THE REPUBLIC OF UGANDA

Lower Secondary Curriculum

PHYSICS SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

CONTENTS

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FOREWORD

This four-year Syllabus for Physics is for one of the 20 subjects of the Lower Secondary School Curriculum. The Syllabus builds upon concepts, skills, attitudes, and values developed at primary school level. It provides a firm foundation for further learning of Physics to those learners who will proceed to study it at a higher level and those who will join science-based vocational institutions. The Learning Outcomes of the syllabus are structured to provide the learner with opportunities to develop understanding of Physics within the different topics, across the four-year study.

The increasing role science and technology have in our lives and the world of work provides a great need for placing Physics at the core of education in the 21st Century. Therefore, everyone, especially those who will develop or apply science and technology in their careers, need to study Physics.

The increasing complexity in the world requires development of abilities such as complex problem solving, physical modeling, and other general skills like critical thinking, creativity, invention, and innovation which are of great value in everyday living. Physics provides the foundation for acquisition of such abilities.

This syllabus has complemented the indigenous knowledge and skills; therefore, the teachers of Physics are required to shape the learning experiences by integrating indigenous knowledge and skills with new knowledge. They should create learning opportunities that promote acquisition of scientific and technical skills, and must ensure that the needs and interests of all learners are catered for.

I, therefore, endorse this Syllabus as the official document for the teaching and learning of Physics at Lower Secondary School level throughout the country.

Hon. Janet K. Museveni
The First Lady and Minister for Education and Sports

ACKNOWLEDGEMENT

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of this Syllabus.

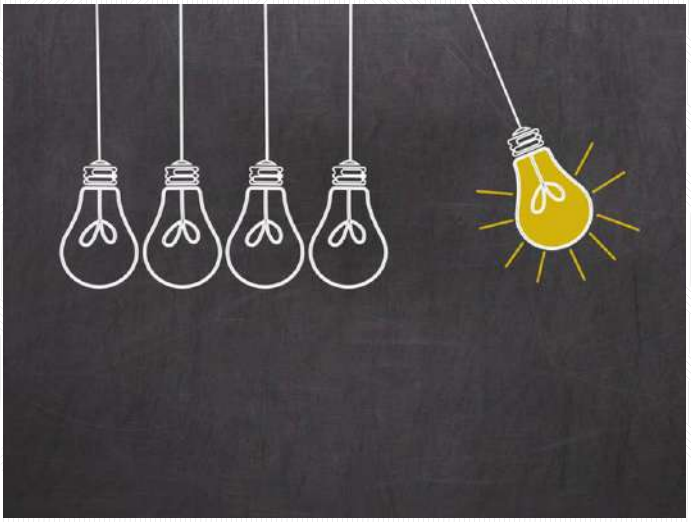
Our gratitude goes to the Ministry of Education and Sports (MoES), for overseeing the development of the syllabus and taking timely decisions whenever necessary. They have worked as a team with NCDC to produce this syllabus. Their decisions have been invaluable in getting this work completed as required. Our thanks also go to our partners in education who provided the necessary guidance.

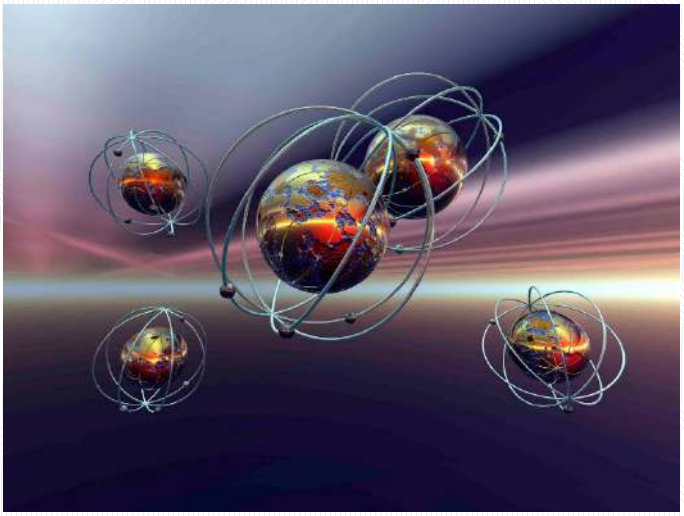
We would also like to thank the members of the public who made helpful contribution towards shaping this syllabus. Their efforts are instrumental towards having this syllabus implemented in the schools and for improved quality of education in Uganda.

The Centre is indebted to the learners, teachers and consultants from Cambridge Education and Curriculum Foundation UK, who worked with NCDC specialists. Great thanks go to members of Physics Working Group who worked tirelessly to put together the necessary facts and guidance in producing this Syllabus.

Furthermore, NCDC would like to thank the World Bank for the initial technical and the Government of Uganda for the financial support towards the Lower Secondary Curriculum Review.

Last but not least, NCDC would like to acknowledge all those behind the scenes who formed part of the team that worked hard to finalise the work on this Syllabus.





NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email *admin@ncdc.go.ug* or through our *Contact Us* page on our website at *www.ncdc.go.ug*.

Grace K. Baguma
Director
National Curriculum Development Centre

INTRODUCTION

The Uganda Vision 2040 aims to transform Uganda into a modern and prosperous country; however, the National Development Plan recognises the existing weaknesses in education, including the low efficiency and variable quality at the secondary level. The Sustainable Development Goal 4 advocates for equitable and quality education, while the NDP II focuses on enhancement of human capital, development, strengthening mechanisms for quality, effective and efficient service delivery and improvement on the quality and relevance of skills development. The NRM Manifesto (2016-2021), emphasises continuous assessment of examination systems and strengthening soft skills, which promote self-esteem, conscientiousness, and a generally positive attitude to work, promoting e-learning and computer literacy in order to enhance learning outcomes. All these are lacking and where they exist it is at a minimum level.

