Republic of Zambia

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDCATION

PHYSICS SYLLABUS

GRADES 10 – 12

Prepared and Published by Curriculum Development Centre
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VISION

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

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PREFACE

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

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.
The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize, analyse and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the learners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.
Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

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

Chishimba Nkosha
Permanent Secretary
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

ACKNOWLEDGEMENTS

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

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

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

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

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MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

INTRODUCTION

This syllabus has taken into consideration relevant aspects of the 1996 National Policy on Education entitled "Educating Our Future", which demands that the education system should aim at producing a learner capable of appreciating the relationship between scientific thought, action and technology on the one hand, and sustenance of the quality of life on the other. Furthermore, it is part of the policy of the Ministry of Education to improve the teaching and learning of Mathematics and Science in High School.

Another major aspect of this syllabus is that it has taken into consideration environmental issues with emphasis on application of Physics in everyday life.

The syllabus takes into account the fact that the pupils who will follow it will be of different background. Some will study further Physics; some will require the knowledge of this background Physics in pursuing other scientific studies, while some will join the world of work.

GENERAL AIMS OF THE SYLLABUS

The Syllabus aims at contributing to pupils' general education by using the impact of well-known applications of physics concepts and principles on society. This approach is intended to stimulate pupils' curiosity and sense of enquiry which will in turn not only provide a suitable basis for further study of the subject, but also provide pupils with sufficient knowledge and understanding to make them become useful and confident citizens. The essence of such an enquiry is related to problem solving. This further aims at developing the skills necessary to find solutions to scientific problems.

During this course pupils should acquire the following:

1. Knowledge and understanding of facts, ideas techniques and the applications of Physics.
2. Skill in applying their knowledge and understanding in problem solving.
3. Practical abilities associated with investigation of certain phenomena and principles in Physics.
4. Positive Scientific attitudes such as open mindedness and willingness to recognise alternative points of view.

GENERAL STRUCTURE OF THE SYLLABUS

The syllabus is divided into units. Every effort has been made to arrange the topics in a logical order but this is not intended to suggest a teaching order. It is hoped teachers will develop a considerable flexibility in planning their presentations.

Each of the Units is described under the headings of "Content", "specific outcomes" knowledge, skills and "values". The column headed "skill" is intended to guide with the type of practical skills to be acquired while value must show what action the learner will take after learning the content and skill and is not to be regarded as exhaustive. The teacher can still extend it by relating the factual contents and specific outcome(s) of the syllabus to social, economic and industrial life at both local and national levels.

In view of the increasing impact of electronics and computers, bipolar transistors and logic gates have been included in the syllabus. It is envisaged that an experimental approach will be adopted and that pupils will spend adequate time on individual experimental work.

MATHEMATICAL REQUIREMENTS

The study of Physics through this syllabus strengthens the applications of mathematical skills. It is assumed the pupils will be computer in the following mathematical techniques:-

1. Taking account of accuracy in numerical work and handling calculations so that significant figures are neither lost unnecessarily nor carried beyond what is justified.
2. Making approximate evaluation of numerical expressions.
3. Formulating simple algebraic equations as mathematical models from physics situations and be able to solve them.
4. Changing the subject of a formula.
5. Expressing small changes or errors as percentages.
6. Calculating areas of various shapes.
7. Dealing with vectors in all simple forms.
8. Plotting results graphically after selecting appropriate variables and scales.

9. Interpreting, analysing and translating graphical information.

NOTE: The list of mathematical abilities above is intended as a guide but is in no way limited nor exhaustive

ASSESSMENT OF OBJECTIVES

The syllabus will stress:

1. Knowledge and understanding in the following:

    (a) Scientific phenomena, facts, concepts, theories and laws.
    (b) Scientific terminology, use of symbols, quantities and units.
    (c) Scientific apparatus and instruments and their safe operation.
    (d) Scientific and technological applications with social, economic and environmental relevance.

2. Handling information and solving problems including to:

    (a) locate, select, organise and present information from a variety of sources;
    (b) translate information from one form to another;
    (c) manipulate numerical data;
    (d) identify patterns and draw inferences from information;
    (e) give reasonable explanations for patterns and relationships;
    (f) make predictions and hypotheses.

