** the colouring of insulators • ***Investigating*** the basic wiring system in a house	activities • ***Participating*** in group activities actively • ***Appreciating*** the use of electricity at home • ***Cooperating*** in group activities • ***Applying*** the safety precautions in the use of electricity • ***Appreciating*** the use of energy saving bulbs

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES

		energy in homes and industry.	power), fuses
			• (Prevent appliances from damage), and the three pin-plugs (connecting appliance).
			  • Safety precautions (prevent electric shocks, accidents)
			  • Three types of Wires: Live (brown), earthling (green and yellow) and neutral(blue)
			• Household circuits: such as cooker circuit, ring circuit, lighting circuit
			• Ways of conserving electrical energy: using energy saving bulbs, switch and save etc.
				• ***Communicating*** ways of conserving energy	

TOPIC	SUBTOPIC	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. 12.9.5.2 Describe the applications of the magnetic effect of an electric current. 12.9.5.3 Explain the behaviour of an electric current in a magnetic field. 12.9.5.4 Describe the application of a current placed in a magnetic field. 12.9.5.5 Describe the nature of forces between parallel currents. 12.9.5.6 Describe the effect of magnetic fields on	• Lines of force (Magnetic flux) : patterns of electric currents • Applications of electromagnets: electric bells relay switches etc. • The behaviour of an electric current in a magnetic field: Displacement of current carrying wire current or electron beam • Applications of current in a magnetic field: e.g. D.C. motors, galvanometers, ammeter etc. • Nature of forces: attraction and repulsion of forces between parallel currents.	• ***Experimenting*** the magnetic field patterns of electric currents • ***Communicating*** use of electromagnets • ***Investigating*** the displacement of a current carrying wire in a field • ***Inferring*** the attraction and repulsion of forces between parallel currents • ***Investigating*** the effects of magnetic fields	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively • ***Asking*** questions for more understanding • ***Applying*** the effects of magnetic field

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		human health and environment.	• Effects of magnetic fields: hearing impairment, radar interference in communication,etc		
12.10 Electromagnetic induction	12.10.1 The phenomenon of electromagnetic induction.	12.10.1.1 Investigate the phenomenon of electro-magnetic induction. 12.10.1.2 Describe the factors affecting magnitude and direction of induced EMF. 12.10.1.3 State the direction of current produced by an induced EMF.	• 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 • Direction of induced current: Lenz and Fleming right hand law.	• ***Experimenting*** the induction of an EMF/current using a magnet, a coil and ammeter • ***Collecting*** data • ***Organising*** the data in a table • ***Interpreting*** the data • ***Analysing*** the factors that affect the magnitude of the induced current/EMF • ***Inferring*** the direction of induced current with Fleming right hand rule	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively • ***Knowing*** the safe rules of experiment
	12.10.2 The simple A.C. and D.C. generators.	12.10.2.1 Describe simple A.C. and D.C. generators.	• Generators: simple A.C. generator (an alternator with slip-rings) and simple	• ***Communicating*** A.C. and D.C. generators • ***Comparing*** the structure and nature	• ***Asking*** questions for more understanding

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.2.2 Compare the simple A.A. generator with a simple D.C. generator in terms of structure and its nature. 12.10.2.3 Describe the action of a diode in rectification. 12.10.2.4 Explain conversion of an A.C. generator to a D.C. generator. 12.10.2.5 Contrast the current produced by the D.C. generator with that produced from batteries.	D.C. dynamo with a commutator • Sstructure and its nature of simple A.C and D.C generators • Action of diodes: change A.C. to D.C. by allowing current to flow in one way • Conversion of A.C. generator to D.C. generator by use of commutator • The direction of Current from D.C generator(varies) and from batteries(constant)	of an A.C. and D.C. generators • ***Communicating*** rectification of alternating current using diodes • ***Comparing*** the direction of current produced by a D.C. generator to the one produced from batteries	• ***Cooperating*** in group activities • Participating in group activities actively • ***Appreciating*** the use of the generators and batteries

