

Republic of Zambia

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDCATION

**SCIENCE SYLLABUS**

**GRADES 10 – 12**



Prepared and Published by Curriculum Development Centre

P.O. Box 50092

**LUSAKA**

**2013**

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**VISION**

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

Table of Contents

[PREFACE ix](#_Toc379452111)

[ACKNOWLEDGEMENTS x](#_Toc379452112)

[INTRODUCTION xi](#_Toc379452113)

[MATHEMATICAL REQUIREMENTS xiv](#_Toc379452114)

[ASSESSMENT xv](#_Toc379452115)

[TIME AND PERIOD ALLOCATION xv](#_Toc379452116)

[GRADE 10 1](#_Toc379452117)

[10.1GENERAL PHYSICS 2](#_Toc379452118)

[10.1.1 International System of Units (SI). 2](#_Toc379452119)

[10.1.2 Length and time 3](#_Toc379452120)

[10.1.3 Mass and weight 3](#_Toc379452121)

[10.2MECHANICS 4](#_Toc379452122)

[10.2.1 Linear motion 4](#_Toc379452123)

[10.2.2 Forces 6](#_Toc379452124)

[10.2.3 Moment of Forces. 7](#_Toc379452125)

[10.2.4 Work, Energy and Power. 8](#_Toc379452126)

[10.2.6 Simple Machines 10](#_Toc379452127)

[GRADE 11 12](#_Toc379452128)

[11.3THERMAL PHYSICS 13](#_Toc379452129)

[11.3.2Measurement of Temperature 14](#_Toc379452130)

[11.3.3 Expansion of Solids, Liquids and Gases. 15](#_Toc379452131)

[11.3.5 Heat transfer by Conduction, Convection and Radiation. 18](#_Toc379452132)

[11.4 WAVE MOTION 20](#_Toc379452133)

[11.4.3Electromagnetic Spectrum 21](#_Toc379452134)

[11.5 SOUND 22](#_Toc379452135)

[11.5.1 Properties of Sound 22](#_Toc379452136)

[11.6 LIGHT 24](#_Toc379452137)

[11.6.1 Rectilinear Propagation of Light 24](#_Toc379452138)

[11.6.2 Refraction of Light 25](#_Toc379452139)

[11.7 MAGNETISM 28](#_Toc379452140)

[11.7.1 Simple　phenomenon of magnetism. 28](#_Toc379452141)

[GRADE 12 30](#_Toc379452142)

[12.8 STATIC ELECTRICITY 31](#_Toc379452143)

[12.8.1 Static 31](#_Toc379452144)

[Electricity 31](#_Toc379452145)

[12.9 CURRENT ELECTRICITY 32](#_Toc379452146)

[12.9.1 Electric charge, current, and potential difference. 32](#_Toc379452147)

[12.9.2 Electric cells 33](#_Toc379452148)

[12.9.3 Electrical resistance. 34](#_Toc379452149)

[12.9.4 Heating effect of an electric current. 35](#_Toc379452150)

[12.9.5 Magnetic effects of electric　currents. 37](#_Toc379452151)

[12.10ELECTROMAGNETIC INDUCTION 38](#_Toc379452152)

[12.10.1 The phenomenon of electromagnetic induction. 38](#_Toc379452153)

[12.10.2 The simple A.C. and D.C. generators. 39](#_Toc379452154)

[12.10.3 Transformers. 40](#_Toc379452155)

[12.11 BASIC ELECTRONICS 42](#_Toc379452156)

[12.11.1Thermionic emission and electrons 42](#_Toc379452157)

[12.12. ATOMIC PHYSICS 43](#_Toc379452158)

[12.12.1 Nuclear atom 43](#_Toc379452159)

[12.12.2 Radioactivity. 44](#_Toc379452160)

[SECTION B: CHEMISTRY 47](#_Toc379452161)

[GRADE 10 48](#_Toc379452162)

[10.1INTRODUCTION TO CHEMISTRY 49](#_Toc379452163)

[10.1.1 Introduction to Chemistry 49](#_Toc379452164)

[10.2THE PARTICULATE NATURE OF MATTER 50](#_Toc379452165)

[10.2.1 Matter and the Kinetic theory 50](#_Toc379452166)

[10.2.2 Diffusion 51](#_Toc379452167)

[10.3EXPERIMENTAL TECHNIQUES 51](#_Toc379452168)

[10.3.1Measuring of quantities 51](#_Toc379452169)

[10.3.2 Criteria of purity 52](#_Toc379452170)

[10.3.3Separating mixtures 53](#_Toc379452171)

[10.4ATOMS, ELEMENTS, COMPOUNDS AND MOLECULES 54](#_Toc379452172)

[10.4.1Atomic structure and Periodic Table 54](#_Toc379452173)

[10.4.2 Bonding 56](#_Toc379452174)

[10.4.5 Chemical formulae and equations 59](#_Toc379452175)

[GRADE 11 60](#_Toc379452176)

[11.5ACIDS, BASES AND SALTS 61](#_Toc379452177)

[11.5.1Characteristic properties of acids and bases 61](#_Toc379452178)

[11.5.2Preparation of salts 63](#_Toc379452179)

[11.6.3 Types of oxides 65](#_Toc379452180)

[11.6.4 Identification of ions and gases 65](#_Toc379452181)

[(Qualitative analysis) 65](#_Toc379452182)

[11.6THE MOLE CONCEPT 66](#_Toc379452183)

[11.6.1 Relative masses 66](#_Toc379452184)

[11.6.2 The mole 66](#_Toc379452185)

[11.7 CHEMICAL REACTIONS 69](#_Toc379452186)

[11.7.1 Rates of chemical reactions 69](#_Toc379452187)

[11.8THE PERIODIC TABLE 70](#_Toc379452188)

[11.8.1Groups and Periods 70](#_Toc379452189)

[11.8.2 Groups and Periodic trends 70](#_Toc379452190)

[11.8.3 Transition metals 71](#_Toc379452191)

[GRADE 12 72](#_Toc379452192)

[12.10 METALS 73](#_Toc379452193)

[12.10.1 General properties of a metals 73](#_Toc379452194)

[12.10.2 Reactivity and Electro Chemical Series 73](#_Toc379452195)

[12.10.3 Alloys 75](#_Toc379452196)

[12.10.4 Corrosion 76](#_Toc379452197)

[12.11 NON -METALS 77](#_Toc379452198)

[12.11.1 General properties of non-metals. 77](#_Toc379452199)

[12.11.2. Hydrogen 77](#_Toc379452200)

[12.11.3. Oxygen 78](#_Toc379452201)

[12.11.3. Oxygen 79](#_Toc379452202)

[12.11.4 Nitrogen 81](#_Toc379452203)

[12.11.7 Carbon and carbonates 83](#_Toc379452204)

[12.12 ORGANIC CHEMISTRY 85](#_Toc379452205)

[12.12.1 Saturated and unsaturated Hydrocarbons 85](#_Toc379452206)

[12.12.2 Alcohols (Alkanols) 88](#_Toc379452207)

[12.12.3Carboxylic acids (alkanoic acids) 89](#_Toc379452208)

[12.12.4 Esters (Alkanoates) 90](#_Toc379452209)

[12.12.5 Homologous series 90](#_Toc379452210)

[12.12.6Macromolecules (Polymers) 91](#_Toc379452211)

[SCIENCE PRACTICAL DATA (PHYSICS) 94](#_Toc379452212)

[SCIENCE PRACTICAL DATA (CHEMISTRY) 100](#_Toc379452213)

[APPARATUS 101](#_Toc379452214)

[REAGENTS 102](#_Toc379452215)

[QUALITATIVE ANALYSIS TESTS 103](#_Toc379452216)

[SCIENCE SCOPE AND SEQUENCE CHART (PHYSICS) 105](#_Toc379452217)

[SCIENCE SCOPE AND SEQUENCE CHART (CHEMISTRY) 107](#_Toc379452218)

# PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leader’s civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

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

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

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

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

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

Chishimba Nkosha

Permanent Secretary

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

# ACKNOWLEDGEMENTS

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

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

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

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

C.N.M Sakala (Mrs.)

Director-Standard and Curriculum

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

# INTRODUCTION

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

**General Aims**

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

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

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

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

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

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

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

* Knowledge with understanding

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

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

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

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

As the pupils study Science they should be able to:

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

**General Structure of the syllabus**

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

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

It is 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;