3. Experimental skills including those involving how to:

(a) follow instructions;
(b) use techniques, apparatus and materials;
(c) observe, measure and record;
(d) plan investigations;
(e) interpret and evaluate observations and results;
(f) evaluate methods and suggest possible improvements.

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

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

TIME ALLOCATION

A minimum of six periods of forty minutes each per week, preferably with one (1) double period taken in laboratory for practical work.

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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.1GENERAL PHYSICS	10.1.1 International System of Units (SI).	10.1.1.1 Distinguish between basic and derived quantities 10.1.1.2 Identify basic units and derived units 10.1.1.3 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/s^2)	• ***Comparing*** basic quantities and derived quantities. • ***Identifying*** 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

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

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
	10.1.4 Density	10.1.4.1 Determine the density of floating objects 10.1.4.2 Determine the density of a mixture of liquids 10.1.4.3 Describe what relative density is 10.1.4.4 Calculate relative density of air	• Density of floating objects: e.g. cork • Density of miscible liquids: e.g. alcohol and water ($\rho=(m_1+m_2)/(v_1+v_2)$) • What relative density is: Relative density as ratio without units • Calculation of relative density: Use of formula; Relative density of substance (relative density =density of substance/density of water)	• ***Calculating*** the density of a floating object using displacement method • ***Comparing*** the densities of other objects	• ***Participating*** in a group actively • ***Asking*** questions for more understanding

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
10.2MECHANICS	10.2.1 Scalars and vectors.	10.2.1.1Describe what scalar and vector quantities are 10.2.1.2 Distinguish between scalars and vectors.	• Scalar and Vector quantities: Quantities; Scalar -size and no direction, vectors -size and direction • The difference between scalar and vectors: Scalar (distance, mass , time, speed, length, area, volume, temperature, density, work, energy, power), Vectors (weight, force, acceleration, displacement, velocity, moment)	• ***Classifying*** physical quantities into vectors and scalars • ***Communicating*** differences between scalars and vectors	• ***Participating*** in a group actively • ***Asking*** questions for more understanding
		10.2.1.3 Demonstrate adding of vectors to determine a resultant 10.2.1.4 Demonstrate how to determine the resultant of two vectors graphically.	• Resultant of vectors: Adding vectors using the formula $F_R = F_1 + F_2$ and $F_R = F_2 - F_1$ • Resultant of two vectors graphically	• ***Determining*** magnitudes of resultant vector • ***Formulating*** the resultant of two vectors by graphical methods	• ***Appreciating*** the use of graphical method when adding vectors

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.2 Linear motion	10.2.2.1 Describe the terms used in mechanics. 10.2.2.2 Demonstrate the use of equations of uniformly accelerated motion to solve problems	• Terms used : such as distance, displacement, speed, velocity, acceleration • Use of the following equations of motion; $v = u + at$, $s = (v + u)t/_2$, $s = ut + ½ at^2$ $v^2 = u^2 + 2as$	• ***Comparing*** distance with displacement; speed with velocity	• ***Participating*** in a group actively • ***Appreciating*** the use of equations of motion to solve problems
		10.2.2.3 Interpret graphical representation of distance-time, Displacement -time, speed-time, velocity-time and acceleration-time.	• Graphical representation of motion in terms of ; rest, constant speed and constant acceleration	• ***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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.2.4 Investigate the consequences of over speeding 10.2.2.5Describe the acceleration of free fall for a body near the earth. 10.2.2.6 Describe qualitatively the motion of bodies falling in a uniform gravitational field with and without air resistance	• Consequences of over speeding e.g. brake failure resulting into car crush, loss of control • Acceleration of free fall for a body near the earth it is constant(approximately 10m/s^2) • The falling motion of bodies in a uniform gravitational field: falling terminal velocity	• ***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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.3 Forces	10.2.3.1 Explain what force is. 10.2.3.2 Explain the effect of forces on bodies. 10.2.3.3 Describe the 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
		10.2.3.4 Demonstrate the relationship between force and acceleration 10.2.3.5 Demonstrate the relationship between mass and acceleration.	• The relationship between force and acceleration: A constant force produces a constant acceleration • The relationship between mass and acceleration: Increase in mass results in reduction in acceleration (mass is inversely proportional to acceleration for a constant force)	• ***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