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.3 Transformers.	12.10.3.1 Demonstrate the principles of mutual induction. 12.10.3.2 Describe the structure and operation of iron core transformers. 12.10.3.3 Apply the transformer and power equations to solve numerical problems involving ideal transformers 12.10.3.4 Calculate the efficiency of a transformer given data. 12.10.3.5 Explain advantages of high alternating potential difference power transmission. 12.10.3.6 Describe the implications of	• 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 • Equations of transformer and power: using relations $\frac{Vp}{V_s} = \frac{Np}{N_s}$ and $Vp\ Ip = V_s\ I_s$ (ideal transformer) • Calculation of efficiency: [Efficiency = $(V_s\ I_s)/(Vp\ Ip) \times 100\%$]	• ***Designing investigations*** to verify mutual induction • ***Communicating*** step up and step down transformers • ***Calculating*** problems relating to the transformers and power using formulae • ***Calculating*** the efficiency of a transformer • ***Communicating*** knowledge on the environmental and cost implications of underground power transmission	• ***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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		underground power transmission compared to overhead lines. 12.10.3.7 Describe the effects of improper management of transformers	• 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		
12.11 Basic electronics	12.11.1Thermionic emission and electrons.	12.11.1.1 Describe What thermionic emission is 12.11.1.2 Investigate properties of cathode rays 12.11.1.3 Distinguish	• 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.	• ***Investigating*** properties of cathode rays by using a CRO • ***Comparing*** the direction of flow of electrons to conventional current • ***Communicating*** the	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		between direction of flow of electrons and flow of conventional current. 12.11.1.4 Describe applications of electron beams. 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.	• Direction of flow of electrons and conventional current • Application of electron beams in CRO ,TV set, X-ray machines etc • 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	devices that make use of electron beams in their operation • ***Investigating*** the basic structure of a CRO. • ***Measuring*** quantities using a CRO	• ***Appreciating*** the use of the cathode rays in specific devices • ***Being*** aware of the structure of a CRO • ***Appreciating*** the use of a CRO in measuring some quantities
12.12. Atomic physics	12.12.1 Nuclear atom	12.12.1.1Describe the structure of the atom. 12.12.1.2 Describe the	• Atomic structure (nucleus and electrons)	• ***Communicating*** an atomic structure • ***Communicating***	• ***Asking*** questions for more

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		composition of the nucleus in terms of protons and neutrons. 12.12.1.3Explain mass number and atomic number.	• Composition of the nucleus (protons and neutrons) • Mass number and Atomic number: mass (Nucleon) number, A, and atomic (proton), number, Z.	knowledge on the existence of protons and neutrons in the nucleus of an atom	understanding • Cooperating in group activities
	12.12.2 Radioactivity.	12.12.2.1 Describe the nature of radioactivity. 12.12.2.2 Describe the characteristics of the three kinds of radioactive radiations: alpha, beta and gamma. 12.12.2.3 Describe methods of detecting radioactive emissions. 12.12.2.4 Explain the origin	• 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) • Detection of radioactive emissions:	• ***Investigating*** the nature of radioactivity • ***Investigating*** radiation using a G.M counter • ***Understanding*** the causes and effects of background radiation • ***Comparing*** nuclear fission to nuclear fusion • ***Calculating*** half life of a radioactive material by using	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Appreciating*** the use of a GM counter to detect radiation • ***Being*** aware of the existence of background radiation and its effects

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		and effects of background radiations 12.12.2.5 Describe what radioactive decay is. 12.12.2.6 Describe what nuclear fusion and fission is. 12.12.2.7 Demonstrate how to determine half-life of a radioactive material. 12.12.2.8 Explain uses of radioactive substances. 12.12.2.9 Describe the safety	by G.M tube, photographic plate, scintillation counter, bubble chamber • Causes of background radiation (cosmic rays, radioactive elements under rocks.) • 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 • Half life of a radioactive material: Time taken for activity to reduce by half of the original	decay curves • ***Communicating*** the uses of radioactive substances • ***Communicating*** knowledge on safety precautions • ***Investigating*** management practices which safeguard the environment from radioactive contamination	• ***Appreciating*** the use of decay curves to determine half life • ***Participating*** in group activities actively • ***Applying*** safety precautions when dealing with radioactive substances

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		precautions necessary when handling or storing radioactive substances. 12.12.2.10. Explain the effects of radioactive substances on the environment and health. 12.12.2.11. Investigate management practices which safeguard the environment from radioactive contamination.	substance (Decay curves) • Uses of radioactive substances: e.g. medical, industrial, agricultural uses • Use of protective materials: such as gloves, goggles, overalls and lead shields • Effect of radioactive substances: such as radiation pollution and health hazards • Appropriate management safe guard practices		

PRACTICAL 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.

SECTION B: CHEMISTRY

GRADE 10

General Outcomes:	**Key competences**
• 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	• 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

• 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	

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1 Introduction to Chemistry	10.1.1 Introduction to Chemistry	10.1.1.1 Describe Chemistry. 10.1.1.2 Classify the branches of chemistry 10.1.1.3 Explain the importance of chemistry. 10.1.1.4 Describe the challenges of chemical industrial activities 10.1.1.5 Demonstrate an	• The study of matter and their chemical changes • Branches such as: Analytical, Biochemistry, Inorganic, Physical and Organic • Improved life through manufacture of soaps, detergents, plastic, sugar, cement, paper, medicines, food production and other life necessities • Production of undesired harmful by-products. • Safety rules in the lab	• ***Classifying*** of chemistry into its branches • ***Identifying*** different branches of chemistry • ***Differentiating*** chemistry from the other natural sciences	• ***Asking*** questions for more understanding • ***Awareness*** of chemistry branches • ***Appreciating*** chemistry

		appreciation of safety in the laboratory.			