# ASSESSMENT

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

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

# TIME AND PERIOD ALLOCATION

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

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**SECTION A: PHYSICS**

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| GRADE 10 | |
| **General Outcomes:**   * Develop an understanding of General Physics * Develop investigative skills * Demonstrate an understanding of mechanics | **Key competences**   * Demonstrate ability to measure length, time, mass, weight and volume * Show skills and knowledge to calculate density, speed, velocity, acceleration and force * Demonstrate ability to use different sources of energy * Demonstrate ability to use simple machines to do work |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
| 10.1GENERAL PHYSICS | 10.1.1 International System of Units (SI). | * + - 1. Distinguish between basic and derived quantities       2. Identify basic units and derived units       3. 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   * Basic and Derived units: Basic units: metre(m), kilogram(Kg), seconds(S) , Kelvin(K) * Derived unit: Newton(N),metre per square second(m/s2) | * ***Comparing*** basic quantities and derived quantities. * *I****dentifying*** basic and derived units of quantities | * ***Asking*** questions about physical quantities * ***Participating*** in group actively |
| 10.1.1.4Identify basic units and derived units.  10.1.1.5Recognise prefixes, multiples and submultiples of fundamental and derived units.  10.1.1.6Use scientific notation and significant figures in numerical problems. | * Fundamental and derived units: Prefixes, multiples and submultiples of basic and derived unit * Scientific notation: numbers written using powers of ten and significant figures: important figures | * ***Comparing*** basic quantities and derived quantities. * ***Identifying*** basic and derived units of quantities * ***Expressing*** numbers in standard form | * ***Asking*** questions about physical quantities * ***Participating*** in group actively * ***Applying*** numbers in standard form |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 10.1.2 Length and time | 10.1.2.1 Demonstrate the use of various measuring instruments to 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 | * Use of measuring instruments: such as rules, vernier calipers and micrometer screw gauge to measure the physical quantity length * Use of devices for measuring time: Using clocks to measure time intervals and period of pendulum * A simple pendulum: Factors affecting the period of pendulum such as length and amplitude | * ***Measuring*** lengths of different objects * ***Measuring*** an interval of time using clocks * ***Communicating*** factors affecting the period of pendulum | * ***Participating*** in group actively * ***Asking*** questions for more understanding   ***Applying*** the use of clocks and devices to determine the period of pendulum |
| 10.1.3 Mass and weight | 10.1.3.1 Distinguish between mass and weight  10.1.3.2 Demonstrate how to measure mass and weight | * 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 | * ***Comparing*** mass with weight * ***Measuring*** mass and weight of objects | * ***Asking*** questions for more understanding * ***Appreciating*** the use of beam and spring balances |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.1.3.3Demonstrate how to locate the centre of mass of an object  10.1.3.4 Describe qualitatively the effect of the position of the centre of mass on the stability of an object. | * Locating the center of mass of an object: Use of lamina to locate centre of mass of an object * Stability of objects in terms of the position of the centre of mass e.g. equilibrium(stable ,unstable and neutral) | * ***Investigating*** the centre of mass of object * ***Communicating*** conditions for stability of objects, e.g. base, position of centre of mass | * ***Participating*** in group actively in locating the centre of mass |
| 10.2MECHANICS | 10.2.1 Linear motion | 10.2.1.1 Describe the terms used in mechanics.  10.2.1.2 Demonstrate the use of equations of uniformly accelerated motion to solve problems  10.2.1.3 Interpret graphical representation of distance-time, Displacement -time, speed-time, velocity-time and acceleration-time. | * 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 at2 v2 = u2 + 2as   * Graphical representation of motion in terms of ; rest, constant speed and constant acceleration | * ***Comparing*** distance with displacement; speed with velocity * ***Classifying*** appropriate equation(s) of motion to solve particular numerical problems * ***Plotting*** and ***interpreting*** graphs | * ***Participating*** in a group actively * ***Appreciating*** the use of equations of motion to solve problems * ***Appreciating*** graphs |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.2.1.4 Investigate the consequences of over speeding  10.2.1.5Describe the acceleration of free fall for a body near the earth.  10.2.1.6 Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance | * Consequences of over speeding e.g. brake failure resulting into car crush, loss of control * Acceleration of free fall for a body near the earth it is constant(approximately 10m/s2) * The falling motion of bodies in a uniform gravitational field: falling terminal velocity | * ***Predicting*** which object in motion would be damaged the most e.g. a slow moving vehicle or a fast moving vehicle , if they hit an obstacle * ***Calculating*** acceleration of a body due gravity * ***Communicating*** the cause and effect relationship of terminal velocity | * ***Appreciating*** speed limits , road humps, speed traps etc * ***Appreciating*** the use of parachutes from height |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 10.2.2 Forces | 10.2.2.1 Explain what force is.  10.2.2.2 Explain the effect of forces on bodies.  10.2.2.3 Describe the inertia law | * The definition of force: Force as “Pull” or “push” * Effects of forces :change in shape, change in size, change direction, change of motion * Resistance to change in state of motion (Newton’s 1st law) | * ***Communicating*** the effects of a force using a spring, trolley, Ticker Tape Timer etc. * ***Investigating*** the relationship between mass and acceleration, e.g. higher inertia is due to larger mass | * ***Participating*** in a group actively * ***Appreciating*** the use of safety belts on vehicles |
| 10.2.2.4 Demonstrate the relationship between force and acceleration  10.2.2.5 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) | * ***Describing*** the relationship between mass and acceleration * ***Organising*** the data of investigation in a table | * ***Appreciating*** Newton’s first law of motion * ***Giving*** a presentation of group work. * ***Knowing*** the safety rules of an investigation |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.2.2.6 Perform calculations on force.  10.2.2.7 Investigate the effect of force on a spring.  10.2.2.8 Demonstrate the effects of friction on the motion of a body.  10.2.2.9 Describe the motion in a circular path due to a perpendicular force. | * 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(v2/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 |
| 10.2.3 Moment of Forces. | 10.2.3.1 Perform calculations based on the principle of moments.  10.2.3.2 Investigate the everyday application of moments. | * 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 spanner , wheelbarrow etc |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 10.2.4 Work, Energy and Power. | 10.2.4.1 Explain the meaning of the terms work, energy and power.  10.2.4.2 Identify the units of measurement for work, energy and power | * 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) | * ***Communicating*** work, energy and power * ***Communicating*** the SI units for work, energy and power | * ***Justifying*** importance of conserving sources of energy * ***Cooperating*** in group activities |
| 10.2.4.3 Calculate work using the appropriate formula  10.2.4.4 Identify the different forms of energy | * 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 | * ***Calculating*** work, energy and power using appropriate formulae * ***Comparing*** different forms of energy | * **Appreciating** the use of clean energy (pollution free energy) * **Cooperating** in group activities |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.2.4.5Explain qualitatively and quantitatively the terms gravitational potential and kinetic energy. | * Potential and Kinetic Energy: Gravitational potential energy(energy due to position), Kinetic energy(energy due to motion)   NB: Gravitational potential energy(EP = mgh) and  kinetic energy  (EK = 1/2mv2 ) | * ***Communicating*** the knowledge on potential(EP) and kinetic(EK) energy | * ***Participating*** actively in groups |
| 10.2.4.6Describe sources of renewable and non- renewable energy.  10.2.4.7 Explain the effects of the use of energy sources on the environment. | * 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 | * ***Communicating*** renewable and non-renewable resources | * ***Participating*** actively in groups * ***Being*** aware that some energy sources are non- renewable |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.2.4.8 Demonstrate energy transformation from one form to another  10.2.4.9. Describe the conservation of energy  10.2.4.10. Demonstrate the calculation of efficiency of energy conversion using the appropriate formula  10.2.4.11.Demonstrate calculation of power using the appropriate formula | * Transformation of energy: e.g. chemical energy(Battery) to electric energy (wire)to light energy( bulb) * Law of conservation of energy * Calculation of efficiency of energy: Using the formula (Efficiency = energy output/ energy input x 100%) * Calculation of power: Using the formula   ( Power = work done/ time) | * ***Observing*** the effects of energy sources on the environment * ***Demonstrating*** energy transformations * ***Describing*** the law of conservation of energy * ***Calculating*** efficiency * ***Calculating*** power from the formula | * ***Asking*** questions for more understanding * ***Applying*** the law of conservation of energy * ***Justifying*** why the difference between energy input and energy output |
| 10.2.6 Simple Machines | 10.2.6.1Describe what a simple machine is  10.2.6.2Identify 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 |

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|  |  | 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. | * 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 | * ***Relating*** the distance moved by the effort to the distance moved by the load | * ***Appreciating*** the use of simple machines in doing work e.g. bottle opener |
| 10.2.6.5 Perform calculations  involving simple machines | * Mechanical advantage (MA = Load/Effort)   Velocity Ratio  (VR = distance moved by effort / distance moved by load)  Efficiency (; Efficiency = (MA/VR) x 100%) | * ***Calculating*** MA, VR and efficiency of a simple machine | * ***Applying*** the formula to compare MA of different simple machines |

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| GRADE 11 | |
| **General Outcomes:**   * Demonstrate an understanding of thermal physics * Develop investigative skills * Demonstrate an understanding of wave motion * Demonstrate an understanding of sound * Demonstrate an understanding of Light * Demonstrate an understanding of magnetism | **Key competences**   * Demonstrate ability to show how pressure varies with volume and temperature * Show skills and knowledge on the construction of thermometers * Demonstrate ability to show heat transfer in solids ,liquids ,and gases |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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| 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. | * 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 | * ***Predicting*** the cause of continuous random motion of the discrete individual particles | * ***Cooperating*** in group activities   ***Being*** aware of the cohesive and adhesive forces in 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 | * 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 | * ***Interpreting*** the intermolecular forces i.e. cohesive and adhesive in a much simpler way * ***Experimenting*** on Brownian motion | * ***Cooperating*** in group activities * ***Being*** aware of the cohesive and adhesive forces in matter |

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|  |  | 11.3.1.5 Apply the kinetic theory to explain gas pressure | * Kinetic theory in gas pressure(compressing a gas in a cylinder) | * ***Collecting*** the data in an experiment * ***Formulating*** conclusion of experiment | * ***Asking*** questions for more understanding |
| 11.3.2Measurement 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. | * 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. | * ***Communicating*** information on temperature * ***Experimenting*** the thermal expansion of matter(liquid, solid, gases) | * ***Asking*** questions for more understanding * ***Cooperating*** in groups activities * ***Appreciating*** the use of thermometers in determining temperature * ***Justifying*** the use of a specific thermometer |

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|  |  | 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 | * 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 | * ***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 | * ***Appreciating*** the use of thermocouples |
| 11.3.3 Expansion of Solids, Liquids and Gases. | 11.3.3.1Describe qualitatively the thermal expansion of solids, liquids and gases. | * The thermal expansion of matter: in terms of linear, area and volume expansion | * ***Experimenting*** the thermal expansion of solids, liquids and gases | * ***Appreciating*** the knowledge about expansion of solids, liquids and gases. * ***Cooperating*** in group activities |

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|  |  | 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. | * Effects of Anomalous expansion of water * Different rates of expansions of matter | * ***Communicating*** the effects of expansion on of water on aquatic life during extreme cold seasons. * ***Comparing*** the rates of expansion of matter | * ***Appreciating*** the knowledge about expansion of solids, liquids and gases. |
| 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.  . | * Boiling and melting points of substances graphical representation and interpretation * Effects of pressure on melting and boiling point of substances: such as increase in pressure lowers the melting point) Boiling point(increased pressure increases the boiling point) | * ***Experimenting*** the boiling and melting points of matters * ***Collecting*** the data on temperature and time interval | * ***Cooperating*** in group activities * ***Asking*** questions for more understanding |