In line with the above, the Education and Sports Sector Strategic plan (2017/20) advocates for delivery of equitable, relevant, and quality education for all. The current secondary school curriculum of Uganda, although highly regarded by some, is focused on the needs of a tiny academically oriented elite, yet the needs of the majority of learners need to be the focus. The Ministry of Education and Sports (MoES) through the National Curriculum Development Centre (NCDC), therefore, undertook a review of the Lower Secondary Curriculum, aimed at providing a learning environment, opportunities, interactions, tasks, and instructions that foster deep learning by putting the learner at the centre of the learning experience. This is in line with the aims of secondary education in Uganda, as provided for in the Government White Paper on education (1992) as outlined below:

The aims of secondary education in Uganda are:

- Instilling and promoting national unity, an understanding of the social and civic responsibilities;
- Promoting an appreciation and understanding of the cultural heritage of Uganda including its languages;
- Imparting and promoting a sense of self discipline, ethical and spiritual values, personal responsibility and initiative.
- Enabling individuals to acquire and develop knowledge and an understanding of emerging needs of the society and the economy.
- Providing up-to-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of socioeconomic development of Uganda;
- Enabling individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment.
- Enabling individuals to develop personal skills of problem solving, information gathering and interpretation, independent reading and writing, as well as self-improvement through learning and development of social, physical and leadership skills such as are obtained through games and sports, societies, and clubs.
- Laying the foundation for further education.
- Enabling the individual to apply acquired skills in solving problems of the community, and
- Instilling positive attitudes towards productive work.

BACKGROUND TO THE CURRICULUM

The review was based on the Education Sector Strategic Plan (ESSP), 2009 – 2018) which set out strategies to improve the quality and relevance of secondary education. The ESSP's sub objective 2.2 was to ensure that "Post-primary students [are] prepared to enter the workforce and higher education". This is also in line with the strategic plan of 2017-2020. To achieve this objective, one of the Ministry's strategies was to revise the curriculum and improve instruction and assessment by eliminating the short comings in the current curriculum.

The review focused on: producing a secondary school graduate who has the competences that are required in the 21st century; promoting values and attitudes. Ensure effective learning and acquisition of skills in order to reduce unemployment among school graduates.

The review also aimed at reducing the content overload and contact hours in the classroom so as to create time for; research and project work, talent development and creativity, and emerging fields of knowledge across all subjects, and doing away with obsolete information. There was a need to address the social and economic needs of the country like the mining sector, tourism, services provision, science and technology development and to ensure rigorous career guidance programme to expose learners to the related subjects. This will enable learners to make informed choices as they transit and to equip them with knowledge and skills that will enhance their competitiveness in the global value chain.

To meet these requirements, the review is based on:

- The development of a holistic education for personal and national development based on clear shared values.
- A commitment to higher standards, deeper understanding and greater opportunities for learners to succeed.
- A focus on the key skills that are essential to work, learning, and life, and which will promote lifelong learning.
- An integrated approach that will develop the ability to apply learning in practical situations.

The ESSP further outlines what the review implies:

"This review will necessitate a sweeping revision of the general secondary curriculum, away from strictly academic learning objectives that are thought to prepare students for erudite higher education and towards a set of competencies that serve both those who continue their education after S4 and those who choose to enter the workforce. The new curriculum will enable learners to acquire specific vocational skills that they can use once they enter the world of work. The new curriculum will help learners make informed decisions as citizens and family members, and it will give those who continue with their education, either immediately in S5 or later in life, the learning skills they need to think critically and study efficiently."

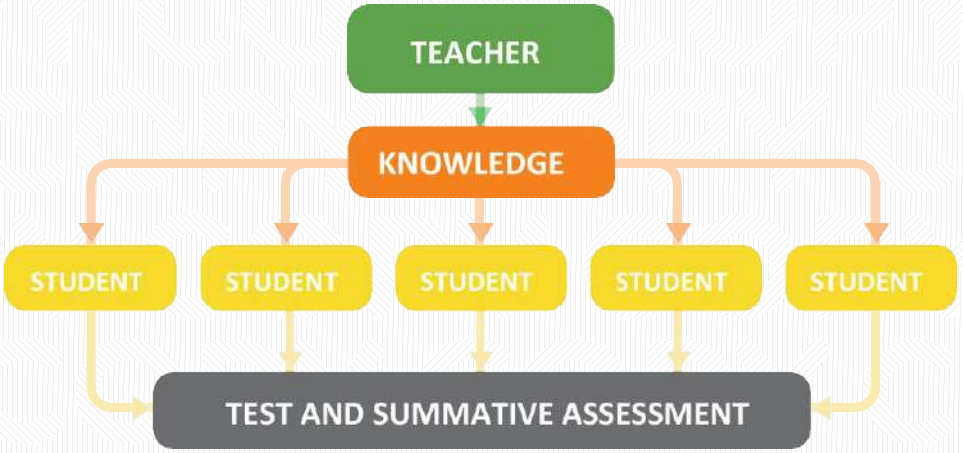
KEY CHANGES IN THE NEW CURRICULUM

The key change in the curriculum is a move from a knowledge-based curriculum to a competence and skill-based curriculum. It is no longer sufficient to accumulate large amounts of knowledge. Young people need to develop the ability to apply their learning with confidence in a range of situations. They need to be able to use knowledge creatively. A level of competence is the ability to use knowledge rather than just to acquire it. This requires an active, learner-centred rather than passive, teacher-centred approach.

This approach to teaching and learning is in support of the Sustainable Development Goals (SDG's), otherwise known as the Global Goals. These are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The key changes in the curriculum will ensure that Uganda is making good progress towards SDG 4 in particular which aims to ensure equitable quality education and promote lifelong learning opportunities for all.

The change can be summarised in the following diagrams.

THE KNOWLEDGE-BASED CURRICULUM



Knowledge-based teaching was based on transferring knowledge from the teacher to the students. The teacher had knowledge and transferred this knowledge to the students by lecturing, talking, and asking them to read the text book or writing notes on the board for the students to copy and learn. Students acquired the knowledge, often without fully understanding it, and were tested at the end of a topic, term or school course to see if they had remembered it. The knowledge was based mainly on the knowledge in the subjects traditionally taught at University, and little attempt was made to make it relevant to young people's own lives. The whole education system was seen by many people as a preparation for University, but the vast majority of learners never reach university. This curriculum caters for this majority as well as those who later on go to University.

THE COMPETENCE BASED CURRICULUM

In the competence-based approach, the "student" becomes a "learner". The new Learning Outcomes can only be achieved through active engagement in the learning process rather than simply absorbing knowledge given by theteacher.

The teacher needs to build on the learners' own knowledge and experience and create Learning Activities through which learners can explore the meaning of what is being learned and understand how it is applied in practical situations.

Teaching and learning becomes a two-way process of dialogue between the Teacher and Learners. Learners also learn from each other through discussion. Assessment also becomes a two-way process of formative and summative assessment not just to give grades but to find out problems the learners may be having and help to solve them.

THE NEW CURRICULUM

This curriculum focuses on four "Key Learning Outcomes" of: self – assured individuals, responsible and patriotic citizens, lifelong learners, and positive contributors to society.
The curriculum emphasises knowledge, application, and behavioural change. It is based on a clear set of values which must be imparted to learners during the learning process.