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.2The Particulate nature of matter	10.2.1 Matter and the Kinetic theory	10.2.1.1 Describe matter 10.2.1.2 Classify the basic units of matter 10.2.1.3Classify the states of matter. 10.2.1.4 Illustrate changes of states of matter. 10.2.1.5 Describe the absorption of heat and release of heat during changes of states of matter	• Anything that has **mass** and occupies space • Atoms ,molecules ,ions • Kinetic theory: in terms of particle arrangement and movement. Solid, liquid, gas • Changes of states such as melting, freezing, boiling, condensation, sublimation in terms of kinetic theory • Changing states of matter, exothermic-release of heat during a reaction, endothermic-absorption of heat during a reaction, include heating and cooling curves	• ***Classifying*** the basic units and states of matter • ***Demonstrating*** the changes of states of matter • ***Inferring*** data on absorption and release of heat during changes of states of matter	• ***Appreciating*** the basic units of matter and its existence in three states • ***Applying*** changes of states of matter in everyday life
	10.2.2 Diffusion	10.2.2.1Describe diffusion	• Movement of particles from region of higher concentration to region of lower concentration	• ***Demonstrating*** the movement of particles in fluids • ***Comparing***	• ***Appreciating*** diffusion • ***Asking*** more questions to learn

		10.2.2.2 Demonstrate diffusion in fluids 10.2.2.3Describe the factors that affect the rate of diffusion	• Liquids and gases (Brownian motion) • E.g. molecular mass, temperature, concentration	movement of particles in fluids and factors affecting their speed of movement	more • ***Fostering*** teamwork

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TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.3 Experimental Techniques	10.3.1 Measuring of quantities	10.3.1.1Demonstratehow 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	• 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.	• ***Demonstrating*** accurate measurement of values of various quantities • ***Identifying*** different measuring apparatus	• ***Applying*** safety rules in use of apparatus
	10.3.2 Criteria of purity	10.3.2.1Describe the differences between a pure substance and a mixture. 10.3.2.2Demonstrate how to determine the purity	• In terms of melting points and boiling points • Sharp melting for pure substance and melting	• ***Demonstrating*** determination of purity of substances • ***Comparing*** pure and impure substances	• ***Appreciating*** purity of substances

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		of a substance 10.3.2.3 Explain the importance of purity of a substance	over a range of temperatures for a mixture. • Importance of purity in substances such as foodstuffs, medicines, drinks		
	10.3.3Separating mixtures	10.3.3.1Distinguish between physical and chemical changes 10.3.3.2Demonstrate different methods of separating mixtures 10.3.3. Interpret simple paper chromatograms.	• 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	• ***Analysing*** the components in the mixture • ***Identifying*** appropriate methods for separating different mixtures	• ***Appreciating*** of the purity of substances • ***Applying*** separation techniques in everyday life

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			paper chromatography)		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.4Atoms, elements, compounds and molecules	10.4.1Atomic structure and Periodic Table	10.4.1.1 Describe an atom and its structure. 10.4.1.2Describe the relative charges and	• 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) • Charges as: +1,0,-1	• ***Identifying*** atoms, elements molecules and compounds • ***Calculating*** relative atomic mass	• ***Awareness*** of the atomic structure

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		approximate relative masses of protons, neutrons and electrons 10.4.1.3Describe the proton (atomic)number and nucleon(mass) number and nuclide notation 10.4.1.4 Describe an element 10.4.1.5 Identify elements using their chemical symbols 10.4.1.6Describe the basis of the Periodic Table 10.4.1.7Describe isotopes 10.4.1.8Calculate relative atomic mass of an element given the %	Masses as: 1, 1, 1/1840 • As number of protons: Z, number of nucleons: A (protons + neutrons)and nuclide notation ${}^{A}_{Z}\mathrm{X}$ • 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 • As atoms with same number of protons but different numbers of neutrons, including radioactive and non-radioactive isotopes • As sum of the products		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		abundances of isotopes and from mass spectrum. 10.4.1.9Describe the use of radioactive isotopes 10.4.1.10 Demonstrate the build-up of electrons in shells	of the percentages and their mass numbers • Such as in medical treatment of cancer, industrial use as tracers • Electronic configuration of atoms (spdf configuration is **NOT** required)		
	10.4.2 Bonding	10.4.2.1 Describe a compound 10.4.2.2 Describe the formation of ions (radicals). 10.4.2.3Describe the formation of ionic (electrovalent) bonds. 10.4.2.4 Describe the formation	• 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, $CaCl_2$ and MgO • Covalent bonding as	• ***Classifying*** ionic compounds and covalent compounds	• ***Appreciating*** the use of ionic compounds and covalent compounds

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		of covalent bonds 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 10.4.2.7 Describe a molecule 10.4.2.8Describe valency and valence electrons. 10.4.2.9Demonstrate how to deduce valency of an element. 10.4.2.10Formulate chemical	sharing of electrons between non-metallic atoms. Covalent bonds as shared pairs of electrons. Such as H_2, Cl_2,H_2O, NH_3, CH_4, HCl, C_2H_6 • Such as double bonds in O_2,C_2H_4andCO_2, Triple bond in $N_2$and C_2H_2 • 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. • Valency as combining power of an atom or radical. Valence electrons as the number of electrons in the outer most shell. • From the formula of a compound, ionic charge,		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		formulae of compounds. 10.4.2.11 Identify the differences in properties of ionic and covalent compounds. 10.4.2.12 Describe metallic bonding 10.4.2.13 Describe the electrical and thermal conductivity of metals	valence electrons. • Using valency and chemical symbols of elements, charges on ions, models, relative numbers of atoms present, diagrammatic representation. • Differences such as volatility, electrical conductivity, density, melting point, boiling point and basic units. • As lattice of positive ions in a 'sea' of delocalised electrons • Due to free electron movement/delocalised electrons		
	10.4.5 Chemical formulae and	10.4.4.1 Demonstrate how to construct word equations. 10.4.4.2 Formulate and balance chemical equations.	• Equation showing reactants and products separated by a full curled arrow (➔). • Number of atoms of each element being equal	• ***Demonstrating*** construction of word equations • ***Formulating*** balanced chemical and ionic	• ***Appreciating*** the conservation of matter.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	equations	10.4.4.3 Construct net ionic equations from balanced chemical equations.	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.	equations.	