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|  |  | 11.3.5.6Investigate effects of impurities on the melting and boiling Points of substances  11.3.3.7 Demonstrate the effect of varying pressure on volume of a gas | * Effects of impurities on the melting and boiling points of substances: such as Impurities lower the melting point and increase the boiling point of a substance * Boyles law: use of equation   PV=a constant at constant pressure | * ***Investigating*** the effect of impurities on melting and boiling points * ***Organising*** and ***analysing*** the data on graphs | * ***Asking*** questions for more understanding * ***Being*** aware of the effects of pressure on boiling and melting points |
| 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. | * Charles law: as temperature against volume of a gas   V1/T1 = V2/T2   * Kelvin Scale; volume- temperature change (constant pressure ) Graphical extrapolation | * ***Organising*** data in the tables to verify the gas laws | * ***Participating*** in groups discussion * ***Asking*** more questions for more understanding * ***Applying*** the use of graphs to relate variables |

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|  |  | 11.3.3.10Demonstrate the use of the ideal gas equation to solve simple numerical problems. | * The ideal gas equation (P1V1/T1=P2V2/T2) and numerical problems | * ***Calculating*** the numerical problems based on gas laws | * ***Appreciating*** the use the equation PV/T=constant |
| 11.3.5 Heat 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. | * 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 | * ***Verifying*** the methods of heat transfer by experimentation * ***Identifying*** the relationship between kinetic theory to heat transfer | * ***Participating*** in group activities during experiments.   ***Being*** aware of the different methods of heat transfer |

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|  |  | 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. | * Differences between good and bad absorbers of heat: e.g. shiny(white or silver) and dull(black surfaces * Differences between good and bad emitters of heat such as shinning (white or silver) and dull (black surfaces | * ***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. | * ***Cooperating*** in group activities * **Asking** questions for more understanding * ***Appreciating*** the knowledge about good and bad emitters |
| 11.3.5.8 Explain every day’s applications of knowledge on conduction, convection and radiation. | * 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 | * ***Appreciating*** the knowledge about heat transfer and its application |

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| 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 | * 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 | * ***Designing*** experiments to demonstrate wave motion by using ropes, strings * ***Communicating*** terms associated with waves | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Being*** aware of the terms associated with wave motion |
| 11.4.1.4 Apply the wave equation in solving wave motion problems  11.4.1.5 Explain the use of waves in everyday life. | * The wave equation: Displacement-time and displacement – distance graphs of a wave. (Use the equation v = fλ.) * Use of waves in our daily life: radio, television, ultrasonic etc. | * ***Calculating*** numerical problems using the formula   “v = fλ”   * ***Communicating*** knowledge on the daily application of waves | * ***Appreciating*** the use of the formula to calculate the speed of a wave * ***Participating*** in group activities |

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|  | 11.4.3Electromagnetic Spectrum | 11.4.3.1Describe main components of electromagnetic spectrum.  11.4.3.2Describe the properties of electromagnetic waves | * 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 108m/s) etc. | * ***Communicating*** all components of electromagnetic spectrum * ***Communicating*** properties of electromagnetic spectrum | * ***Being*** aware of the components of electromagnetic waves and their properties. |
| 11.4.3.3Identify the sources of each of the rays in the electromagnetic spectrum.  11.4.3.4 Describe the method of detection of each of the main components of the electromagnetic spectrum. | * Sources of Components of electromagnetic spectrum: e.g. sun radioactive materials, oscillating electrical circuit etc. * The method for detecting electromagnetic radiation | * ***Analysing*** the sources of each of the electromagnetic rays waves * ***Communicating*** knowledge on how to detect the rays | * ***Appreciating*** the knowledge about the existence of electromagnetic radiation. * ***Cooperating*** in group activities * ***Participating*** in groups actively |

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|  |  | 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. | * Uses of electromagnetic waves      * Harmful effects of electromagnetic waves e.g. skin cancer etc. | * ***Communicating*** the uses of electromagnetic waves * ***Investigating*** the harmful effects radiation | * ***Appreciating*** the knowledge about the existence of electromagnetic radiation. * ***Cooperating*** in group activities * ***Participating*** in groups actively |
| 11.5 SOUND | 11.5.1 Properties of Sound | 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 sounds requires a medium for transmission. | * Production of sound using vibrating objects * Sound wave essentials: rarefactions   (“stretches”) and compressions  (“Squashes”)   * Range of audible sound frequencies (20Hz to 20000Hz) * Effects of sound waves traveling through air and a vacuum | * ***Experimenting*** on sound production * ***Communicating*** knowledge about wave motion * ***Designing*** experiment that sound requires a medium for its propagation through experimentation | * ***Cooperating*** in group activities * ***Participating*** in groups actively * **Ask*ing***  questions for more understanding |

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|  |  | 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. | * 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 | * ***Communicating*** knowledge about the speeds of sound in different medium. | * ***Being*** aware of the fact that sound travels at different speeds in different media * ***Giving*** presentation * ***Listening*** to others with respect |
| 11.5.1.8 Describe the factors which influence the quality of sound  11.5.1.9 Describe what ultrasonic is  11.5.1.10 Describe the uses of ultrasonic. | * 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. | * ***Identifying*** factors that influence the quality of sound * ***Communicating*** the uses of ultrasonic | * ***Appreciating*** uses of ultrasonic * ***Listening*** to others with respect |

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|  |  | 11.5.1.11State how to minimise sound pollution | * Measures to minimize sound pollution: such as sound proof structures | * ***Investigating*** measures to minimize sound pollution | * ***Being*** aware of the fact that sound can pollute the environment |
| 11.6 LIGHT | 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 | * 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. | * ***Experimenting*** the nature of light (light travels in a straight line) * ***Predicting*** the formation of shadows and eclipse * ***Experimenting*** the laws of reflection | * ***Appreciating*** the existence of light * ***Cooperating*** in group activities * ***Asking*** questions for more understanding * ***Giving*** presentation * ***Listening*** to others with respect |

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|  |  | 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. | * Image in a plane mirror (virtual, laterally inverted ,position, position and size) * The position of an image: through Construction of ray diagrams | * ***Investigating*** the characteristics of an image formed by plane mirrors using ray diagrams | * ***Appreciating*** image formed by plane mirror |
| 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. | * 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 | * ***Experimenting*** the refraction of light * ***Collecting*** data on the laws of refraction * ***Calculating*** the refractive index | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Participating*** in group activities actively * ***Applying*** the knowledge of refraction in daily life |

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|  |  | 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’.  . | * Refractive index of glass * Using the formula; refractive index of substance = real depth/apparent depth” * Critical angle: as angle of incidence at which the angle of refraction is 90o | * ***Comparing*** the refractive index to critical angle | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Participating*** in group activities actively * ***Applying*** the knowledge of refraction in daily life |
| 11.6.2.8 Describe the relationship between critical angle and refractive index  11.6.2.9 Explain how total internal reflection occurs. | * The relationship between critical angle and refractive index*:*   *n* = sin 90o/ sin c, Angle of incidence greater than critical angle   * Internal reflection: all the light reflected inside the more denser medium | * ***Communicating*** the relationship between Critical angle and refractive index | * ***Cooperating*** in group activities * ***Participating*** in group activities actively |

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|  |  | 11.6.2.10 Explain how total internal reflection is used. | * Use of internal reflection: optic fibre for communication | * ***Observing*** the total internal reflection | * ***Appreciating*** use of fibre glass |
| 11.6. 3 Lenses. | 11.6.3.1 Describe different types of lenses.  11.6.3.2 Explain the action of lenses on beams of light.  11.6.3.3Demonstrate how to determine the focal length,  11.6.3.4 Demonstrate how to obtain images formed by converging lenses  11.6.3.5 Describe the uses of lenses in everyday life. | * Types of lenses; Convex(thin converging) and concave (diverging) * Types of rays: Converge and diverge rays of light * Focal length:   NB: use of formula:   * “1/f = 1/u +1/v Characteristics of image: in terms of the position, size and nature of images formed by converging lenses.   magnification=v/u”   * Use of lens: in correcting defects in vision: short sight-concave lens, long sight-convex lens, LCD, Camera etc. | * ***Communicating*** different types of lenses * ***Experimenting*** to find out what happens to light when passed through lenses. * ***Inferring*** the focal length * ***Predicting*** the images formed by converging lenses * ***Investigating*** the uses of lenses | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Participating*** in group activities actively * ***Giving*** presentation of group activity * ***Listening*** to others with respect * ***Accept*** responsibility of group work |

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| 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. | * 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 | * ***Communicating***  knowledge on magnetism theory * ***Investigating*** induced magnetism | * ***Cooperating*** in group activities * ***Asking*** questions   for more understanding   * ***Participating*** in group activities actively |
| 11.7.1.4 Demonstrate the making of a magnet  11.7.1.5 Demonstrate the demagnetisation of a magnet  11.7.1.6 Demonstrate the plotting of magnetic field lines.  11.7.1.7 Distinguish the magnetic properties of iron and steel. | * 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). | * ***Demonstrating*** on the making on magnets * ***Experimenting*** on the plotting of magnetic field * ***Differentiating*** between magnetic and non-magnetic materials | * ***Cooperating*** in group activities * ***Asking*** questions   for more understanding  ***Participating*** in group activities actively |

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|  |  | 11.7.1.8 Explain the use of magnetic screening and magnetic keepers.  11.7.1.9Describe the uses of magnets. | * 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 | * ***Experimenting*** on magnetisation and demagnetisation * ***Observing*** magnetic field lines using a compass and/ or iron filings * ***Formulating*** the pattern of magnetic field lines | * ***Applying*** the use of magnets in everyday life * ***Appreciating*** the uses of magnets |

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| GRADE 12 | |
| **General Outcomes:**   * Demonstrate an understanding about Static electricity * Develop investigative skills * Demonstrate an understanding of Current Electricity * Demonstrate an understanding about electromagnetic induction * Demonstrate an understanding of basic electronics * Demonstrate an understanding about atomic physics | **Key competences**   * Demonstrate ability to measure current and voltage * Show skills and knowledge to dispose cells and battery * Demonstrate ability to save electricity * Demonstrate ability to cost use of electricity |