At the heart of every subject there are generic skills that allow development into lifelong learners. Besides, there are also cross cutting issues that are embedded across subjects to enable learners understand the connections between the subjects and complexities of life.

Key Learning Outcomes

This curriculum sets out 'Key Learning Outcomes' that sum up the expectations of the curriculum as a whole, and sets out clearly the qualities that young people will develop.

By the end of the educational process, young people will become:

Self-assured individuals who:

- Demonstrate self- motivation, self-management, and self-esteem.
- Know their preferences, strengths, and limitations.
- Adjust their behaviour and language appropriately to different social situations.
- Relate well to a range of personality types.

Responsible and patriotic citizens who:

- Cherish the values promoted in the curriculum
- Promote the development of indigenous cultures and languages; appreciate diversity, equity, and equality.
- Apply environmental and health awareness when making decisions for themselves and their community.
- Are positive in their own identity as individuals and global citizens.
- Are motivated to contribute to the well-being of themselves, their community, and the nation.

Lifelong learners who:

- Can plan, reflect, and direct their learning.
- Actively seek lifelong learning opportunities for personal and professional development.

Positive contributors to society who:

- Have acquired and can apply the Generic Skills.
- Demonstrate knowledge and understanding of the emerging needs of the society and economy.
- Understand how to design, make, and critically evaluate products and processes to address needs.
- Appreciate the physical, biological, and technological world; make informed decisions about sustainable development and its impact on people and the environment.

Values

This curriculum is based on a clear set of values. These values underpin the whole curriculum and the work of schools. They are also the values on which learners need to base their lives as citizens of Uganda. The values are derived from The Uganda National Ethics and Values Policy of 2013. They are:

- Respect for humanity and environment
- Honesty; uphold and defend the truth at all times
- Justice and fairness in dealing with others
- Hard work for self-reliance
- Integrity; moral uprightness and sound character
- Creativity and innovativeness
- Social Responsibility
- Social Harmony
- National Unity
- National Consciousness and patriotism

These values are not taught directly in lessons, nor will they be assessed, but they will inform and shape all teaching and learning.

Generic Skills

The generic skills lie at the heart of every subject. They are the skills that enable the learner to access and deepen learning across the whole curriculum. They are the same skills that are sought by employers and which will unlock the world of work. They allow young people to develop into lifelong learners who can adapt to change and cope with the challenges of life in the 21st Century.

Young people need to be able to think critically and solve problems, both at school and work. They need to be creative and innovative in their approach to learning and life. They must be able to communicate well in all forms, co- operate with others, and also work independently. They must also be able to use functional mathematics and ICT effectively. The details of the generic skills are:

Critical thinking and problem-solving

- Plan and carry out investigations
- Sort and analyse information
- Identify problems and ways forward
- Predict outcomes and make reasonable decisions
- Evaluate different solutions

Creativity and innovation

- Use imaginations to explore possibilities
- Work with others to generate ideas
- Suggest and develop new solutions
- Try out innovative alternatives
- Look for patterns and make generalisations

Communication

- Listen attentively and with comprehension
- Talk confidently and explain ideas/opinions clearly
- Read accurately and fluently
- Write and present coherently
- Use a range of media to communicate ideas

Co-operation and Self-directed Learning

- Work effectively in diverse teams
- Interact effectively with others
- Take responsibility for own learning
- Work independently with persistence
- Manage goals and time

Mathematical computation and ICT proficiency

- Use numbers and measurements accurately
- Interpret and interrogate mathematical data
- Use mathematics to justify and support decisions
- Use technology to create, manipulate, and process information
- Use technology to collaborate, communicate, and refine their work

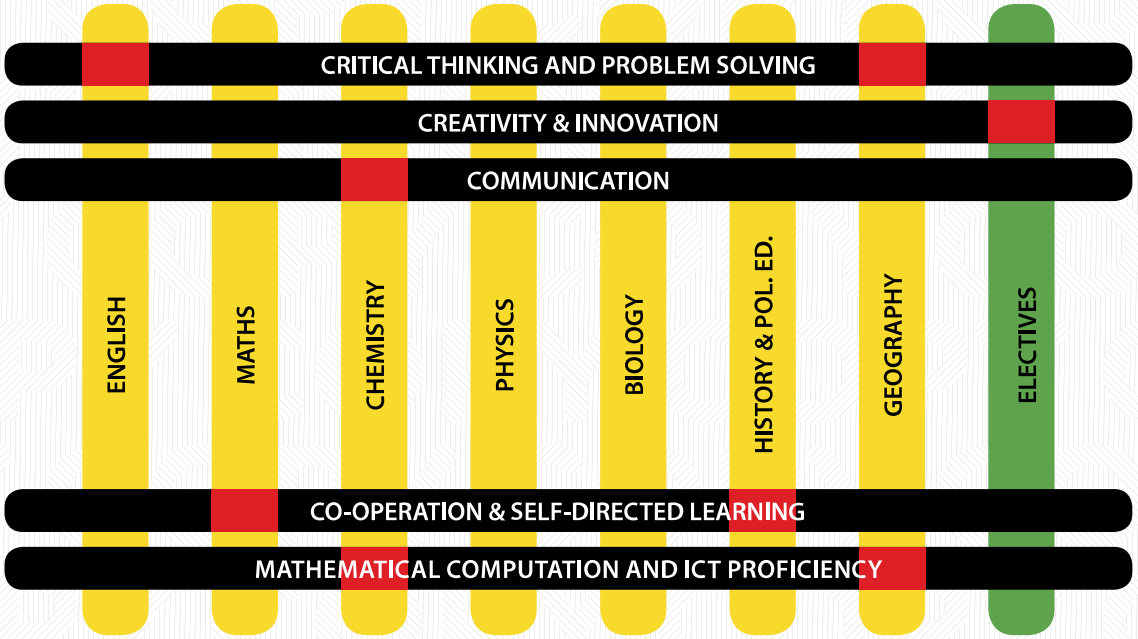
GENERIC SKILLS WITHIN PHYSICS

These skills are not separate subjects in themselves; they are developed within the subjects of the curriculum. They also facilitate learning within those subjects. It is when these generic skills are deployed that learning is most effective.

The generic skills are a key part of the new curriculum. They have been built into the syllabuses for each of the subjects which provide the context for the skills development. Physics provides a rich context for learners to communicate, co-operate, and think critically about how the world works, and to understand the world from a scientific point of view.