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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	**SKILLS**	**VALUES**
	10.2.5 Work, Energy and Power.	10.2.5.1 Explain the meaning of the terms work, energy and power. 10.2.5.2 Identify the units of measurement for work, energy and power	• 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
		10.2.5.3 Calculate work using the appropriate formula 10.2.5.4 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.5.5Explain 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($E_P = mgh$) and kinetic energy ($E_K = 1/2mv^2$)	• ***Communicating*** the knowledge on potential(E_P) and kinetic(E_K) energy	• ***Participating*** actively in groups
		10.2.5.6Describe sources of renewable and non-renewable energy. 10.2.5.7 Explain the effects of the use of energy sources on the environment.	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.5.8 Demonstrate energy transformation from one form to another 10.2.5.9. Describe the conservation of energy 10.2.5.10. Demonstrate the calculation of efficiency of energy conversion using the appropriate formula 10.2.5.11. Demonstrate calculation of power using the appropriate formula	• 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 using 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	10.2.6.1 Describe what a simple machine is 10.2.6.2 Identify the different types of simple machines.	• The definition of a simple machine: Enables a large load to be overcome by a small effort • Types of simple machines: e.g. Levers, pulleys, gears, inclined planes, wheel and axle	• ***Communicating*** the knowledge on simple machines and types	• ***Cooperating*** in group activities • ***Listening*** to other learners with respect

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.6.3Describe the distances moved by the effort and the load in a simple machine 10.2.6.4 Explain the terms of Mechanical advantage (MA), Velocity Ratio (VR) and Efficiency.	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	10.2.7 Pressure	10.2.7.1 Explain what pressure is. 10.2.7.2 Describe how pressure relate to force and area using appropriate examples and formula	• The definition of pressure: Pressure(force/area) Units(pascals, N/m^2 ,millibars) • The relationship between force and area in pressure and its formulae: Relating force and area as on when force increases pressure increase and when area increase pressure reduce (calculations using the formula P = F/A)	• ***Measuring*** pressure using barometer , and manometers • ***Calculating*** pressure in fluids	• ***Cooperating*** in group activities • ***Listening*** to other learners with respect • ***Applying*** the idea of pressure in our daily life
		10.2.7.3 Identify factors affecting pressure in liquids. 10.2.7.4 Describe the transmission of pressure in hydraulic systems. 10.2.7.5 Calculate pressure in liquids. 10.2.7.6 Explain the mechanism of a mercury barometer.	• Factors affecting pressure in liquids: Depth/height and density of the liquid • Applications of pressure (Pascal's Law): e.g. hydraulic brakes, hydraulic press and jack • Calculation of pressure in liquids: Using appropriate formula; "p = ρgh" to calculate pressure in liquids • The mechanism of a mercury barometer: Use in determining atmospheric pressure	• ***Communicating*** factors affecting pressure in liquids • ***Describing*** the transmission of pressure • ***Calculating*** pressure using the formula p= ρgh • ***Communicating*** the principle of Archimedes principle	• ***Appreciating*** the use of simple machines in doing work e.g. bottle opener • ***Appreciating*** the use the formula to calculate pressure

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		10.2.7.7 Explain the mechanism of a manometer 10.2.7.8 Explain principles of upthrust and floatation. 10. 2.7.9 Describe how upthrust relate to floatation in fluids.	• The mechanism of a manometer: Use in determining gas pressure • Principles of upthrust and floatation in fluids (Archimedes principle) • Relationship of upthrust and floatation	• ***Communicating*** the principle of Archimedes principle	• ***Appreciating*** the use of a barometer and manometer • ***Cooperating*** in group activities

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 • Demonstrate ability to show that sound requires a medium for transmission