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| 12.8 STATIC ELECTRICITY | 12.8.1 StaticElectricity | 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 | * 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. | * ***Experimenting*** the existence of charges by rubbing some materials * ***Detecting*** charge   using an electroscope   * ***Communicating*** properties and uses of static charge | * ***Cooperating*** in group activities * ***Asking*** questions for more understanding * ***Participating*** in groups actively * ***Applying*** the safety rules of experiment |
| 12.8.1.4 Describe the electric charging and discharging of objects.  12.8.1.5 Explain the relationship between current and static electricity. | * 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. | * ***Experimenting*** charging and discharging of objects * ***Communicating*** knowledge on the relationship between current and static electricity | * ***Asking*** questions for more understanding * ***Participating*** in groups actively * ***Knowing*** the safe rules of experiment |

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| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.8.1.6 Investigate effects of static charges on the environment. | * Effects of static charges on an environment: e.g. lightning etc | * ***Investigating*** the effects of static charges on the environment e.g. lightning | * ***Being*** aware of the effects of charges |
| 12.9 CURRENT ELECTRICITY | 12.9.1 Electric 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) | * Scientific Terms: such as Electric charge, potential difference and electric current * Units of electric charge and current: as Coulomb and ampere(I =Q/t * Measure an electric current in the circuit: Ammeter * Potential difference: as energy required to move a unit charge between two points in a circuit * Volt: as joules per coulomb * Difference between PD and EMF in terms of work done per unit of charge in driving charge in a circuit and through a component | * ***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 |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  |  | 12.9.1.7 Describe the basic concept of EMF.  12.9.1.8 Demonstrate the measuring of potential difference (PD) and electromotive force (EMF). | * The maximum PD of a cell * Measurement of PD and EMF: Connecting terminals across source of electric current /conductor | * ***Communicating*** basic concept of EMF * ***Experimenting*** on measurement of PD | * ***Appreciating*** the safety rules during an experiments |
| 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 |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  | 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. | * Resistance: opposition to the flow of charge * Value of resistance in series and parallel   (use formula 1/R = 1/R1 + 1/R 2 )   * Relationship between current and potential difference: (Graph of p.d. against current for Ohmic and non-Ohmic conductors) | * ***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 |
| 12.9.3.4 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. | * Internal resistance of a cell due to chemicals * Ohm’s law in series and parallel circuits.   ( R = V/I) | * ***Communicating*** internal resistance of a cell | * ***Cooperating*** in group activities * ***Participating*** in group activities actively |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 12.9.4 Heating effect of an electric current. | 12.9.4.1 Demonstrate energy transformations in an electric circuit.  12.9.4.2 Investigate the heating effect of an electric current.  12.9.4.3 Demonstrate how to calculate electrical energy. | * Conversion of energy from electricity to heat. * Heating effect of an electric current in heating appliances. * Calculations of electrical energy: Use of formula (E= VIt, etc.) | * ***Analysing*** energy changes from one form to the other * ***Investigating*** the heating effect of an electric current | * ***Cooperatin***g in group activities * ***Participating*** in group activities actively |
| 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. | * 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 power), fuses(Prevent appliances from damage), and the three pin-plugs (connecting appliance). | * ***Calculating*** electrical energy using E=VIt * ***Communicating*** relationship among power, voltage and current | * ***Appreciating*** the use of electricity at home * ***Applying*** the safety precautions in the use of electricity   ***Appreciating*** the use of energy saving bulbs |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  |  | 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 | * Safety precautions (prevent electric shocks, accidents) * Three types of Wires: Live (brown), earthling (green and yellow) and neutral(blue) | * ***Investigating*** the safety precautions * ***Communicating*** the colouring of insulator | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities |
| 12.9.4.9 Describe the domestic electrical wiring system  12.9.4.10 Describe ways of conserving electrical energy in homes and industry. | * Household circuits: such as cooker circuit, ring circuit, lighting circuit * Ways of conserving electrical energy: using energy saving bulbs, switch and save etc. | * ***Investigating*** the basic wiring system in a house * ***Communicating*** ways of conserving energy | * ***Appreciating*** the use of electricity at home * ***Applying*** the safety precautions in the use of electricity |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 12.9.5 Magnetic effects of electric　currents. | 12.9.5.1 Explain magnetic field patterns of electric currents.  12.9.5.2 Describe the applications of the magnetic effect of an electric current. | * Lines of force (Magnetic flux) : patterns of electric currents * Applications of electromagnets: electric bells relay switches etc. | * ***Experimenting*** the magnetic field patterns of electric currents * ***Communicating*** use of electromagnets | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities |
| 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 human health and environment. | * 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. * Effects of magnetic fields: hearing impairment, radar interference in communication etc | * ***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 * ***Applying*** the effects of magnetic field |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
| 12.10ELECTROMAGNETIC 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 * ***Analysing*** the factors that affect the magnitude of the induced current/EMF | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Participating*** in group activities actively * ***Knowing*** the safe rules of experiment |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  | 12.10.2 The simple A.C. and D.C. generators. | 12.10.2.1 Describe simple A.C. and D.C. generators.  12.10.2.2 Compare the simple A.A. generator with a simple D.C. generator in terms of structure and its nature. | * Generators: simple A.C. generator (an alternator with slip-rings) and simple D.C. dynamo with a commutator * Structure and its nature of simple A.C and D.C generators | * ***Communicating*** A.C. and D.C. generators * ***Comparing*** the structure and nature of an A.C. and D.C. generators | * ***Cooperating*** in group activities * Participating in group activities actively * ***Appreciating*** the use of the generators and batteries |
| 12.10.2.3 Describe the action of a diode in rectification.  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. | * 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) | * ***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 |

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| **TOPIC** | **SUB TOPIC** | **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. | * 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 | * ***Designing investigations*** to verify mutual induction * ***Communicating***  step up and step down transformers | * Participating in group activities actively |
| 12.10.3.3 Apply the transformer and power equations to solve numerical problems involving ideal transformers | * Equations of transformer and power: using relations   Vp = Np  Vs  Ns  and  Vp Ip= Vѕ Iѕ  (ideal transformer) | * ***Calculating*** problems relating to the transformers and power using formulae | * ***Appreciating*** of the use transformer |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  |  | 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 underground power transmission compared to overhead lines.  12.10.3.7 Describe the effects of improper management of transformers | * Calculation of efficiency: [Efficiency = (Vѕ Iѕ)/( Vp Ip) x 100%] * Advantage of high alternating potential difference power transmission: as in reducing power losses in cables. * Environmental and cost implications of underground power transmission * Effects of improper management of Transformers such as overheating, low/high voltage | * ***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 |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
| 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 | * 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 | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities * ***Participating*** in group activities actively |
| 12.11.1.3 Distinguish between direction of flow of electrons and flow of conventional current.  12.11.1.4 Describe applications of electron beams. | * Direction of flow of electrons and conventional current * Application of electron beams in CRO ,TV set, X-ray machines etc | * ***Comparing*** the direction of flow of electrons to conventional current |  |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.11.1.5 Describe the basic structure and an action of cathode-ray oscilloscope.  12.11.1.6 Describe the uses of cathode-ray oscilloscope. | * 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 | * ***Communicating*** the devices that make use of electron beams in their operation * ***Investigating*** the basic structure of a CRO. * ***Measuring*** quantities using a CRO * ***Communicating*** an atomic structure * ***Communicating*** knowledge on the existence of protons and neutrons in the nucleus of an atom | * ***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 * ***Asking*** questions for more understanding * Cooperating in group activities |
| 12.12. ATOMIC PHYSICS | 12.12.1 Nuclear atom | 12.12.1.1Describe the structure of the atom.  12.12.1.2 Describe the composition of the nucleus in terms of protons and neutrons.  12.12.1.3Explain mass number and atomic number. | * Atomic structure (nucleus and electrons) * Composition of the nucleus (protons and neutrons) * Mass number and Atomic number: mass (Nucleon) number, A, and atomic (proton), number, Z. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 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. | * 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) | * ***Investigating*** the nature of radioactivity * ***Investigating*** radiation using a G.M counter | * ***Asking*** questions for more understanding * ***Cooperating*** in group activities |
| 12.12.2.3 Describe methods of detecting radioactive emissions.  12.12.2.4 Explain the origin and effects of background radiations | * Detection of radioactive emissions: by G.M tube, photographic plate, scintillation counter, bubble chamber * Causes of background radiation (cosmic rays, radioactive elements under rocks.) | * ***Understanding*** the causes and effects of background radiation | * ***Appreciating*** the use of a GM counter to detect radiation * ***Being*** aware of the existence of background radiation and its effects |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.12.2.5 Describe what radioactive decay is.  12.12.2.6 Describe what nuclear fusion and fission is. | * 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 | * ***Comparing*** nuclear fission to nuclear fusion | * ***Awareness*** of radioactive substances |
| 12.12.2.7 Demonstrate how to determine half-life of a radioactive material.  12.12.2.8 Explain uses of radioactive substances. | * Half life of a radioactive material: Time taken for activity to reduce by half of the original substance (Decay curves) * Uses of radioactive substances: e.g. medical, industrial, agricultural uses | * ***Calculating*** half life of a radioactive material by using decay curves * ***Communicating*** the uses of radioactive substances | * ***Communicating*** knowledge on safety precautions * ***Appreciating*** the use of decay curves to determine half life |

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| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.12.2.9 Describe the safety precautions necessary when handling or storing radioactive substances. | * Use of protective materials: such as gloves, goggles, overalls and lead shields | * ***Demonstrating*** safety precautions when handling dangerous chemicals | * ***Applying*** safety precautions when dealing with 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. | * Effect of radioactive substances: such as radiation pollution and health hazards * Appropriate management safe guard practices | ***Investigating*** management practices which safeguard the environment from radioactive contamination | * ***Participating*** in group activities actively * ***Applying*** safety precautions when dealing with radioactive substances |