The subjects also provide the contexts for progression within the skills. The same skills definitions apply to all year groups; skills progression is provided by the increasing complexity of the subject matter within each subject. For example, within 'critical thinking, learners begin thinking critically about the relatively simple subject matter in Senior 1 and then progress to thinking about the much more complex matters in Senior 4.

Thus, the progression is in the increasing complexity of the matters being thought about.



Cross-cutting Issues

There are some issues that young people need to learn about, but which are not confined to one subject These are the 'Cross-cutting issues' that need to be studied across the subjects. These issues develop learners' understanding of the connections between the subjects, and the complexities of life.

The Cross-cutting Issues identified in the curriculum are:

- Environmental awareness
- Health awareness
- Life skills
- Mixed abilities and involvement
- Socio-economic challenges
- Citizenship and patriotism

(For details on cross-cutting issues, refer to the Curriculum Framework document, page 11).

These have been built into the syllabuses of each subject. The way in which they operate within the subject is very similar to the generic skills. Physics provides a very good context for environmental and health awareness, and to understand the complex and diverse world in which we live.

ICT Integration

ICT is embedded as a learning/teaching tool. ICT framework is summarized below and cuts across all the subjects on the curriculum.

CATEGORY OF A TASK IN THE SYLLABUS	ICT APPLICATION (HOW ICT WILL BE INTEGRATED FOR THE TASK CATEGORY)
Field works	Use of cameras to take photos and record videos
Presentations in class	Use presentation application
Key words and meanings	Use online dictionary or search online
Drawing/graphics	Use publishing software, Word processor
Role play, narrations	Use audio and video recordings
Demonstrations	Use audio and video recordings and simulations
Locating and putting marks on an area	Use digital/online mapping
Present findings in graphic and written format	Use desktop publishing software or word processor
Showing data charts	Use spreadsheet software
Group discussions	Mind-mapping software
Search for extra reading materials	Download files on Internet or by sharing
Writing equations and formulas	Use equation editors
Carrying out academic research	Using the Internet and other academic applications like Encarta", "Britannica" etc.
Sharing or learning with people across the world	Forming learning networks, formation of blogs, social media, emails, etc.

THE PHYSICS SYLLABUS

Physics is a compulsory subject from Senior 1 to Senior 4.

Time allocation

PHYSICS	S1&2	S3&4
	3 periods a week	4 periods a week

Rationale

Physics lies at the heart of the natural sciences. Almost any scientific problem can be approached using the ideas and methods of physics. Physics explains how the world works and helps us understand why things in the natural world happen the way they do. It prepares learners to pursue science related disciplines in higher education in line with the Vision 2040 conceptualisation of Strengthening Fundamentals (Infrastructure, Human Capital, Science, Technology, Engineering and Innovations, Security and Defence).

The study of Physics enables learners to:

- acquire sufficient scientific knowledge and understanding that will prepare them for the challenges of the 21st century
- become confident citizens in a technological world, able to take or develop an informed interest in scientific matters,
- recognise the usefulness, and limitations of Physics and to appreciate its applicability in other disciplines and in everyday life,
- be suitably prepared for studies beyond the O' level, carry out experimental work
- develop attitudes relevant to science in general and Physics in particular such as:
  - concern for accuracy and precision
  - objectivity
  - integrity
  - enquiry
  - initiative
  - inventiveness
  - innovativeness
- develop awareness that the study and practice of Physics are co-operative and cumulative activities, that are subject to social, economic, technological, ethical, and cultural influences, justifications, and limitations,
- appreciate that the applications of Physics may be both beneficial and detrimental to the individual, community, and the environment,
- develop interest in and care for the environment and the proper utilisation of resources with respect to Uganda,

Teaching and Learning Physics

The thrust of the new syllabuses is experiential and towards deeper understanding. The focus in Physics is on the development of understanding through experimentation, scientific enquiry, and rational thought.

The new syllabuses provide learners with a wide range of contexts in which to develop this understanding. These contexts are designed to engage the interest of the learner and to provide opportunities to build life-related knowledge, experience, and skills. Teachers are encouraged to go beyond the textbooks and provide as many meaningful contexts as possible. The generic skills have been integrated throughout the curriculum and can only be acquired through active approaches.

The role of the teacher is to build on learners' existing knowledge and experience, and to extend that by posing problems to the learners. This makes them think about their own ideas and experiences as well as adding new knowledge and skills to it.

Learners need to interact with real situations inside and outside the classroom. They need to look at pictures or diagrams, examine statistics, or read texts from a range of sources. They need to find out knowledge and ideas for themselves. They should then be expected to express these in their own words, not those of the teacher, and so demonstrate that they have understood what they have learnt.

In this approach, learners are encouraged to:

- be responsible for their learning.
- think for themselves and form their own ideas and opinions.
- become critical thinkers, ready to face new challenges and situations for themselves.

THE PHYSICS SYLLABUS

Programme Planner

SENIOR ONE	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Introduction	Introduction to Physics	6
	Mechanics and properties of matter	Measurements in Physics	30
Term 2	Mechanics and properties of Matter	States of matter	10
	Mechanics and properties of Matter	Effects of forces	16
	Heat	Temperature measurements	10
Term 3	Heat	Heat transfer	12
	Heat	Expansion of solids, liquids, and gases	8
	Light	Nature of light; reflection of light at plane surfaces	16
		Total	**108**

SENIOR TWO	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Mechanics and properties of Matter	Work, energy, and power	20
	Mechanics and properties of Matter	Turning effect of forces, centre of gravity, and stability	16
Term 2	Mechanics and properties of Matter	Pressure in solids and fluids	16
	Mechanics and properties of Matter	Mechanical properties of Materials and Hooke's law	12
	Light	Reflection of light at curved surfaces	8
Term 3	Magnetism	Magnets and magnetic fields	10
	Electricity	Electrostatics	8
	Earth and space physics	The solar system	18
		Total	**108**

SENIOR THREE	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Mechanics and properties of Matter	Linear and non-linear motion	30
	Light	Refraction, dispersion, and colour	18
Term 2	Light	Lenses and optical instruments	18
	Waves	General wave properties	16
	Waves	Sound waves	14
Term 3	Heat	Heat quantities and vapours	20
	Earth and space physics	Stars and galaxies	14
	Earth and space physics	Satellites and communication	14
		Total	**144**