GRADE 11

General Outcomes:	Key Competences
• 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 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 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	• 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	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.5Acids, 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. 11.5.1.2 Describe the meaning of weak,	• 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.	• ***Identifying*** acids and bases. • ***Investigating*** the acidity and alkalinity of substances in everyday life	• ***Applying*** the uses of acids and bases

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		strong, dilute and concentrated acids and alkalis 11.5.1.3 Describe the pH scale 11.5.1.4 Describe neutrality, acidity and alkalinity in terms of pH value 11.5.1.5 Determine the pH value of a solution. 11.5.1.6 Demonstrate the characteristic properties of acids 11.5.1.7 Demonstrate the characteristic properties of bases	• Strength as degree of ionisation, Concentration as the number of ions per volume of solution. • As scale ranging from 0 to 14 showing the degree of acidity and alkalinity. • The pH values: 7 for neutrality, below 7 for acidity and above 7 for alkalinity • Using universal indicator: different colours at different pH values, Using pH meter: precise values • Such as reactions with metals, bases, carbonates/bicarbonates and effect on indicators. • Such as reactions with acids and ammonium salts, effect on indicators. • Such as in controlling the acidity in the soil,		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.8 Illustrate the importance of acid- base reactions 11.5.1.9 State the uses of acids and bases.	treatment of indigestion, brushing teeth with toothpaste. • Such as control of pH in agriculture, making of soap, in car batteries		
	11.5.2 Preparation of salts	11.5.2.1 Describe a salt 11.5.2.2Classify salts according to their nature and solubility in water. 11.5.2.3 Demonstrate the preparation of	• 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	• ***Classifying*** of salts • ***Demonstrating*** the preparation of soluble and insoluble salts • ***Differentiating*** hydrated and anhydrous salts	• ***Awareness*** of salts • ***Applying*** safety rules in preparation of salts

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		an insoluble salt. 11.5.2.4Demonstrate the preparation soluble salts. 11.5.2.5 Demonstrate the preparation of ammonium, potassium and sodium salts. 11.5.2.6 Demonstrate the existence of hydrated salts and differentiate from anhydrous salts 11.5.2.7 Describe the behaviour of salts with reference to the atmosphere.	• By reaction of acids with bases, suitable metals and carbonates/ bicarbonates. Separated by crystallisation and filtration. E.g. Zinc sulphate, copper (II) sulphate • 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. • As hygroscopic, efflorescent, deliquescent.		
	11.6.3 Types of oxides	11.5.3.1 Describe the various types of oxides.	• Acidic oxides as oxides with acidic properties such as SO_2 and CO_2.	• ***Classifying*** different types of	• ***Awareness*** of different types of oxides.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			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, H_2O. Amphoteric oxides as oxides with both acidic and basic properties ZnO, Al_2O_3 and PbO.	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. 11.6.4.2 Demonstrate the identity of gases.	• 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. • Gases being ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide. Refer to Qualitative notes	• ***Observing*** and ***interpreting*** results of reactions of ions with different test reagents. • ***Analysing*** chemical composition of salts. • ***Identifying*** gases	• ***Awareness*** about composition of salts • ***Appreciating*** different types of gases.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.6The mole concept	11.6.1 Relative masses	11.6.1.1 Describe Relative Atomic Mass and relative molecular mass. 11.6.1.2Calculate the relative formula mass of a compound	• 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.	• ***Comparing*** the relative atomic masses and relative molecular masses • ***Calculating*** relative molecular mass of compounds	• ***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.	• As number or quantities of particles e.g. atoms, ions, molecules, electrons equivalent to 6.02 x 10^{23}(Avogadro's constant) • Apply $n = {}^{m}/_{Mr}$ and $n = {}^{v}/_{Vm}$	• ***Analysing*** chemical substances quantitatively • ***Demonstrating*** acid-base titrations • ***Problem solving*** in mole concept	• ***Applying*** mole concept • ***Asking*** questions to learn more • ***Awareness*** of the mole concept • ***Fostering***

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.3Describe the relationship of Avogadro's law to reacting moles and volumes of gases at r.t.p and s.t.p. 11.6.2.4Determine the concentration of a solution and apply dilution law. 11.6.2.5Illustrate calculations involving stoichiometric reacting moles and volumes of gases and solutions. 11.6.2.6 Describe and calculate the percentage yield in a reaction and the percentage purity of a substance	where n = number of moles • As Molar gas volume (Vm) 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, $M_1V_1 = M_2V_2$. • 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		team work