# SECTION B: CHEMISTRY

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| GRADE 10 | | |
| **General Outcomes:**   * Develop an understanding of Chemistry and its branches * Develop investigative skills about Chemistry * Demonstrate an understanding of the particulate nature of matter * Develop investigative skills about states of matter * Demonstrate an understanding of Experimental Techniques and its application in everyday life * Develop investigative skills in experimental techniques * Demonstrate an understanding of atoms, elements, molecules and compounds. * Develop investigative skills about the nature of substances. * Demonstrate an understanding of the importance, production, use, and effect on the environment of common elements and simple compounds |  | **Key competences**   * Demonstrate the ability to measure time ,temperature, mass and volume   • Show basic skills and knowledge in constructing balanced chemical equations with state symbols  • Demonstrate investigative skills in experimental techniques |  |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
| 10.1INTRODUCTION TO CHEMISTRY | 10.1.1 Introduction to Chemistry | 10.1.1.1 Describe Chemistry.  10.1.1.2 Classify the branches of chemistry | * The study of matter and their chemical changes * Branches such as: Analytical, Biochemistry, Inorganic, Physical and Organic | * ***Classifying*** of chemistry into its branches * ***Identifying*** different branches of chemistry | * ***Asking*** questions for more understanding * ***Awareness*** of chemistry branches |
| 10.1.1.3Explain the importance of chemistry.  10.1.1.4 Describe the challenges of chemical industrial activities  10.1.1.5Demonstrate an appreciation of safety in the laboratory. | * 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 | * ***Differentiating*** chemistry from the other natural sciences | * ***Appreciating*** chemistry |

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| **TOPIC** | **SUB TOPIC** | **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. | * Anything that has **mass** and occupies space * Atoms ,molecules ,ions * Kinetic theory: in terms of particle arrangement and movement. Solid, liquid, gas | * ***Classifying*** the basic units and states of matter | * ***Appreciating*** the basic units of matter and its existence in three states |
| 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 | * 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 | * ***Demonstrating*** the changes of states of matter * ***Inferring*** data on absorption and release of heat during changes of states of matter | * ***Applying*** changes of states of matter in everyday life |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 10.2.2 Diffusion | 10.2.2.1Describe diffusion  10.2.2.2 Demonstrate diffusion in fluids  10.2.2.3Describe the factors that affect the rate of diffusion | * Movement of particles from region of higher concentration to region of lower concentration * Liquids and gases   (Brownian motion)   * Factors of diffusion E.g. molecular mass, temperature, concentration | * ***Demonstrating*** the movement of particles in fluids * ***Comparing*** movement of particles in fluids and factors affecting their speed of movement | * ***Appreciating*** diffusion * ***Asking*** more questions to learn more   ***Fostering*** teamwork |
| 10.3EXPERIMENTAL TECHNIQUES | 10.3.1Measuring 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 |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 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 of a substance | * In terms of melting points and boiling points * Sharp melting for pure substance and melting over a range of temperatures for a mixture. | * ***Differentiating*** between melting points and boiling points * ***Demonstrating*** determination of purity of substances * ***Comparing*** pure and impure substances | * ***Appreciating*** purity of substances |
| 10.3.2.3 Explain the importance of purity of a substance | * Importance of purity in substances such as foodstuffs, medicines, drinks | * ***Communicating*** the importance of purity in substances | * ***Appreciating*** of the purity of substances |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 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 Rf values and distances covered by components (restricted to paper chromatography) | * ***Analysing*** the components in the mixture * ***Identifying*** appropriate methods for separating different mixtures | * ***Applying*** separation techniques in everyday life |

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| **TOPIC** | **SUB TOPIC** | **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 approximate relative masses of protons, neutrons and electrons | * 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   Masses as: 1, 1, 1/1840 | * ***Communicating*** atoms, elements molecules and compounds * ***Calculating*** relative atomic mass | * ***Awareness*** of the atomic structure |
| 10.4.1.3Describe the proton (atomic)number and nucleon(mass) number and nuclide notation | * As number of protons: Z, number of nucleons: A (protons + neutrons)and nuclide notationX | * ***Calculating*** relative atomic mass | * ***Asking*** more questions to learn more * ***Fostering*** teamwork |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.4.1.4 Describe an element  10.4.1.5 Identify elements using their chemical symbols  10.4.1.6Describe the basis of the Periodic Table | * 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 | * ***Communicating*** elements and the periodic table | * ***Appreciating*** elements from the environment |
| 10.4.1.7Describe isotopes  10.4.1.8Calculate relative atomic mass of an element given the % abundances of isotopes and from mass spectrum. | * As atoms with same number of protons but different numbers of neutrons, including radioactive and non-radioactive isotopes * As sum of the products of the percentages and their mass numbers | * ***Calculating*** relative atomic mass of an element | * ***Asking*** more questions to learn more * ***Fostering*** teamwork |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.4.1.9Describe the use of radioactive isotopes  10.4.1.10 Demonstrate the build-up of electrons in shells | * Such as in medical treatment of cancer, industrial use as tracers * Electronic configuration of atoms (spdf configuration is **NOT** required) | * ***Communicating*** the uses of isotopes | * ***Awareness*** of the uses of isotopes |
| 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. | * As substance formed from two or more elements chemically combined * Cations by electron loss, anions by electron gain. * Electrovalent bonding as loss and gain of electrons between metallic and non-metallic atoms. Ionic bonds as electrostatic force between cations and anions. Such as NaCl, CaCl2 and MgO | * ***Classifying*** ionic compounds and covalent compounds | * ***Appreciating*** the use of ionic compounds and covalent compounds |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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|  |  | 10.4.2.4 Describe the formation of covalent bonds  10.4.2.5 Describe the electronic arrangement in simple multiple covalent molecules | * Covalent bonding as sharing of electrons between non-metallic atoms. Covalent bonds as shared pairs of electrons. Such as H2, Cl2,H2O, NH3, CH4, HCl, C2H6 * Such as double bonds in O2,C2H4andCO2, Triple bond in N2and C2H2 | * ***Communicating*** the formation of covalent bonds * ***Inferring*** the arrangements of simple multiple covalent molecules * ***Demonstrating*** bond formation using models | * ***Asking*** more questions to learn more * ***Fostering*** teamwork |
| 10.4.2.6 Describe the uses of ionic and covalent compounds  10.4.2.7 Describe a molecule | * 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. | * ***Communicating*** the uses of ionic and covalent compounds | * ***Asking*** more questions to learn more * ***Fostering*** teamwork * ***Appreciating*** ionic and covalent compounds |

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| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 10.4.2.8Describe valency and valence electrons.  10.4.2.9Demonstrate how to deduce valency of an element. | * 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, valence electrons. | * ***Demonstrating*** the deducing of valency | * ***Asking*** more questions to learn more * ***Fostering*** teamwork |
| 10.4.2.10Formulate chemical formulae of compounds.  10.4.2.11Identify the differences in properties of ionic and covalent compounds. | * 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. | * ***Formulating*** chemical formulae * ***Differentiating*** chemical formulae * ***Investigating*** properties of ionic and covalentcompounds | * ***Asking*** more questions to learn more * ***Fostering*** teamwork * ***Appreciating*** ionic and covalent compounds |

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|  |  | 10.4.2.12Describe metallic bonding  10.4.2.13Describe the electrical and thermal conductivity of metals | * As lattice of positive ions in a ‘sea’ of delocalised electrons   Due to free electron movement/delocalised electrons | * ***Communicating*** metallic bonding and thermal conductivity | * ***Asking*** more questions to learn more |
| 10.4.5 Chemical formulae and equations | 10.4.4.1 Demonstrate how to construct word equations.  10.4.4.2 Formulate and balance chemical equations.  10.4.4.3 Construct net ionic equations from balanced chemical equations. | * Equation showing reactants and products separated by a full curled arrow (🡺). * Number of atoms of each element being equal on both sides of the equation. Balancing can be done by inspection. Equations may include state symbols (s-solid, l – liquid, g – gas, aq – aqueous). * Only ionic aqueous reactants/products must be broken down into their respective ions then cancel out spectator ions to come up with net ionic equation. | * ***Demonstrating*** construction of word equations * ***Formulating*** balanced chemical and ionic equations. | * ***Appreciating*** the conservation of matter. |

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| GRADE 11 | | |
| **General Outcomes:**  **•** Demonstrate an understanding of acids, bases and salts.  • Develop investigative skills about acids, bases and salt.  • Demonstrate an understanding of the importance, production, use, and effect on the environment of acids, bases and salts.  **•** Demonstrate an understanding of the Mole Concept   * Develop investigative skills about quantitative analysis. * Demonstrate an understanding of chemical reactions and energy changes * Develop investigative skills about various types of reactions. * Demonstrate an understanding of the Periodic Table * Develop investigative skills about the Periodic Table |  | **Key Competences**  **•** Demonstrate the skills and knowledge in relating number of valence electrons to the Group number and the number of shells to the Period.  • Demonstrate skills in classifying salts according to their solubility.  • Demonstrate ability to classify oxides as acidic, basic, neutral and amphoteric.  • Demonstrate ability to use tests in identifying aqueous cations, anions and gases.  • Demonstrate basic skills and knowledge in calculating stoichiometric reacting moles.  • Show ability to identify factors that affect rates of chemical reactions**.** |  |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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| 11.5ACIDS, BASES AND SALTS | 11.5.1Characteristic 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, strong, dilute and concentrated acids and alkalis | * Acid as compound that produces hydrogen ions as the only positively charged ions in aqueous solutions,   Base generally as an oxide or hydroxide of a metal including ammonium hydroxide  Alkalis as soluble bases that produce hydroxide ions in aqueous solution as the only negatively charged ions.   * Strength as degree of ionisation,   Concentration as the number of ions per volume of solution. | * ***Identifying*** acids and bases. * ***Investigating*** the acidity and alkalinity of substances in everyday life | * ***Applying*** the uses of acids and bases |

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|  |  | 11.5.1.3 Describe the PH scale  11.5.1.4 Describe neutrality, acidity and alkalinity in terms of PH value | * 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 | * ***Identifying*** acids and bases. * ***Investigating*** the acidity and alkalinity of substances in everyday life | * ***Applying*** the uses of acids and bases |
| 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  11.5.1.8 Illustrate the importance of acid- base reactions | * 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, treatment of indigestion, brushing teeth with toothpaste. |