SENIOR FOUR	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Electricity	Introduction to current electricity	14
	Electricity	Voltage, resistance and Ohm's law	18
	Magnetism	Electromagnetic effects	16
Term 2	Electricity	Electric energy distribution and consumption	28
	Modern physics	Atomic models	20
Term 3	Modern physics	Nuclear processes	20
	Modern physics	Digital electronics	20
		Total	**136**

Notes to users:

The following words and terms are used in this syllabus and should be interpreted as:

Knowledge: this is formed from accepted facts or information which forms a mental model (which may be incomplete)

Understanding: involves thinking and is formed from a collection of knowledge which links facts together and can be used to make generalisations or apply principles

Investigations: involve thinking and the use of scientific equipment to apply understanding and a methodology which involves some or all of:

- planning to select techniques, apparatus, and materials
- identifying variables and how to control them
- making predictions based on prior knowledge and propose hypotheses
- recording observations, measurements and estimates in appropriate format
- identifying patterns in outcomes
- interpreting and evaluating observations and results using suitable methods e.g. graphs
- identifying possible sources of errors and how to minimize them

Research involves using knowledge and includes asking questions of others, discussion, reading, watching films, listening to the teacher or use of the Internet to improve understanding

Investigations and research seek to encourage learners to apply knowledge and understanding in a new situation, analyse information, especially in observations, and create charts or graphs. Synthesising information from different sources is combined to establish new patterns and evaluation which involves making judgements about the validity of results or evidence. In many cases, this will require scaffolding to help learners to benefit from the approach.

The syllabus details for all subjects are set out in three columns:

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The knowledge, understanding or skills expected to be learned by the end of the topic	The sorts of learning activities which include the generic skills that will help learners achieve the Learning Outcomes.	Opportunities for assessment within the learning

Teachers should base their lesson plans on the Learning Outcomes using the Suggested Learning Activities as a guide. These are not the only possible learning activities, therefore, teachers are encouraged to extend these and devise their own that are appropriate to the needs of their class.

DETAILED SYLLABUS FOR PHYSICS

SENIOR 1: TERM 1

Theme: Introduction

TOPIC 1: INTRODUCTION TO PHYSICS

6 PERIODS

Competency: The learner should be able to understand the importance of Physics and safe laboratory practice.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the meaning of physics, its branches and why it is important to study Physics (u, v/a))
b. understand why it is important to follow the laboratory rules and regulations (u, v/a)
	• In groups, learners research the meaning of the word physics; discuss the science they have studied in primary schools, and relate the topics studied to the definition of physics. After class discussion, individuals produce reports on conclusions.
	• In groups, learners research and discuss some of the natural phenomena which can be explained using physics, report to and discuss with the class.
	• In groups, learners discuss and relate different careers to Physics
	• In groups learners
	  • discuss rules and risk assessment to keep themselves and others safe in the laboratory
	  • produce a poster or chart to guide the class in safe practice
		• Observe and listen to learners as they research and discuss the meaning of physics, its importance and safe practice in the laboratory. Intervene to ensure that all are making progress towards achievement of learning outcomes.
		• Evaluate learning by assessment of products: group and individual reports; safety guidance.

ICT Support Learner uses internet to search for some personalities who have made discoveries in Physics and display on a spreadsheet what they did.		

SENIOR 1: TERM 1 Theme: Mechanics and Properties of Matter

TOPIC 2: MEASUREMENTS IN PHYSICS 30 PERIODS

Competency: The learner should be able to estimate and measure length, area, volume, mass, density, and time and express them using appropriate units.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. understand how to estimate and measure physical quantities: length, area, volume, mass, and time (u, s, gs) b. explain how they choose the right measuring instrument and units; explain how to use the instruments to ensure accuracy (u, s) c. appreciate that the accuracy of measurements may be improved by making several measurements and taking an average value (gs, v/a) d. identify potential sources of error in measurement and devise strategies to minimise them (u, s, v/a) e. understand the scientific method and explain the steps used in relation to the study of physics (u) f. know that practical investigations involve a 'fair test', analysis, prediction and justification of results, and observations, and apply learning in practice (k, s) g. record data in graphs and charts and look for trends (u, s) h. understand and be able to use scientific notation and significant figures (u, s) i. understand density and its application to floating and sinking (u) j. determine densities of substances and relate them to purity (u, s, gs) k. understand the global nature of ocean currents and how they are driven by changes in water density and temperature (u, s)	• In groups, learners examine, discuss, research, and make notes on the accurate use of tape measures, rulers, vernier calipers, stop clocks/watches, balances, measuring cylinders, and displacement cans. • In pairs, learners choose appropriate units, record estimates, and then make and record accurate measurements of each of the following: the length of a football pitch, the width of a classroom, the area of a desk top, the thickness of a desk top, the time a friend takes to walk 20 paces, the mass of a pen, the volume of water in a container, the volume of a regular and an irregular solid • In pairs, learners compare estimates and accurate measurements, agree on techniques for selecting measuring instruments and units and for ensuring accuracy/ minimising error before completing reports on class conclusions. • In groups, learners plan, carry out, and report on a simple investigation, e.g. to compare the rate of cooling of water and a strong salt solution, considering: • predictions/hypotheses • ensuring a fair test, controlled and measured variables • selection of equipment and materials • frequency of measurements • accuracy of measurements • recording results in a table • presenting results in a graph • analysis of results and drawing conclusions	• Listen to group and pair discussions. Ask probing questions to promote critical thinking and ensure that learners gain expected knowledge, understanding, and skills. • Observe pairs and groups engaged in practical activities and intervene to ensure practice is safe and investigations are well planned and conducted. • Evaluate quality of learning through assessment of products: outcomes of/reports on measuring exercises; investigation reports; scientific notation calculations.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	• possible sources of error • possible improvements • In pairs, learners research on the use of scientific notation before class discussion about the need for its use when dealing with very large or small numbers (e.g. $\times 10^6$, 4.31×10^{-3}) • Individuals practice • Identifying and rounding of numbers to required significant figures • converting large & small numbers into scientific notation • In groups, learners predict whether solids float or sink in water and record conclusions, then plan, carry out and report on a practical investigation to find the densities of the solids and compare results with the theoretical values and predictions on floating. • In pairs, learners research, discuss, and produce a report on: • how ocean currents are related to changes in water density • the possible impact on ocean currents of the warming of the North Atlantic due to climate change.	