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.6.2.7 Determine limiting reagent in a given reaction 11.6.2.9 Demonstrate calculations involving different types of acid–base titration reactions.	quantities • % 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 • Using titration law		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.7 Chemical reactions	11.7.1 Rates of chemical reactions	11.7.1.1Describe rate of a chemical reaction. 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. 11.7.1.4 Describe methods of controlling the rate of chemical reactions. 11.7.1.5 Describe the effect of a catalyst on the activation energy	• 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. • Made by either reducing or reducing the frequency of collisions between reacting particles such as explosions in flour mills/coal mines when ignited to surface area • Catalyst lowers the activation energy thus increasing the rate of a chemical reaction.	• ***Demonstrating*** factors that control the rate of chemical reactions. • ***Comparing*** experimental results at different conditions • ***Analysing*** and ***interpreting*** experimental results.	• Applying safety rules and the factors that affect the rate of chemical reactions. • ***Awareness*** of slow and spontaneous reactions.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.8The Periodic Table	11.8.1Groups and Periods	11.8.1.1Describe the Period 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	• As a tool for classifying elements. • Vertical columns as Groups and horizontal rows as Periods • As metallic and non-metallic	• ***Identifying*** of vertical columns and horizontal rows of the periodic table. • ***Classifying*** elements as metallic and non-metals	• 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.	• 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	• ***Identifying*** characteristics of representative elements from Groups. • ***Classifying*** elements according to their Groups and Periods	• ***Awareness*** of elements and their positions on the Periodic Table • ***Appreciating*** positioning of elements on the Periodic Table • ***Appreciating*** the uses of elements on

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.8.2.3 Describe the importance of halogens 11.8.2.4Describe the harmful effects of halides. 11.8.2.5Describe the use of the noble gases in providing an inert atmosphere	description as a collection of soft metals. • Such as fluoride in toothpaste, chlorine in water treatment, antiseptic, bromide in photographic film • 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.		the Periodic Table
	11.8.3 Transition metals	11.8.3.1 Describe transition metals. 11.8.3.2 Describe general properties of transition metals.	• 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. **Note**: Electronic	• ***Investigating*** the physical and chemical properties of transition elements. • ***Identifying*** transition metals	• ***Appreciating*** transition metals

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.8.3.3 Describe the uses of transition metals	configuration of transition metals will **not** be required • Uses such as catalysts, alloys, engineering materials NB: Heavy metals are no longer used to make paint for health reasons		

Grade 12

General Outcomes:	**Key competences:**
• 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 •	• Demonstrate ability to determine the reactivity series of metals • Demonstrate ability to prepare and test gases • Demonstrate ability to identify organic compounds

TOPIC	**SUBTOPIC**	**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	• Similar nuclei positive ions in a 'sea' of delocalised electrons. • Similar In terms of density, melting points, boiling points, appearance	• ***Identifying*** properties of metals.	• ***Appreciating*** metals

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		properties of metals	• All metals are electropositive as illustrated in the reaction with air, water / steam, dilute non-oxidizing acids, aqueous solutions of other metal ions.		
	12.10.2 Reactivity and Electro Chemical Series	12.10.2.1 Describe the reactivity series of metals 12.10.2.2. Explain the apparent non reactivity 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	• 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 • 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. • As related to the reactivity/stability of the	• ***Comparing*** methods of extracting metals.	• ***Awareness*** of methods of extracting metals and dangers some metals pose.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		metals and ammonium compounds. 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.	metallic ion present in the compound. Compounds of more reactive metals difficulty to decompose while compounds of less reactive metals easily decompose. • 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, alzehermia by aluminium		
	12.10.3 Alloys	12.10.3.1Describe alloys. 12.10.3.2Describe diagrammatic representations of alloys. 12.10.3.3 Explain the advantages of using alloys over pure metals.	• As mixture of two or metals/carbon such as steel, brass, bronze • Different nuclei positive ions in a 'sea' of delocalised electrons • Such as alloys exhibiting better properties compared to a pure metal (conductor, strength, weight ratio,	• ***Identifying*** characteristics of alloys • ***Comparing*** structures of alloys and pure metals.	• ***Appreciating*** alloys. •

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.10.3.4 Identify common uses of alloys	hardness). • Such as cutlery, food packaging, aircraft.		
	12.10.4 Corrosion	12.10.4.1 Describe corrosion 12.10.4.2 Relate corrosion to the reactivity of metals. 12.10.4.3 Describe different methods of preventing corrosion.	• As chemical wearing of metals resulting from attack by atmospheric oxygen in presence of moisture. • As more reactive metals easily corrode while less reactive metals do not easily corrode. • Such as sacrificial protection, painting, greasing/oiling, alloying and galvanising.	• ***Identifying*** corrosion. • ***Applying*** methods of reducing corrosion. • ***Relating*** sacrificial protection methods to reactivity series.	• ***Appreciating*** ways of minimizing corrosion.