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|  |  | 11.5.1.9 State the uses of acids and bases. | * Such as control of PH in agriculture, making of soap, in car batteries | * ***Identifying*** acids and bases. * ***Investigating*** the acidity and alkalinity of substances in everyday life | * ***Applying*** the uses of acids and bases |
| 11.5.2Preparation 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 an insoluble salt.  11.5.2.4Demonstrate the preparation soluble salts. | * As a compound formed when the hydrogen ions of an acid are fully or partially replaced by a metal or ammonium ions. Or a compound made of positive metallic/ammonium ions and any negative ion of an acid. * As acid, basic and normal salts. Solubility rules of salts * Using precipitation method and separated by filtration. E.g. Barium sulphate, Silver chloride * By reaction of acids with bases, suitable metals and carbonates/ bicarbonates. Separated by crystallisation and filtration. E.g. Zinc sulphate, copper (II) sulphate | * ***Classifying*** of salts * ***Demonstrating*** the preparation of soluble and insoluble salts * ***Differentiating*** hydrated and anhydrous salts * ***Experimenting*** on preparation of salts | * ***Awareness*** of salts * ***Applying*** safety rules in preparation of salts |

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|  |  | 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 | * 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. | * ***Classifying*** of salts * ***Demonstrating*** the preparation of soluble and insoluble salts * ***Differentiating*** hydrated and anhydrous salts * ***Experimenting*** on preparation of salts | * ***Awareness*** of salts   ***Applying*** safety rules in preparation of salts |
| 11.5.2.7 Describe the behaviour of salts with reference to the atmosphere. | * As hygroscopic, efflorescent, deliquescent. | * ***Classifying*** of salts * ***Demonstrating*** the preparation of soluble and insoluble salts * ***Differentiating*** hydrated and anhydrous salts   ***Experimenting*** on the behaviour of salts | * ***Awareness*** of salts * ***Applying*** safety rules in preparation of salts |

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|  | 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 SO2 and CO2.   Basic oxides as oxides with basic properties such as CaO and MgO.  Neutral oxides as oxides with neither acidic nor basic properties such as CO, H2O.  Amphoteric oxides as oxides with both acidic and basic properties ZnO, Al2O3 and PbO. | * ***Classifying*** different types of oxides | * ***Awareness*** of different types of oxides. * Applying acid-base reactions |
| 11.6.4 Identification of ions and gases(Qualitative analysis) | 11.6.4.1 Demonstrate the identity of aqueous cations and anion. | * 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 | * ***Observing*** and ***interpreting*** results of reactions of ions with different test reagents. * ***Analysing*** chemical composition of salts. | * ***Awareness*** about composition of salts |

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|  |  | 11.6.4.2 Demonstrate the identity of gases. | * Gases being ammonia, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide. Refer to Qualitative notes | * ***Identifying*** gases | * ***Appreciating*** different types of gases. |
| 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 1023(Avogadro’s constant) * Apply n = m/Mr and   n =v/Vm  where n = number of moles | * ***Analysing*** chemical substances quantitatively | * ***Applying*** mole concept * ***Asking*** questions to learn more * ***Awareness*** of the mole concept   ***Fostering*** team work |

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|  |  | 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. | * As Molar gas volume (Vm) of any gas at rtp is 24dm3 or 22.4 dm3 at stp. * Concentration as mol/dm3 / g/dm3.   The number of moles of solute before dilution is the same as after dilution, M1V1 = M2V2. | * ***Demonstrating*** acid-base titrations * ***Problem solving*** in mole concept | * ***Applying*** mole concept * ***Asking*** questions to learn more * ***Awareness*** of the mole concept   ***Fostering*** team work |
| 11.6.2.5Illustrate calculations involving stoichiometric reacting moles and volumes of gases and solutions. | * Using molar mass and molar volume of a gas using the mole concept. (Questions on gas laws and conversions of gaseous volumes to different temperatures and pressures will **not** be required). Proportional stoichiometric masses and the given quantities | * ***Problem solving*** in mole concept | * ***Applying*** mole concept * ***Asking*** questions to learn more * ***Awareness*** of the mole concept   ***Fostering*** team work |

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|  |  | 11.6.2.6 Describe and calculate the percentage yield in a reaction and the percentage purity of a substance  11.6.2.7 Determine limiting reagent in a given reaction | * % 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 | * ***Problem solving*** in mole concept | * ***Applying*** mole concept * ***Asking*** questions to learn more * ***Awareness*** of the mole concept   ***Fostering*** team work |
| 11.6.2.8 Demonstrate calculations involving different types of acid–base titration reactions. | * Using titration law | * ***Demonstrating*** acid-base titrations | * ***Applying*** mole concept * ***Asking*** questions to learn more * ***Awareness*** of the mole concept   ***Fostering*** team work |

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| 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. | * 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. | * ***Demonstrating*** factors that control the rate of chemical reactions. * ***Comparing*** experimental results at different conditions | * ***Applying*** safety rules and the factors that affect the rate of chemical reactions.   ***Awareness*** of slow and spontaneous 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 | * 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. | * ***Analysing*** and ***interpreting*** experimental results. | * ***Applying*** safety rules and the factors that affect the rate of chemical reactions.   ***Awareness*** of slow and spontaneous reactions. |

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| 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.  11.8.2.3 Describe the importance of halogens | * As chemical relativity of group I, II, and VII, elements * Properties such as solubility, effect of heat on compounds, melting points, boiling points and displacement reactions. For Group VII consider atomicity, colour changes, changes in physical states, for Group I including description as a collection of soft metals. * Such as fluoride in toothpaste, chlorine in water treatment, antiseptic, bromide in photographic film | * ***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 the Periodic Table |

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|  |  | 11.8.2.4Describe the harmful effects of halides.  11.8.2.5Describe the use of the noble gases in providing an inert atmosphere | * 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 | * ***Communicating*** harmful effects of halides and uses of noble gases | * ***Awareness*** of harmfulness of halides * ***Appreciating o***f uses of noble gases |
| 11.8.3 Transition metals | 11.8.3.1 Describe transition metals.  11.8.3.2 Describe general properties of transition metals.  11.8.3.3 Describe the uses of transition metals | * 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 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 | * ***Investigating*** the physical and chemical properties of transition elements. * ***Identifying*** transition metals | * ***Appreciating*** transition metals |

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| GRADE 12 | | |
| **General Outcomes:**   * Demonstrate an understanding of metals * Develop investigative skills about some properties and uses of metals. * Demonstrate an understanding of Non- metals. * Develop investigative skills about some industrial uses of non-metals Demonstrate an understanding of Organic Chemistry * Develop investigative skills about organic compounds |  | **Key competences:**   * Demonstrate ability to determine the reactivity series of metals * Demonstrate ability to prepare and test gases * Demonstrate ability to identify organic compounds |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
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| 12.10 METALS | 12.10.1 General properties of a metals | 12.10.1.1 Describe diagrammatic representations of pure metals  12.10.1.2 Describe the physical properties of metal  12.10.1.3 Describe the chemical properties of metals | * Similar nuclei positive ions in a ‘sea’ of delocalised electrons. * Similar In terms of density, melting points, boiling points, appearance * All metals are electropositive as illustrated in the reaction with air, water / steam, dilute non- oxidizing acids, aqueous solutions of other metal ions. | * ***Identifying*** properties of metals. | * ***Appreciating*** metals |
| 12.10.2 Reactivity and Electro Chemical Series | 12.10.2.1 Describe the reactivity series of metals | * 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 | * ***Comparing*** methods of extracting metals. | * ***Awareness*** of methods of extracting metals and dangers some metals pose. |

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|  |  | 12.10.2.2. Explain the apparent non reactivity of aluminium.  12.10.2.3 Demonstrate an order of reactivity. | * 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. | * ***Demonstrating*** reactivity of aluminium and order of reactivity | * ***Appreciating*** of aluminium |
| 12.10.2.4 Describe the effects of heat on hydroxides, carbonates, nitrates of metals and ammonium compounds. | * As related to the reactivity/stability of the metallic ion present in the compound. Compounds of more reactive metals difficulty to decompose while compounds of less reactive metals easily decompose. | * ***Demonstrating*** effects of heat on salts | * ***Asking*** questions to learn more * ***Awareness*** of the heat on salts   ***Fostering*** team work |

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|  |  | 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. | * 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 | * ***Comparing*** methods of extracting metals. | * ***Asking*** questions to learn more * ***Awareness*** of the importance of metals * ***Fostering*** team work |
| 12.10.3 Alloys | 12.10.3.1Describe alloys.  12.10.3.2Describe diagrammatic representations of alloys. | * As mixture of two or metals/carbon such as steel, brass, bronze * Different nuclei positive ions in a ‘sea’ of delocalised electrons | * ***Identifying*** characteristics of alloys * ***Comparing*** structures of alloys and pure metals. | * ***Appreciating*** alloys. |

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|  |  | 12.10.3.3 Explain the advantages of using alloys over pure metals.  12.10.3.4 Identify common uses of alloys | * Such as alloys exhibiting better properties compared to a pure metal (conductor, strength, weight ratio, hardness). * Such as cutlery, food packaging, aircraft. | * ***Identifying*** characteristics of alloys * ***Comparing*** structures of alloys and pure metals. | * ***Appreciating*** alloys. |
| 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. |

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| 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. |
| 12.11.2. Hydrogen | 12.11.2.1. Demonstrate the laboratory preparation, collection and test for hydrogen.  12.11.2.2 Describe the physical and chemical properties of hydrogen  12.11.2.3 Describe industrial manufacture of hydrogen. | * 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 | * ***Demonstrating*** laboratory preparation of hydrogen. | * ***Appreciating*** physical and chemical properties of hydrogen and its uses. |