Note:

(i) the reading of vernier calipers and micrometer screw gauge should be left out but only mention instances where these instruments are used

(ii) both digital and analogue clocks should be used if available

(iii) Accuracy and significant figures to be emphasised throughout the whole syllabus, for both theoretical and practical work

(iv) Scientific method should be continuously applied to ALL other topics and sub-topics

(v) The experiment to determine density using the density bottle should not be carried out, though results obtained from the experiment may be used in numerical problems

ICT Support

- use spreadsheets to record experimental results, generate graphs and analyse results
- use spreadsheets and enter appropriate formulae to make calculations

SENIOR 1: TERM 2 Theme: Mechanics and Properties of Matter

TOPIC 3: STATES OF MATTER 10 PERIODS

Competency: The learner should be able to use the knowledge of the arrangement and motion of particles to explain the properties of solids, liquids, gases and plasma.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the meaning of matter (u)
b. understand that atoms are the building blocks from which all matter is made; appreciate that the states of matter have different properties (k, u)
c. apply the particle theory to explain diffusion and Brownian motion and their applications (s)
d. understand how the particle theory of matter explains the properties of solids, liquids and gases, changes of state, and diffusion (u)
e. understand the meaning and importance of plasma in physics (u, v/a)
	• In groups, learners draw on their prior learning and research to produce a presentation on:
	  • why matter is anything which occupies space and has mass
	  • the particle theory of matter
	  • how matter exists in different states and give common examples of solids, liquids, and gases
	  • the nature of plasma and why it is described as the fourth state of matter
	  • the properties of solids, liquids, and gases, including shape, pouring, and compressing
	  • Brownian motion
	• In pairs, learners observe/present demonstrations, research, and report on the factors that affect rate of diffusion in fluids; compare diffusion of liquids and gases (link to transpiration, and osmosis in biology).
	• In groups, learners apply knowledge of the particle theory to explain on a poster:
	  • the properties of solids, liquids and gases
	  • why, when curry is cooking in the kitchen, it can be smelt in all parts of the home, even if there are no air currents
	  • why diffusion takes place faster in a gas than in a liquid
	• In groups, learners plan, carry out and report on investigations, using the scientific method to explain, using water and ice, the changes of state of matter resulting from heating and cooling. They use the observations to explain why heat is taken in during melting and boiling and given out during condensing and freezing.
		• Listen to presentations and group discussions and where appropriate, ask questions to promote clarification and deepen understanding.
		• Observe groups and pairs and intervene to offer guidance.
		• Evaluate the quality of learning and progress towards the learning outcomes through assessment of products: presentations, investigation reports, and personal research.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	• In pairs, learners research, discuss and report on the importance of changes of state in everyday life, including control of body temperature in mammals, rain and the water cycle, cooling drinks with ice and making ice cream.	
Note: 1. More discussion on plasma and its availability to be emphasised 2. Cooling curves should not be introduced at this point		
ICT Support Learners use the internet or video to view simulations of plasma in nature		

SENIOR 1: TERM 2 Theme: Mechanics and Properties of Matter

TOPIC 4: THE EFFECTS OF FORCES 16 PERIODS

Competency: The learner should be able to explore the nature and types of force and describe how forces move or change the shape of objects, and understand some common applications of forces.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. know that a force is a push or a pull and that the unit of force is the Newton (k)
b. know the effects of balanced and unbalanced forces on objects (k, s)
c. understand the existence of the force of gravity and distinguish between mass and weight (u)
d. appreciate that the weight of a body depends on the size of the force of gravity acting upon it (k, u, v/a)
e. understand the concept of friction in everyday life contexts (u)
f. understand the meaning of adhesion and cohesion as forms of molecular forces (u)
g. explain surface tension and capillarity in terms of adhesion and cohesion and their application (u, v/a)
	• In pairs, learners use springs, rubber bands, and force meters to research, push, and pull forces and use this to
	  • explain the meaning of force
	  • identify a variety of forces and give instances where they occur
	  • categorise forces as contact and non-contact
	  • demonstrate the effects of forces on objects
	  • identify examples of the effects of forces (change of movement and/or shape) on objects
	  • express forces in Newtons and use the symbol N.
	• In pairs, learners:
	• consider a tug of war to explain forces and predict in diagrams what will happen when the pulling forces of the teams are a) unbalanced and b) balanced.
	• calculate resultant forces when linear and perpendicular forces are applied to an object
		• Listen to pairs/groups and ask probing questions to promote critical thinking and deepen understanding of forces.
		• Observe learners involved in activities; intervening to avoid misconceptions and to help with strategies for solving numerical problems related to the resultant of two or more forces.
		• Listen to discussions and pose questions where appropriate to deepen thinking on how adhesion and cohesion occur and the practical implications.
		• Observe group work and assess presentations to gauge progress towards the learning outcomes; intervening as appropriate.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

	• In groups, learners draw on prior learning and research about gravity and explain in a presentation:
	  • why gravity is less on the moon than on Earth
	  • why objects are attracted to the Earth
	  • why the Earth revolves around the sun
	  • applications of force of gravity such as irrigation in farming and other consequences of weight
	  • the relationship between mass and weight (W=mg)
	  • why the weight of a body depends on the size of the force of gravity acting upon it
	• In groups, learners draw on prior learning to explain friction, and plan and carry out a practical investigation to find the effects and use of frictional forces to explain:
	  • the factors that affect frictional force between two surfaces in contact and determine the limiting friction between them
	  • ways of reducing or increasing friction
	  • why heavy objects can be more easily moved on rollers
	  • why objects slide more easily across a smooth surface than a rough surface
	  • why car tyres become smoother and thinner with time and why tyre tread is important
	  • why it is easier to write with a pencil on paper rather than on glossy plastic
	• In groups, learners investigate the existence of surface tension on water, observe demonstrations and explain in a presentation:
	  • the effects of spraying a layer of oil on the water surface in ponds
	  • capillarity, cohesion, and adhesion and explore with glass tubes of different diameters;
	  • real life examples of adhesion and cohesion (e.g. damp course in buildings, and fluid flow in plant stems)	

Note:

1. Treatment of F=ma not required at this point
2. Both scale drawing and mathematical (Pythagoras theorem) method can be used to obtain the resultant force of perpendicular forces.
3. The angle at which the resultant is inclined is not required
4. Only the qualitative treatment of friction is required
5. The use of the expression W=mg to be emphasized
6. Emphasise the meaning rather than the definition of surface tension
7. Mathematical treatment of surface tension is beyond the scope of this syllabus

ICT Support

Use Internet as a source of research for information about gravity on earth and other planets