TOPIC	SUBTOPIC	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.	• In terms of density, melting points, boiling points, oxidizing agent (electronegative elements)	• ***Identifying*** the physical and chemical properties of non-metals	• ***Appreciating*** non-metals.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	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 12.11.2.4 Describe industrial manufacture of hydrogen. 12.11.2.6 Describe the uses of hydrogen.	• 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, **o**dour, **d**ensity/"**w**eight", **s**olubility and chemical (effect on **l**itmus, **i**nflammability, combustion)(COWSLIPS) • By cracking, electrolysis of water (brine) and from natural gas • Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding.	• ***Demonstrating*** laboratory preparation of hydrogen.	• ***Appreciating*** physical and chemical properties of hydrogen and its uses. .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.3. Oxygen	12.11.3.1 Demonstrate the laboratory preparation, collection and test for oxygen. 12.11.3.2 Describe the physical and chemical properties of oxygen. 12.11.3.3 Describe the industrial manufacture of oxygen. 12.11.3.4 Describe the uses of oxygen in industry and in natural processes. 12.11.3.6 Explain the importance of ozone layer and dangers of its depletion. 12.11.3.7 Demonstrate the chemical test for water. 12.11.3.8 Describe the importance of water	• 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 • Such as burning, welding, in blast furnace and respiration . • It traps radiation, if depleted by CFCs causes skin cancer, respiratory diseases • Using white anhydrous copper (II) sulphate which turns blue. • For laundry, drinking,	• ***Demonstrating*** laboratory preparation of oxygen. • ***Observing*** the reaction.	• ***Appreciating*** physical and chemical properties of oxygen and its uses. .

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			as solvent.		
	12.11.4 Nitrogen	12.11.4.1 Describe industrial manufacture of nitrogen. 12.11.4.2 Explain the characteristics and importance of Nitrogen as a gas.	• By fractional distillation of liquid air • As non- reactive insoluble gas hence used as refrigerant, food packaging. Manufacture of ammonia gas.	• ***Demonstrating*** laboratory preparation of ammonia. • ***Observing*** colour changes.	• ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.4.3 Demonstrate the preparation collection and test for ammonia in the laboratory 12.11.4.4 Describe the manufacture of ammonia. 12.11.4.5 Describe the physical and chemical properties of ammonia. 12.11.4.8 Describe the thermal dissociation of ammonium salts. 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	• Action of a base on ammonium salt and collected by upward delivery method, turns damp red litmus paper blue. • Haber Process (Temperature, catalyst, pressure (Haber process). • In terms of **c**olour, **o**dour, **d**ensity/"**w**eight", **s**olubility and as reducing agent, a base/alkali, a complexing reagent. • Such as ammonium chloride, ammonium nitrate, ammonium carbonate. • 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		.
	12.11.7 Carbon	12.11.7.1 Describe allotropes	• As different forms of an	• ***Demonstrati***	• ***Appreciating***

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	and carbonates	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. 12.11.7.4 Demonstrate the laboratory preparation, collection and the test for carbon dioxide. 12.11.7.4 Describe the physical and chemical properties of carbon dioxide. 12.11.7.5 Describe the uses of carbon dioxide. 12.11.7.6 Describe the manufacture of lime from limestone. 12.11.7.7 Describe the uses of lime and slaked lime.	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. • By reaction of dilute acids with carbonates or bicarbonates, collected by downward delivery method/ above water, forms white precipitate with limewater. • 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. • By thermal dissociation of limestone	***ng*** laboratory preparation of carbon dioxide. • ***Observing*** colour changes.	physical and chemical properties of carbon dioxide and limestone and their uses. • ***Awareness*** of Global warming .

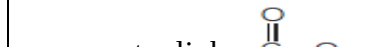
TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.7.8 Describe the uses of limestone. 12.11.7.9 Describe the greenhouse effect	• Such as in neutralizing acidic soils, lime as a drying agent for ammonia. • Such as in manufacturing of lime, cement, glass, iron. • As global warming due to increase of carbon dioxide in the atmosphere		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.12 Organic Chemistry	12.12.1Saturated and unsaturated Hydrocarbons	12.12.1.1 Describe an organic compound. 12.12.1.2 Describe hydrocarbon 12.12.1.3 Illustrate and name the structures of the aliphatic alkanes up to five carbon atoms. 12.12.1.4 Demonstrate the	• 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 *ane*, • Use idea of branched (side chains) and unbranched butane and pentane and	• ***Identifying*** alkanes and alkenes. • ***Comparing*** properties of alkanes and alkenes • ***Observing*** colour changes.	• ***Appreciating*** economic values of alkanes and alkenes. • ***Awareness*** of organic compounds. .