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.3THERMAL PHYSICS	11.3.1Simple kinetic theory of Matter.	11.3.1.1 Explain What the kinetic theory is 11.3.1.2 Describe qualitatively the molecular model of matter.	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.2.5 Describe the relationship between the Celsius and Kelvin scales. 11.3.2.6 Describe the structure and use of a thermocouple thermometer 11.3.2.7 Demonstrate 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.	11.3.3.1 Describe 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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 $V_1/T_1 = V_2/T_2$ • 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.3.10Demonstrate the use of the ideal gas equation to solve simple numerical problems.	• The ideal gas equation ($P_1V_1/T_1=P_2V_2/T_2$) and numerical problems	• ***Calculating*** the numerical problems based on gas laws	• ***Appreciating*** the use the equation PV/T=constant
	11.3.4 The Engine	11.3.4.1 Explain what an internal combustion engine is. 11.3.4.2 Identify the different parts of an internal combustion engine. 11.3.4.3 Describe the operation of the spark plug.	• The internal Combustion Engine; The ignition of the mixture of liquid fuel and air, inside the cylinder (Petrol and diesel engine) • Parts of internal combustion engine: such as valves, piston, spark plug, cylinder • The operation of Spark plug (produces a spark).	• ***Communicating*** the operation of an internal combustion engine. • ***Communicating*** different parts and different strokes of an internal combustion Engine.	• ***Appreciating*** the use of machines • ***Asking*** questions for more understanding • ***Participating*** actively in group activities

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.4.4 Describe the different strokes in a four stroke internal combustion engine 11.3.4.5 Describe efficiency of a diesel and petrol engine	• Intake, compression, power and exhaust. • Efficiency of Diesel engines and petrol engines	• ***Comparing*** the most efficient and yet economical engine to use	• ***Appreciating*** the use of machines • ***Participating*** actively in group activities
	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.	• 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.	• ***Verifying*** the methods of heat transfer by experimenting • ***Identifying*** the relationship between kinetic theory to heat transfer	• ***Participating*** in group activities during experiments. • ***Being*** aware of the different methods of heat transfer

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.3.5.5Demonstrate convection in liquids and gases. 11.3.5.6 Demonstrate the differences between bad and good absorbers of radiant energy	• Heat transfer in fluids through Convection current • Differences between good and bad absorbers of heat: e.g. shiny(white or silver) and dull(black surfaces	• ***Communicating*** uses of bad and good conductors in everyday life • ***Observing*** heat transfer in fluids	• ***Participating*** in group activities during experiments. • ***Being*** aware of the different methods of heat transfer
		11.3.5.7 Demonstrate the differences between good and bad heat emitters. 11.3.5.8 Explain every day's applications of knowledge on conduction, convection and radiation.	• Differences between good and bad emitters of heat such as shinning (white or silver) and dull (black surfaces • Application of knowledge on the processes of heat transfer: e.g. thermos flask, electric kettle ,land and sea breeze, greenhouse effect	• ***Experimenting*** good and bad absorbers of radiant heat • ***Inferring*** good and bad emitters of heat. • ***Investigating*** the daily applications of the methods of heat transfer	• ***Cooperating*** in group activities • **Asking** questions for more understanding • ***Appreciating*** the knowledge about good and bad emitters • ***Appreciating*** the knowledge about heat transfer and its application

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.3.6 Measurements of heat.	11.3.6.1Demonstrate the difference between temperature and heat energy. 11.3.6.2Describe the terms of heat capacity and specific heat capacity.	• Difference between temperature(level of hotness) and Heat energy(energy transferred • Terms of heat capacity and specific heat capacity: such as Heat capacity(heat to raise temperature by 1K) Specific heat capacity (quantity of heat which raises the temperature of unit mass by 1K.)	• ***Comparing*** between temperature and heat transfer • ***Communicating*** heat capacity and specific heat capacity	• ***Participating*** in group activities • ***Being*** aware of the difference between heat capacity and specific heat capacity
		11.3.6.3Identify the SI units of specific heat capacity. 11.3.6.4Demonstrate how to measure specific heat capacity of solids and liquids.	• SI Units of specific heat capacity: Joules per kilogram Kelvin(J/kg K) • Measurement of Specific heat capacity of solids and liquids through Electrical method and methods of mixture	• ***Communicating*** the SI units for specific heat capacity • ***Measuring*** specific heat capacity of solids and liquids	• ***Cooperating*** in group activities • ***Appreciating*** the knowledge about heat capacity