SENIOR 1: TERM 2 Theme: Heat

TOPIC 5: TEMPERATURE MEASUREMENTS 10 PERIODS

Competency: Appreciate that temperature change is a result of heat effects in a body and that daily temperature changes have an effect on our lives.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. Understand the difference between heat and temperature (u) b. Understand how temperature scales are established (u) c. Calibrate a thermometer and use it to measure temperature (s, u) d. Compare the qualities of thermometric liquids (u, s, v/a) e. Describe the causes and effects of the daily variations in atmospheric temperature (u, v/a)	• In groups, learners discuss the effects of heat on substances and use the discussion to explain the difference between heat and temperature • In groups, learners draw on prior learning about how thermometers measure temperature and compare the accuracy of mercury, alcohol and digital thermometers as water is heated and/or cooled. • In groups, learners plan and report on an investigation into the thermometric qualities of liquids; calibrating their experimental thermometers and evaluating the accuracy of the calibration. • In groups, learners discuss and report on the causes of the variation in atmospheric temperature and its effects to life on earth.	• Listen to discussion in groups and pairs and pose questions to encourage thinking to understand that energy can neither be created nor destroyed, only transformed from one type to another. • Observe how learners participate in group and pair work; ensuring that all participate and make progress. • Assess the quality of products and scientific literacy, and then evaluate progress towards the learning outcomes.
Note: Gas and resistance thermometers should not to be discussed at this level		
ICT Support • use any computer program to draw a flow chart showing the various energy changes • use data collection tools such as a temperature probe (sensor) to capture the temperature heat variation		

SENIOR 1: TERM 3 **Theme: Heat**

TOPIC 4: HEAT TRANSFER 12 PERIODS

Competency: The learner should be able to explain the modes of heat transfer and their applications to daily life.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand how heat energy is transferred and the rate at which transfer takes place (u, s)
b. understand what is happening at particle level when conduction, convection, and radiation take place and their application (k, u, v/a)
c. understand that greenhouse effect and global warming are aspects related to heat transfer on the earth surface (u, v/a)
	• In groups, learners design, carry out and report on investigations to show how heat is transferred in different solids, water and air to explain:
	  • conduction in different solids in terms of particle theory
	  • convection in liquids and air in terms of particle theory
	  • the causes and effects of convection currents in the atmosphere and their relation to weather/climate
	• In groups, learners use prior learning to design, carry out and report on investigations to:
	  • Compare rates of heat conduction by different materials
	  • compare the radiation of heat from different surfaces and how heat is transferred by radiation
	  • compare how well heat is absorbed/ reflected by different surfaces
	• In pairs, learners research and make a presentation on how heat transfer is kept to a minimum in a vacuum flask
	• In groups, learners search and make presentations on causes and effects of global warming and how the greenhouse works
		• Listen to discussions and encourage learners to draw on prior learning and their experience of heat transfer and insulation. Pose questions to promote deep thinking.
		• Observe how learners work together to share information about heat and explain it at particle level. Intervene to offer guidance and deepen understanding.
		• Assess learners' knowledge, understanding, and skills through products; making sure all progress to achieve learning outcomes.

SENIOR 1: TERM 3 — Theme: Heat

TOPIC 7: EXPANSION OF SOLIDS, LIQUIDS AND GASES — 8 PERIODS

Competency: The learner should be able to explain the effect of heat on the expansion of solids, liquids, and gases and explore their applications.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. understand that substances expand on heating, and recognise some applications of expansion (u, s) b. understand the effect and consequences of changes in heat on volume and density of water (u, s) c. know about the anomalous expansion of water between 0ºC and 4 ºC and its implications (u, k, v/a)	• In groups, learners design, carry out and report on a practical investigation to compare the rates of expansion of solids and liquids. Explain how the expansion of materials is observed and used in e.g. expansion of tyres/balloons, metal bridges, and weather systems, water expanding when frozen/ice forming on the surface of water. Share the results with the class. • In pairs, learners research, discuss and prepare a presentation on 'How particle theory can be used to explain how heating changes the volume and density of solids, liquids, and gases'. • In pairs, learners produce an annotated diagram / graphic presentation, explaining why ice forms on the surface of a body of water and why this is important for life on earth.	• Listen to groups' and pairs' discussions and ask probing questions to ensure understanding. • Observe how learners investigate and use the outcomes to explain expansion; intervene to deepen learning of all participants. • Evaluate quality of learning through assessment of products: investigation reports and presentations.
Note: Gas laws should not be used to explain expansion of gases at this level. Numerical treatment of gas expansion not required. Only simple illustration of gas expansion in everyday life is required.		

SENIOR 1: TERM 3 — Theme: Light

TOPIC 8: NATURE OF LIGHT; REFLECTION AT PLANE SURFACES — 16 PERIODS

Competency: The learner should investigate how some objects emit light resulting in light and shade, while other objects, such as a mirror, simply reflect light, and understand the applications of light/shade and reflection.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. Know illuminated and light source objects in everyday life (u, s) b. understand how shadows are formed and that eclipses are natural forms of shadows (u) c. understand how the reflection of light from plane surfaces occurs and how we can make use of this (k, u, s, gs)	• In groups, learners brainstorm prior learning about natural and artificial sources of light and the formation of shadows, and explain using diagrams. • In pairs, learners use their knowledge about how light travels to explain in diagrams how light from the sun reaches the Earth and how eclipses are formed. • In pairs, learners apply prior learning to investigations of a pinhole camera and use it to explain magnification and image, using diagrams. • In pairs, learners investigate the characteristics of images formed by plane mirrors and research and explain angles of incidence and reflection; recording findings with (ray) diagrams. Then they use this information to verify laws of reflection • In pairs, learners apply their knowledge of reflection to design, make, and report on a device (periscope) using card and mirrors which would allow a person to see over a wall.	• Listen to pairs' discussions and intervene to ensure that diagrams are drawn accurately and that they use them to explain the nature of light, the formation of shadows, and the pinhole camera. • Observe pairs and groups engaged in practical activities and intervene to ensure that investigations are well planned and conducted and misconceptions are avoided. • Evaluate learning through products: diagrams and designs; assess progress towards the learning outcomes.
ICT Support Use of ICT simulations and other relevant pictures to show the appearance of the sun, moon and earth during eclipses.		