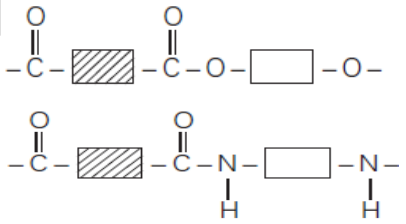
TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		structures of isomers and their names. 12.12.1.5 Describe fractional distillation of petroleum (crude oil) 12.12.1.6Describe the uses of the fractions of crude oil 12.12.1.7 Describe the chemical properties of alkanes. 12.12.1.8 Account for the apparent non reactivity of alkanes as compared to other organic compounds. 12.12.1.9 Illustrate unsaturation in alkenes. 12.12.1.10 Describe and name the structures of the alkenes up to	nomenclature follows IUPAC system. • As different fractions of crude oil collected at different boiling temperatures. • 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. • Use the concept of catenation and the general formula $C_nH_{2n.}$Structures must contain one carbon to carbon double bond. Named		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		5 carbon atoms. 12.12.1.11 Demonstrate the structures of isomers of alkenes. 12.12.1.12 Describe the chemical properties of alkenes. 12.12.1.13 Illustrate the differences and similarities between saturated and unsaturated Hydrocarbons. 12.12.1.14Describe the chemical tests for unsaturated hydrocarbons (alkenes) 12.12.1.15 Describe the uses of alkenes.	using the IUPAC system all should end with- *ene.* • Using the unbranched structures of butene and pentene (positional isomers). • Such as combustion, addition reactions (hydrogenation, hydration, hydrohalogenation, halogenation, addition polymerisation). • 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)		
	12.12.2	12.12.2.1 Describe the	• As an organic compound	• ***Identifying***	• ***Appreciating*** the

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	Alcohols (Alkanols)	chemical composition of an alcohol. 12.12.2.2 Describe and name structures of primary alcohols up to five carbon atoms. 12.12.2.3 Demonstrate isomerism in alcohols 12.12.2.4 Describe the formation of alcohols. 12.12.2.5 Describe the chemical properties of alcohols 12.12.2.6Describe the uses of alcohols	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- ***ol***). • Using branched and unbranched and positional isomers of propanol, butanol and pentanol. • By hydration of alkenes, hydrolysis of esters and fermentation for ethanol. • Such as combustion, esterification, dehydration and oxidation • Uses such as fuel, antiseptic, organic solvent, alcoholic beverages.	structures of alcohols. • ***Demonstrating*** isomerism in alcohols	properties and economic uses of alcohols

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.3Carboxylic acids (alkanoic acids)	12.12.3.1 Describe and name structures of carboxylic acids up to five carbon atoms. 12.12.3.2 Describe the formation of carboxylic acids 12.12.3.3 Demonstrate the chemical properties of carboxylic acids. 12.12.3.4Describe the uses of carboxylic acids	• Using concept of catenation (Chain), organic compounds with a carboxylic group (COOH), general formula $C_nH_{2n+1}COOH$, all should end with- ***oic acid.*** • By the oxidation of alcohols and hydrolysis of esters • Such as reaction with bases, carbonates, metals and alcohols (esterification). • Such as formation of esters.	• ***Identifying*** structures of carboxylic acids. • ***Demonstrating*** the chemical properties of carboxylic acids	• ***Appreciating*** the properties and economic uses of carboxylic acids.
	12.12.4 Esters (Alkanoates)	12.12.4.1 Describe and name the structures of esters up to five carbon atoms. 12.12.4.2 Describe the chemical properties	• Using the concept of catenation (Chain), Organic compounds with an ester link  and all should end with – ***oate.*** • Such as combustion and hydrolysis.	• ***Identifying*** structures and characteristic properties of esters. • ***Describing*** the chemical properties of esters	• ***Appreciating*** the properties and economic uses of esters.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		of esters 12.12.4.3Describe the uses of esters and relate the uses to properties.	• Such as in perfumes, food flavourants because of having pleasant smell.		
	12.12.5 Homologous series	12.12.5.1 Describe homologous series 12.12.5.2Describe the general characteristics of homologues (members).	• 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.	• ***Identifying*** different homologous series.	• ***Awareness*** of homologous series.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.12.6Macromolecules (Polymers)	12.12.6.1 Describe macromolecules (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.	• 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 • By condensation polymerisation, Nylon: from a diamine and dioic acid structures represented as:  • Terylene: from diol and dioic acid. Structures represented as:	• ***Classifying*** macromolecules • ***Identifying*** linkages in different macromolecules	• ***Awareness*** of polymers. • ***Appreciating*** economic use of polymers.

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.12.6.6 Differentiate between the structure of Nylon and Terylene. 12.12.6.7 Describe typical uses of plastics and synthetic fibres. 12.12.6.8 Describe the biodegradability of synthetic fibres. 12.12.6.9Describe natural macromolecules 12.12.6.10Describe 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. 12.12.4.13 Describe hydrolysis of fats (saponification). 12.12.4.14Identify the products of the hydrolysis of starch and proteins.	• Nylon as polyamide and Terylene as polyester. • Plastics used as in carrier bags, buckets, pipes Nylon and terylene as in clothing, tents, strings, ropes. • As non-biodegradable (cannot be broken down by microorganisms) • Such as Carbohydrates, proteins and fats (lipids). • 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-□-O-□- Proteins – amide, fats – ester linkages. • Such as difference and similarities between nylon and proteins. Terylene and fats.		

TOPIC	SUBTOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
			• As formation of soaps and glycerine (glycerol). • Using chromatography to identify the amino acids from proteins, simple sugars from starch.		