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	.	11.3.6.5Describe the terms latent heat, specific latent heat of fusion and of vaporisation. 11.3.6.6Demonstrate the solving of numerical problems on heat measurement	• Scientific Terms: Latent heat; specific latent heat of fusion (melting) and specific latent heat of vaporization • Numerical problem on latent heat	• ***Communicating*** specific latent heat • ***Calculating*** numerical problems on heat measurement	• ***Being*** aware of latent heat • ***Appreciating*** the formula used to calculate latent heat
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.	• 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	• ***Designing*** experiments to demonstrate wave motion by using ropes, strings	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities •

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	.	11.4.1.3Describe the terms associated with waves	Scientific terms: Amplitude (A), period(T),frequency (f), wavelength (λ) and wave front	• ***Communicating*** terms associated with waves	• ***Being*** aware of the terms associated with wave motion
		11.4.1.4 Apply the wave equation in solving wave motion problems	• The wave equation: Displacement-time and displacement – distance graphs of a wave. (Use the equation v = fλ.)	• ***Calculating*** numerical problems using the formula "v = fλ"	• ***Appreciating*** the use of the formula to calculate the speed of a wave • ***Participating*** in group activities
		11.4.1.5 Explain the use of waves in everyday life.	• Use of waves in our daily life: radio, television, ultrasonic etc.	• ***Communicating*** knowledge on the daily application of waves	

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	11.4.2 Propagation of waves	11.4.2.1 Explain what propagation, reflection, refraction and diffraction of waves are 11.4.2.2 Demonstrate constructive and destructive interference of waves	• Scientific terms: Propagation- transmission, reflection- and refraction of waves. Diffraction of waves using wide, narrow gaps, sharp edges. • Two types of Interference of waves: such as Constructive and destructive	• ***Experimenting*** the reflection, refraction and propagation of waves using appropriate apparatus. • ***Analysing*** the wave patterns produced by using barriers having different slit sizes	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in class discussion actively
	11.4.3Electromagnetic spectrum	11.4.3.1Describe main components of electromagnetic spectrum.	• Main components of electromagnetic spectrum: such as Gamma, X-rays, ultra violet, visible light, infrared, microwaves and radio waves	• ***Communicating*** all components of electromagnetic spectrum •	• ***Being*** aware of the components of electromagnetic waves

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.4.3.2Describe the properties of electromagnetic waves	• Properties of electromagnetic waves: e.g. transverse in nature, same speed in vacuum (approximately, c = 3.0 x 10^8m/s) etc.	• ***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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		11.5.1.5 Determine the speed of sound in air. 11.5.1.6 Describe the relative speed of sound in solid, liquid and gas. 11.5.1.7 Demonstrate the characteristics of sound waves.	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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
11.6LIGHT	11.6.1 Rectilinear propagation of light	11.6.1.1Describe the rectilinear propagation of light. 11.6.1.2Investigate the formation of shadows and eclipse. 11.6.1.3Describe reflection of light. 11.6.1.4 Investigate the laws of reflection of light	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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 90^o	• ***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*:* $n = \sin 90^o / \sin c$, 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
11.7 MAGNETISM	11.7.1 Simple phenomenon of magnetism.	11.7.1.1Describe properties of magnets 11.7.1.2Explain the domain theory of magnetism 11.7.1.3 Demonstrate induced magnetism.	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.8 STATIC ELECTRICITY	12.8.1 Static Electricity	12.8.1.1Demonstrate 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.1.7 Describe the basic concept of EMF. 12.9.1.8 Demonstrate the measuring of potential difference (PD) and electromotive force (EMF).	• 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.9.3 Electrical resistance.	12.9.3.1Explain the meaning of resistance 12.9.3.2 Demonstrate how to determine resistance in a simple circuit. 12.9.3.3 Describe the relationship between current and potential difference in Ohmic and non Ohmic conductors.	• Resistance: opposition to the flow of charge • Value of resistance in series and parallel (use formula $1/R = 1/R_1 + 1/R_2$) • Relationship between current and potential difference: (Graph of p.d. against current for Ohmic and non-Ohmic conductors)	• ***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