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|  |  | 12.11.2.6 Describe the uses of hydrogen. | * Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding. | * ***Communicating*** the uses of hydrogen | * ***Appreciating*** physical and chemical properties of hydrogen and its uses. |
| 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. | * 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 | * ***Demonstrating*** laboratory preparation of oxygen. * ***Observing*** the reaction. * ***Communicating*** the uses of oxygen | * ***Appreciating*** physical and chemical properties of oxygen and its uses. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.11.2.6 Describe the uses of hydrogen. | * Such as reducing agent, fuel for rockets, manufacturing ammonia and margarine, balloons filler, welding. | * ***Communicating*** the uses of hydrogen | * ***Appreciating*** physical and chemical properties of hydrogen and its uses. |
| 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. | * 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 | * ***Demonstrating*** laboratory preparation of oxygen. * ***Observing*** the reaction. * ***Communicating*** the uses of oxygen | * ***Appreciating*** physical and chemical properties of oxygen and its uses. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.11.3.4 Describe the uses of oxygen in industry and in natural processes.  12.11.3.5Explain the importance of ozone layer and dangers of its depletion. | * Such as burning, welding, in blast furnace and respiration * It traps radiation, if depleted by CFCs causes skin cancer, respiratory diseases | * ***Communicating*** the uses of oxygen | * ***Appreciating*** uses of oxygen . |
| 12.11.3.6 Demonstrate the chemical test for water.  12.11.3.7 Describe the importance of water | * Using white anhydrous copper (II) sulphate which turns blue. * For laundry, drinking, as solvent. | * ***Demonstrating*** the chemical testing of water * ***Communicating*** the importance | * ***Appreciating*** importance of water |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 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. |
| 12.11.4.3 Demonstrate the preparation collection and test for ammonia in the laboratory  12.11.4.4 Describe the manufacture of ammonia. | * 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). | * ***Demonstrating*** laboratory preparation of ammonia. * ***Observing*** colour changes. | * ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.11.4.5 Describe the physical and chemical properties of ammonia.  12.11.4.8 Describe the thermal dissociation of ammonium salts. | * 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. | * ***Demonstrating*** laboratory preparation of ammonia. * ***Observing*** colour changes. | * ***Appreciating*** physical and chemical properties of nitrogen and ammonia and their uses. |
| 12.11.4.9 Describe the uses ammonia  12.11.4.10 Describe the manufacture of nitric acid  12.11.4.10 Explain the importance of nitrogenous fertilizers  12.11.4.11 Describe the effects of nitrogenous fertilizers on the environment | * 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 |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 12.11.7 Carbon and carbonates | 12.11.7.1 Describe allotropes  12.11.7.2 Describe the physical properties of the allotropes of carbon.  12.11.7.3 Describe the formation and properties of carbon monoxide. | * As different forms of an element existing in the same physical state. * In terms crystalline and non-crystalline allotropes of carbon. * By incomplete combustion of carbon and carbon compounds, reduction of carbon dioxide by carbon. In terms of colour, odour, density, solubility, poisonous.   Reacts as reducing agent. | * ***Demonstrating*** laboratory preparation of carbon dioxide. * ***Observing*** colour changes. | * ***Appreciating*** physical and chemical properties of carbon dioxide and limestone and their uses. |
| 12.11.7.4 Demonstrate the laboratory preparation, collection and the test for carbon dioxide. | * By reaction of dilute acids with carbonates or bicarbonates, collected by downward delivery method/ above water, forms white precipitate with limewater. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.11.7.4 Describe the physical and chemical properties of carbon dioxide.  12.11.7.5 Describe the uses of carbon dioxide. | * 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 | * ***Demonstrating*** laboratory preparation of carbon dioxide. * ***Observing*** colour changes. | * ***Awareness*** of Global warming * ***Appreciating*** physical and chemical properties of carbon dioxide and limestone and their uses. |
| 12.11.7.6 Describe the manufacture of lime from limestone.  12.11.7.7 Describe the uses of lime and slaked lime.  12.11.7.8 Describe the uses of limestone.  12.11.7.9 Describe the greenhouse effect | * By thermal dissociation of limestone * Such as in neutralizing acidic soils, lime as a drying agent for ammonia. * Such as in manufacturing of lime, cement, glass, iron. * As global warming due to increase of carbon dioxide in the atmosphere |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
| 12.12 ORGANIC CHEMISTRY | 12.12.1 Saturated 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.  12.12.1.4Demonstrate the structures of isomers and their names.  12.12.1.5 Describe fractional distillation of petroleum (crude oil) | * 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 CnH2n+2, Named by IUPAC system, all should end with *ane*, * Use idea of branched (side chains) and unbranched butane and pentane and nomenclature follows IUPAC system. * As different fractions of crude oil collected at different boiling temperatures. | * ***Identifying*** alkanes and alkenes. * ***Comparing*** properties of alkanes and alkenes * ***Observing*** colour changes. | * ***Appreciating*** economic values of alkanes and alkenes. * ***Awareness*** of organic compounds. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 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. | * 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. | * ***Identifying*** alkanes and alkenes. * ***Comparing*** properties of alkanes and alkenes * ***Observing*** colour changes. | * ***Appreciating*** economic values of alkanes and alkenes. * ***Awareness*** of organic compounds. |
| 12.12.1.10 Describe and name the structures of the alkenes up to 5 carbon atoms. | * Use the concept of catenation and the general formula CnH2n.Structures must contain one carbon to carbon double bond. Named using the IUPAC system all should end with- *ene.* | * ***Identifying*** alkanes and alkenes. * ***Comparing*** properties of alkanes and alkenes * ***Observing*** colour changes. | * ***Appreciating*** economic values of alkanes and alkenes. * ***Awareness*** of organic compounds. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 12.12.1.11Demonstrate the structures of isomers of alkenes.  12.12.1.12 Describe the chemical properties of alkenes. | * Using the unbranched structures of butene and pentene (positional isomers). * Such as combustion, addition reactions (hydrogenation, hydration, hydrohalogenation, halogenation, addition polymerisation). | * ***Identifying*** alkanes and alkenes. * ***Comparing*** properties of alkanes and alkenes * ***Observing*** colour changes. | * ***Appreciating*** economic values of alkanes and alkenes. * ***Awareness*** of organic compounds. |
| 12.12.1.13 Illustrate the differences and similarities between saturated and unsaturated  Hydrocarbons.  12.12.1.14Describe the chemical tests for unsaturated hydrocarbons (alkenes)  12.12.1.15 Describe the uses of alkenes. | * 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) | * ***Identifying*** alkanes and alkenes. * ***Comparing*** properties of alkanes and alkenes * ***Observing*** colour changes. | * ***Appreciating*** economic values of alkanes and alkenes. * ***Awareness*** of organic compounds. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 12.12.2 Alcohols (Alkanols) | 12.12.2.1 Describe the chemical composition of an alcohol.  12.12.2.2 Describe and name structures of primary alcohols up to five carbon atoms. | * As an organic compound with a hydroxyl group with general formula CnH2n+1OH * Using concept of catenation (Chain). Named following IUPAC nomenclature and all should end with- ***ol***). | * ***Identifying*** composition of alcohols   ***Comparing*** structures of alcohols | * ***Appreciating*** economic values of alcohols. * ***Awareness*** of organic compounds. |
| 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 | * 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 | * ***Identifying*** uses of alcohols * ***Comparing*** properties of alcohols. | * ***Appreciating*** economic values of alcohols. * ***Awareness*** of organic compounds. |

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| **TOPIC** | **SUB TOPIC** | **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 | * Using concept of catenation (Chain), organic compounds with a carboxylic group (COOH), general formula   CnH2n+1COOH, all should end with- ***oic acid.***   * By the oxidation of alcohols and hydrolysis of esters | * ***Identifying*** structures of carboxylic acids. | * ***Appreciating*** the properties and economic uses of carboxylic acids. |
| 12.12.3.3 Demonstrate the chemical properties of carboxylic acids.  12.12.3.4Describe the uses of carboxylic acids | * Such as reaction with bases, carbonates, metals and alcohols (esterification). * Such as formation of esters. | * ***Demonstrating*** the chemical properties of carboxylic acids | * ***Appreciating*** the properties and economic uses of carboxylic acids. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  | 12.12.4 Esters (Alkanoates) | 12.12.4.1 Describe and name the structures of esters up to five carbon atoms.  12.12.4.2 Describe the chemical properties of esters | * 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. |  |
| 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. | * ***Describing*** the chemical properties of esters | ***Appreciating*** the properties and economic uses of esters. |
| 12.12.5 Homologous series | 12.12.5.1 Describe homologous series  12.12.5.2Describe 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 CH2 and have a general method of preparing members. | * ***Identifying*** different homologous series. | * ***Awareness*** of homologous series. |

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| **TOPIC** | **SUB TOPIC** | **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 | * 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 | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers. |
| 12.12.6.5 Describe the formation of nylon and Terylene. | * By condensation polymerisation, Nylon: from a diamine and dioic acid structures represented as:   TeryleneNylon | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers. |

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| **TOPIC** | **SUB TOPIC** | **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. | * Terylene: from diol and dioic acid. Structures represented as:   Nylon as polyamide and Terylene as polyester.   * Plastics used as in carrier bags, buckets, pipes   Nylon and terylene as in clothing, tents, strings, ropes. | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers. |
| 12.12.6.8 Describe the biodegradability of synthetic fibres.  12.12.6.9Describe natural macromolecules | * As non-biodegradable (cannot be broken down by microorganisms) * Such as Carbohydrates, proteins and fats (lipids). | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers. |

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| **TOPIC** | **SUB TOPIC** | **SPECIFIC OUTCOMES** | **CONTENT** | | |
| **KNOWLEDGE** | **SKILLS** | **VALUES** |
|  |  | 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. | * Carbohydrates contain carbon, hydrogen and oxygen in the form CxH2yOy where x is a multiple of six. * In starch – glycosidic,   Proteins – amide, fats – ester linkages   * Such as difference and similarities between nylon and proteins. Terylene and fats. | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers |
| 12.12.4.13 Describe hydrolysis of fats (saponification).  12.12.4.14Identify the products of the hydrolysis of starch and proteins. | * As formation of soaps and glycerine (glycerol).   .   * Using chromatography to identify the amino acids from proteins, simple sugars from starch. | * ***Classifying*** macromolecules * ***Identifying*** linkages in different macromolecules | * ***Awareness*** of polymers. * ***Appreciating*** economic use of polymers |

# SCIENCE PRACTICAL DATA (PHYSICS)

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

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

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

KEY QUANTITIES, SYMBOLS AND UNITS IN PHYSICS.