Chemistry Practical Syllabus

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^oC. Recommended thermometer range is -10^oC to 110^oC. 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 20 cm^3
Pipette fillers.
Thermometers calibrated -10^{o}C to 110^{o}C at intervals of 1^{o}C.
Stop clocks/stop watches which record time in seconds.
Wash bottles.
Pyrex test tubes are essential for heating purposes with capacities 125mmx 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/dm^3
Nitric acid 1.0 mol/dm^3
Sulphuric acid 0.5 mol/dm^3
Aqueous ammonia 1.0 mol/dm^3

Aqueous sodium hydroxide 1.0mol/dm^3
Lime water (a solution of calcium hydroxide)
Aqueous silver nitrate 0.05 mol/dm^3
Aqueous potassium dichromate (VI) 0.1 mol/dm^3
Aqueous potassium iodide 0.1 mol/dm^3
Aqueous lead (II) nitrate 0.2 mol/dm^3
Aqueous potassium permanganate (VII) approximate 0.02 mol/dm^3
Barium nitrate 0.2 mol/dm^3

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	Turns orange potassium dichromate

	potassium dichromate (VI)	green.

SCIENCE SCOPE AND SEQUENCE CHART:(PHYSICS) GRADE 10 -12

Topic	Grade 10		Grade 11		Grade 12
Unit 1 **Measurements**	**SUBTOPIC**	**Unit 3** **Thermal Physics**	**SUBTOPIC**		**SUBTOPIC**
	10.1.1 International System of Units (SI).		11.3.1Simple kinetic theory of Matter.	**12.8 Static electricity**	12.8.1 Static Electricity.
	10.1.2 Length and time		11.3.2Measurement of temperature	**12.9 Current electricity**	12.9.1Electric charge, current, and potential difference.
	10.1.3 Mass and, weight		11.3.3Expansion of solids, liquids and gases.		12.9.2 Electric cells.
	10.1.4 Density		11.3.4Heat transfer by conduction,		12.9.3 Electrical resistance

Unit 2 Mechanics	10.2.1 Scalars and vectors.		convection and radiation.		12.9.4 Heating effect of an electric current.
	10.2.2 Linear motion		11.3.5Measurements of heat.		12.9.5 Magnetic effects of electric currents. .
	10.2.3 Forces	**Unit 4 Wave motion**	11.4.1 Simple ideas of the wave motion theory.	12.10 Electromagnetic induction	12.10.1 The phenomenon 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, Energy and Power.		11.4.3Electromagnetic spectrum		12.10.3Transformers.
	10.2.6 Simple machines	**11.5 Sound**	11.5.1 Properties of sound	**12.11 Basic electronics**	12.11.1 Thermionic emission and electrons.
		Unit 6 Light	11.6.1 Rectilinear propagation of light.		12.11.2 Circuit components.
			11.6.2Refraction of light		12.11.3 Simple electronic systems
	10.2.7 Pressure		11.6.3Thin converging and diverging lenses.		12.11.4 Impact of electronics on society and industry.
		11.7 Magnetism	11.7.1 Simple phenomenon of	**12.12. Atomic physics**	12.12.1 Nuclear atom

			magnetism		
					12.12.2 Radioactivity

SCIENCE SCOPE AND SEQUENCE CHART:(CHEMISTRY) GRADE 10 -12

Topic	Grade 10		Grade 11		Grade 12
Unit 1	**SUBTOPIC**	**Unit 5**	**SUBTOPIC**	**Unit 9**	**SUBTOPIC**
Introduction to Chemistry	10.1.1 Introduction to Chemistry	**Acids, Bases and Salts**	11.5.1 Characteristic properties of acids and bases	**Chemistry and Electricity**	12.9.1.Conductors
Unit 2	10.2.1 Matter and the Kinetic theory		11.5.2 Preparation of salts	**Unit 10**	12.10.1 General properties of a metals
The Particulate nature of matter	10.2.2 Diffusion	**Unit 7**	11.6.3 Types of oxides	**Metals**	12.10.2 Reactivity and Electro Chemical Series
Unit 3	10.3.1 Measuring of quantities	**The mole concept**	11.6.4 Identification of		12.10.4 Corrosion

Experimental Techniques			ions and gases (Qualitative analysis)		
	10.3.2 Criteria of purity		11.6.1 Relative masses		12.10.5 Thermal stability of the compounds
	10.3.3Separatingmixtures		11.6.2 The mole	**Unit 11 Non Metals**	12.11.1 General properties of non-metals.
Unit 4 Atoms, elements, molecules and compounds	10.4.1Atomic structure and Periodic Table		11.6.3 Empirical and Molecular formulae		12.11.2. Hydrogen
	10.4.2 Bonding	**Unit 7 Chemical reactions and energy changes**	11.7.1 Rates of chemical reactions		12.11.3. Oxygen
	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
			11.7.4Energetics of reactions		12.11.6 Sulphur
		Unit 8 The Periodic Table	**11.8.1** Group and the periodic trends		12.11.7 Carbon and carbonates
			11.8.2 Group properties	**Unit 12 Organic Chemistry**	12.12.1 Saturated and unsaturated Hydrocarbons