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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.9.4.7 Explain the need for earthing metal cases and for double Insulation. 12.9.4.8Describe 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

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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
12.10 ELECTROMAGETIC 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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.10.2 The simple A.C. and D.C. generators.	12.10.2.1 Describe simple A.C. and D.C. generators. 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

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 $\frac{V_p}{V_s} = \frac{N_p}{N_s}$ and $V_p I_p = V_s I_s$ (ideal transformer)	• ***Calculating*** problems relating to the transformers and power using formulae	• ***Appreciating*** of the use transformer

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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 = $(V_s I_s)/(V_p I_p) \times 100\%$] • Advantage of high alternating potential difference power transmission: as in reducing power losses in cables. • Environmental and cost implications of underground power transmission • Effects of improper management of Transformers such as overheating, low/high voltage	• ***Calculating*** the efficiency of a transformer • ***Communicating*** knowledge on the environmental and cost implications of underground power transmission	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Participating*** in group activities actively • ***Appreciating*** the use of the formula • ***Being*** aware of the environmental and cost implications of underground power transmission

TOPIC	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 • ***Communicating*** applications of electron beams	• ***Cooperating*** in group activities ***Participating*** in group activities actively

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	• ***Appreciating*** the use of the cathode rays in specific devices • ***Being*** aware of the structure of a CRO • ***Appreciating*** the use of a CRO in measuring some quantities
	12.11.2 Circuit components	12.11.2.1 Identify symbols of basic circuit component. 12.11.2.2 Determine resistor values using standard colour codes.	• Circuit components and its symbols: such as resistors, potentiometers, capacitors, thermistors, light dependent resistors, reed switches and relays switches, light emitting diodes etc • Values of resistors recognised from the colour bands	• ***Communicating*** the basic circuit components • ***Calculating*** resistance using standard colour codes and values	• ***Cooperating*** in group activities • ***Asking*** questions for more understanding

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		12.11.2.3 Describe action of variable potential divider. 12.11.2.4 Explain the action and application of thermistor and light dependent resistors.	• Action of variable potential divider • Action of thermistor (as semi conductor) and application of thermistor and light dependent resistors (sensitive to temperature changes in light intensity)	• ***Investigating*** the variable potential divider • ***Communicating*** the daily applications of thermistor and light dependent resistors	• ***Participating*** in group activities actively • ***Appreciating*** the use of the thermistors and LDRs in devices
		12.11.2.5 Investigate the charging and discharging of capacitors. 12.11.2.6 Describe the role of capacitors in electronic equipments.	• Charging and discharging of capacitors: Charging through a resistor when connected to current flow and discharging through a resistor when not connected to current flow. • Role of capacitors in electronic equipments: filter circuits ,delay circuits, smoothening rectified current etc	• ***Experimenting*** the charging and discharging of a capacitor • ***Communicating*** the role played by capacitors in electronic equipments	• ***Participating*** in group activities actively • ***Appreciating*** the use of the thermistors and LDRs in devices

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
	12.11.3 Simple Electronic Systems.	12.11.3.1 Describe the action of a bipolar transistor. 12.11.3.2 State the different types of logic gates.	• Action of a bipolar transistor current amplifier: bipolar transistor as used in electronic switches • Types of Logic gates: such as NOT ,AND, OR,NAND, NOR	• ***Communicating*** the action of a bipolar transistor • ***Communicating*** different types of logic gates	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities
		12.11.3.3 Demonstrate how to derive the truth tables of logic gates. 12.11.3.4 Describe the use of bistable and astable circuits.	• How to derive the truth tables of logic gates. • The Use of c bistable and astable circuits: ross-coupled logic gates. (Bistable) in computers for data storage. Astable as pulse generator and the used in clocks that controls operations in a computer	• ***Investigating*** truth tables of logic gates using numbers of 0 and 1 in inputs and out puts • ***Communicating*** the use of cross-coupled logic gates	• ***Appreciating*** the use of the truth tables when dealing with logic gates • ***Participating*** in group activities actively