The pages 96 – 98 comprise the symbols and units which may from time to time be used during the study of Physics.

The candidate is expected to have the knowledge of how to apply the symbols and units in physics.

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

course.

LIST OF SUGGESTED APPARATUS AND EQUIPMENT FOR THE SYLLABUS

1.0 Measurements and Mechanics

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

2.0 Thermal physics

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

3.0 Light

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

4.0 Sound

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

5.0 Magnetism

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

6.0 Wave motion

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

7.0 Electric current/static electricity

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

8.0 Basic electronics

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

9.0 Nuclear physics

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

KEY QUANTITIES, SYMBOLS AND UNITS.

Quantity Symbols Unit

Mass m kg

Length l m

Time t s

Electric current I A

Thermodynamic temperature T K

Amount of substance n mol

Distance d m

Displacement s, x m

Area An m2

Volume V m3

Density ρ kgm-3

Speed u, v ms-1

Velocity u, v ms-1

Acceleration and ms-2

Acceleration of free-fall g ms-2

Force F N

Weight W N

Momentum P Ns

Work W J

Energy E, U, W J

potential energy Ep J

Kinetic energy Ek J

Heat energy Q J

Change of internal-energy ∆U J

Power P W

Pressure P Pa

Torque T Nm

Gravitational constant G Nkg-2ms2

Period T s

Frequency f Hz

Wave length λ m

Speed of electromagnetic-waves c ms-1

Avogadro constant number NA mol-1

Celsius temperature θ oC

Half - life t½ s

Decay constant λ s-1

Specific heat capacity c JK-1KG-1

Electromotive force E V

Resistance R Ω

Resistivity ρ Ωm

DATA AND FORMULAE

Speed of light in free space C = 3.00 x 108 ms-1

Elementary charge e = 1.60 x 10-19\_coulomb

The Planck constant h = 6.63 x 10-34 Js

Molar gas constant R = 8.31 JK-1 mol-1

The Avogadro constant NA = 6.02 x 1023 mol-1

Gravitational constant G = 6.67 x 10-11 Nm2kg2

Acceleration of free fall g = 9.81 ms-2

The Boltzmann constant k = 1.38 x 10-23 JK-1

Uniformly accelerated motion s = ut + ½ at2

Or

v2 = u2 + 2as

Work done on/by a gas W = P∆V

gravitational potential Ep = mgh

Energy in motion E=mc2

Refractive index n = sin i

sin r

Resistors in series R = R1 + R2 + R3 + ...

Resistors in parallel 1 = 1 + 1 + 1 + ...... +

R R1 R2 R3

Electric potential V = Q/4𝝅ɛ0r

Capacitors in series 1 = 1 + 1 + 1 +....

C C1 C2  C 3

Capacitors in parallel C = C1 + C2  + C3 +

pressure of an ideal gas P = 1 NMC3

3 V

alternating current/voltage X = xo sin wt

hydrostatic pressure P = ρgh

energy of charged capacitor w = ½QV

radio-active decay x = xo exp (-λt)

Decay constant λ = 0.693

t½

# SCIENCE PRACTICAL DATA (CHEMISTRY)

The following points should be considered during practical in chemistry:

1. 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.

1. 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.
2. 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.

1. A learner is expected to read the burette accurately and to the nearest volume of 0.1cm3. 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.
2. A student is expected to take note of the temperature readings to the nearest 0.5oC. Recommended thermometer range is -10oC to 110oC. The time should be recorded in seconds and the stop clock/stop watch will be the most convenient timing instrument.
3. 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 2cm3) 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 25cm3 or 50cm3.

Filter funnel.

Beaker (polystyrene, glass) volume of 250cm3.

Conical flasks with volume of 250cm3.

Burette with a volume of 50cm3.

Pipettes with volumes of 25cm3 or 20 cm3

Pipette fillers.

Thermometers calibrated -10oC to 110oC at intervals of 1oC.

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/dm3

Nitric acid 1.0 mol/dm3

Sulphuric acid 0.5 mol/dm3

Aqueous ammonia 1.0 mol/dm3

Aqueous sodium hydroxide 1.0mol/dm3

Lime water (a solution of calcium hydroxide)

Aqueous silver nitrate 0.05 mol/dm3

Aqueous potassium dichromate (VI) 0.1 mol/dm3

Aqueous potassium iodide 0.1 mol/dm3

Aqueous lead (II) nitrate 0.2 mol/dm3

Aqueous potassium permanganate (VII) approximate 0.02 mol/dm3

Barium nitrate 0.2 mol/dm3

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

# QUALITATIVE ANALYSIS TESTS

**Notes for use in qualitative analysis**

**Test for anions**

|  |  |  |
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| **Anions** | **Test** | **Test result** |
| Carbonate (CO32 – ) | 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 (NO3 – )[ in solution] | Add aqueous sodium hydroxide, then aluminum foil, warm carefully. | Ammonia produced |
| Sulphate (SO42 – ) [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 (Al3+) | White ppt.soluble in excess giving a colourless solution | White ppt., insoluble in excess |
| Ammonium ions (NH) | Ammonia produced on warming | - |
| Calcium ions (Ca2+) | White ppt., insoluble in excess | No change |
| Copper ions (Cu2+) | Light blue ppt., insoluble in excess | Light blue ppt., soluble in excess, giving a dark blue solution |
| Iron(II) ions (Fe2+) | Green ppt., insoluble in excess | Green ppt., insoluble in excess, turns reddish-brown on standing |
| Iron (III) ions ( Fe3+) | Red-brown ppt., insoluble in excess | Red-brown ppt., insoluble in excess |
| Zinc ions (Zn2+) | 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 (Cl2) | Introduce damp blue litmus paper to the gas | Turns litmus paper red then bleaches it |
| Hydrogen (H2) | Introduce a lighted splint into the gas | Puts out the lighted splint with a ‘pop’sound |
| Oxygen (O2) | Introduce a glowing splint into the gas | Glowing splint relighted |
| Sulphur dioxide (SO2) | Bubble the gas through acidified potassium dichromate (VI) | Turns orange potassium dichromate green. |

# SCIENCE SCOPE AND SEQUENCE CHART (PHYSICS)

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

| **Grade 10** | | **Grade 11** | | **Grade 12** | |
| --- | --- | --- | --- | --- | --- |
| **Measurements** | **SUBTOPIC** | **Thermal**  **Physics** | **SUBTOPIC** | **Static electricity** | **SUBTOPIC** |
| 10.1.1 International System of Units (SI). | 11.3.1Simple kinetic theory of Matter. | 12.8.1 Static Electricity |
| 10.1.2 Length and time | 11.3.2 Measurement of temperature | **Current electricity** | 12.9.1Electric charge, current, and potential difference. |
| 10.1.3 Mass and, weight | 11.3.3 Expansion of solids, liquids and gases. | 12.9.2 Electric cells. |
| 10.1.4 Density | 11.3.4 Heat transfer by conduction, convection and radiation. | 12.9.3 Electrical resistance |
| **Mechanics** | 10.2.1 Scalars and vectors | 12.9.4 Heating effect of an electric current |
| 10.2.2 Linear motion | 11.3.5 Measurements of heat | 12.9.5 Magnetic effects of electric currents |
| 10.2.3 Forces | **Wave motion** | 11.4.1 Simple ideas of the wave motion theory. | **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, | 11.4.3 Electromagnetic spectrum | 12.10.3Transformers |
|  |  |  |
|  | Energy and Power. | **Basic**  **electronics** | 12.11.1 Thermionic emission and electrons |
| 10.2.6 Simple machines | **Sound** | 11.5.1 Properties of sound |
| **Light** | 11.6.1 Rectilinear propagation of light. | 12.11.2 Circuit components. |
| 11.6.2 Refraction of light | 12.11.3 Simple electronic systems |
| 10.2.7 Pressure | 11.6.3 Thin converging and diverging lenses. | 12.11.4 Impact of electronics on society and industry. |
| **Magnetism** | 11.7.1 Simple phenomenon of magnetism | **12.12. Atomic physics** | 12.12.1 Nuclear atom |
| 12.12.2 Radioactivity |

# SCIENCE SCOPE AND SEQUENCE CHART (CHEMISTRY)

| **Topic** | **Grade 10** |  | **Grade 11** |  | **Grade 12** |
| --- | --- | --- | --- | --- | --- |
| **Introduction to Chemistry** | **SUBTOPIC** | **Acids, Bases and Salts** | **SUBTOPIC** | **Chemistry and**  **Electricity** | **SUBTOPIC** |
| 10.1.1 Introduction to Chemistry | 11.5.1 Characteristic properties of acids and bases | 12.9.1.Conductors |
| **The Particulate nature of matter** | 10.2.1 Matter and the Kinetic theory | 11.5.2 Preparation of salts | **Metals** | 12.10.1 General properties of a metals |
| 10.2.2 Diffusion | **The mole**  **concept** | 11.6.3 Types of oxides | 12.10.2 Reactivity and  Electro Chemical  Series |
| **Experimental Techniques** | 10.3.1 Measuring of quantities | 11.6.4 Identification of ions and gases  (Qualitative analysis) | 12.10.4 Corrosion |
| 10.3.2 Criteria of purity | 11.6.1 Relative masses | 12.10.5 Thermal stability of the compounds |
| 10.3.3Separatingmixtures | 11.6.2 The mole | **Non Metals** | 12.11.1 General properties of non-metals. |
| **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 | **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 |
| **The Periodic Table** | 11.8.1Group and the periodic trends | 12.11.7 Carbon and carbonates |
| 11.8.2 Group properties | **Organic Chemistry** | 12.12.1 Saturated and unsaturated  Hydrocarbons |