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
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.	• ***Communicating*** an atomic structure • ***Communicating*** knowledge on the existence of protons and neutrons in the nucleus of an atom	• ***Asking*** questions for more understanding • Cooperating in group activities
	12.12.2 Radioactivity.	12.12.2.1 Describe the nature of radioactivity. 12.12.2.2 Describe the characteristics of the three kinds of radioactive radiations: alpha, beta and gamma.	• 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 • ***Communicating*** characteristics of the three kinds of radioactive substances	• ***Asking*** questions for more understanding • Cooperating in group activities

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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.)	• ***Investigating*** radiation using a G.M counter • ***Understanding*** the causes and effects of background radiation	• ***Asking*** questions for more understanding • ***Cooperating*** in group activities • ***Appreciating*** the use of a GM counter to detect radiation • ***Being*** aware of the existence of background radiation and its effects
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		. 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
		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

TOPIC	SUB TOPIC	SPECIFIC OUTCOMES	CONTENT		
			KNOWLEDGE	SKILLS	VALUES
		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

PHYSICS PRACTICAL DATA

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

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

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

KEY QUANTITIES, SYMBOLS AND UNITS IN PHYSICS.

The pages 60 – 62 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	m^2
Volume	V	m^3

Density	ρ	kgm^{-3}
Speed	u, v	ms^{-1}
Velocity	u, v	ms^{-1}
Acceleration	and	ms^{-2}
Acceleration of free-fall	g	ms^{-2}
Force	F	N
Weight	W	N
Momentum	P	Ns
Work	W	J
Energy	E, U, W	J
potential energy	Ep	J
Kinetic energy	Ek	J
Heat energy	Q	J
Change of internal-energy	ΔU	J
Power	P	W
Pressure	P	Pa
Torque	T	Nm
Gravitational constant	G	$Nkg^{-2}ms^{2}$
Period	T	s
Frequency	f	Hz
Wave length	λ	m
Speed of electromagnetic-waves	c	ms^{-1}
Avogadro constant number	N_A	mol^{-1}
Celsius temperature	θ	^oC
Half - life	$t½$	s
Decay constant	λ	s^{-1}
Specific heat capacity	c	$JK^{-1}KG^{-1}$

Electromotive force	E	V
Resistance	R	Ω
Resistivity	ρ	Ωm

DATA AND FORMULAE

Speed of light in free space	$C = 3.00 \times 10^{8}\ ms^{-1}$
Elementary charge	$e = 1.60 \times 10^{-19}$_coulomb
The Planck constant	$h = 6.63 \times 10^{-34}\ Js$
Molar gas constant	$R = 8.31\ JK^{-1}\ mol^{-1}$
The Avogadro constant	$N_A = 6.02 \times 10^{23}\ mol^{-1}$
Gravitational constant	$G = 6.67 \times 10^{-11}\ Nm^2kg^2$
Acceleration of free fall	$g = 9.81\ ms^{-2}$
The Boltzmann constant	$k = 1.38 \times 10^{-23}\ JK^{-1}$
Uniformly accelerated motion	$s = ut + ½\ at^2$ Or $v^2 = u^2 + 2as$
Work done on/by a gas	$W = P\Delta V$
gravitational potential	$E_p = mgh$
Energy in motion	$E=mc^2$
Refractive index	$n = \frac{\sin i}{\sin r}$
Resistors in series	$R = R_1 + R_2 + R_3 + \ ...$
Resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ... +$

Electric potential	$V = Q/4\pi\varepsilon_0 r$
Capacitors in series	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + 1 + \frac{1}{C_3} + \ldots$
Capacitors in parallel	$C = C_1 + C_2 + C_3 +$
pressure of an ideal gas	$P = \frac{1}{3}\frac{NMC^3}{V}$
alternating current/voltage	$X = x_o \sin wt$
hydrostatic pressure	$P = \rho gh$
energy of charged capacitor	$w = \frac{1}{2}QV$
radio-active decay	$x = x_o \exp(-\lambda t)$
Decay constant	$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$

SCOPE AND SEQUENCE

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

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