SENIOR 2: TERM 1 Theme: Mechanics and Properties of Matter

TOPIC 1: WORK, ENERGY AND POWER 20 PERIODS

Competency: Understand and use the relationship between energy, work done, force, and power in the operation of simple machines

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. know that the sun is our major source of energy, and the different forms of energy (k)
b. know that energy can be changed from one form into another and understand the law of conservation of energy (k, u)
c. understand the positive and negative effects of solar energy(u)
d. understand the difference between renewable and non-renewable energy resources with respect to Uganda. (u, v/a)
a. know and use the relationship between work done, force, and distance moved, and time taken (k, s)
b. understand that an object may have energy due to its motion or its position and change between kinetic and positional potential energy (u, s)
c. know the mathematical relationship between positional potential energy and kinetic energy, and use it in calculations (k, u, s, gs)
d. understand the meaning of machines and explain how simple machines simplify work (u, s)
d. understand the principles behind the operation of simple machines (u, s, gs)
	• In pairs, learners explain on a poster how the sun is the Earth's major source of energy
	• In groups, learners draw on prior learning to discuss and explain the energy transformations that take place:
	  • at a waterfall
	  • when a diesel generator is used to provide light and heat
	  • when fruit falls to the ground from a tree
	• In pairs, learners research on the law of conservation of energy and explain it on a poster or chart
	• In groups, learners research and report on the positive and negative impact of solar energy.
	• In pairs, learners research on the terms; work, energy, and power and discuss how they are related. They explain in diagrams the factors that determine the amount of work done by moving masses through different distances, and identify examples of work being done on an object in everyday life.
	• In groups, learners discuss prior learning about energy and transformation, kinetic and potential energy and create a poster to explain how potential energy is converted to kinetic energy as an object falls. Using this understanding, groups predict and report on the energy changes that take place as a pendulum swings.
	• In pairs, learners calculate work done (e.g. when a student lifts a weight of 800 N through a height of 10 m in 48 s.) using the equation
	work done = force x distance moved in the direction of force, and the power developed using the equation:
	power = work done ÷ time taken.
	• In groups, learners burn wood, paper or liquid paraffin, (this word is not clear), observe and discuss the reaction and explain on a poster:
	  • energy transformation
	  • energy loss and conservation
		• Listen to pair and group discussions; ask probing questions to promote thinking and understanding about work, power, and energy.
		• Observe pairs and groups engaged in activities and intervene to ensure calculations are well understood and conducted.
		• Evaluate quality of learning through assessment of products: work diagrams, energy transformation reports, work posters, and work/KE/velocity calculations, and gauge progress towards learning outcomes.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	• renewable and non-renewable energy sources • their effects on the environment • ways to conserve energy for the future • In pairs, learners calculate the kinetic energy and the velocity of a falling object e.g. brick of mass 0.5 kg falls from the top of a wall 20m high and hit the ground (ignoring any friction as the brick travels through the air). • In groups, learners revisit prior learning and produce a poster to explain the moment of a force and how machines make it possible to perform tasks using smaller forces than would otherwise be the case, referring to applications such as: • opening a door • garden tools • wheel and axle • pulley system • inclined plane • lever and screw • In pairs, learners use simple equipment to investigate the following and explain using a poster or presentation: • 1st, 2nd and 3rd class levers • why it is easier to undo a tight nut using a spanner with a long handle than one with a short handle • load, effort, and fulcrum • mechanical advantage, velocity ratio and efficiency of simple machines • power loss and efficiency in simple machines, and how efficiency can be maximised.	

Note:

Derivation of P.E. = mgh and K.E= $\frac{1}{2}mv^2$ is not required, but only the use of these equations in calculating P.E and K.E is recommended

ICT Support

- Using ICT simulations to show how some machines do work is recommended

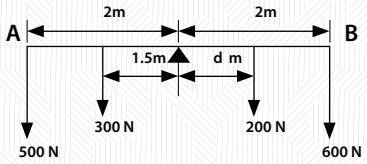
SENIOR 2: TERM 1 Theme: Mechanics and properties of matter

TOPIC 2: TURNING EFFECT OF FORCES, CENTRE OF GRAVITY AND STABILITY

16 PERIODS

Competency: The learner should be able to investigate the relation between turning effect of forces and stability of bodies.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the turning effect of forces and its applications (u, s, v/a)
b. understand and apply the concept of centre of gravity (u, s, v/a)
	• In groups, learners revisit prior learning and research about balanced moments, in order to:
	  • explain the principle of moments using a balance(see-saw)
	  • explain turning effect and the meaning of equilibrium
	  • apply this understanding to practice estimating and determining mass/ weight and distance from the pivot in order to balance
	• In pairs, learners practice moments calculations e.g. determine the value of distance **d** if AB is balanced in the figure below (or similar).
	 
	
	• In pairs, learners investigate and report on how to find the centre of gravity of a lamina of uniform and non-uniform shape and then prepare a report on:
	  • the relationship between the position of the centre of gravity of an object to its stability e.g. a bus, a racing car, etc.
	  • how the position of the centre of gravity has implications for the design of objects
	  • what happens when bodies in stable, neutral, and unstable equilibrium are displaced
		• Listen to group/pair discussions and ask questions to deepen learning.
		• Observe how practical work is planned and conducted and pose questions to improve critical thinking, learning, and practical techniques.
		• Evaluate the quality of learning through assessment of products: reports on moments, calculations, investigation details, and reports on applications.

Note:

1. Examples on moments should involve one or two pivots/turning points only.
2. Variety of examples and practical activities using a metre rule and a knife edge are recommended.

SENIOR 2: TERM 2 Theme: Mechanics and Properties of Matter

TOPIC 3: PRESSURE IN SOLIDS AND FLUIDS 16 PERIODS

Competency: The learner should be able to explain pressure in solids and fluids and identify their applications in everyday life.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand that pressure is the result of a force applied over an area (u, s)
b. understand the effect of depth on the pressure in a fluid and the implications of this (u, s)
c. understand the nature of the atmosphere and how atmospheric pressure is measured (u, s)
d. know the structure of the atmosphere and the significance of the different layers (k, u, v/a)
e. understand the use of the Bernoulli effect in devices like aerofoils and Bunsen burner jets (u)
f. understand the concept of sinking and flotation in terms of forces acting on a body submerged in a fluid (u)
g. understand and apply the Archimedes' Principle in different situations (u, s, v/a)
	• In pairs, learners use blocks of different surface area and plasticine to investigate and then report on the relationship of force and surface area. Solve numerical problems involving force and pressure, using the equation: pressure = force/area e.g. the pressure a drawing pin exerts if its tip area is 1 mm^2 and the force used to push it is 2 N, and explain the implications.
	• In groups, learners revisit the particle theory, carry out research and explain using a poster or presentation: what happens when a small amount of boiling water is poured into an empty plastic bottle, the cap is placed on tightly, and the water cools.
	• In pairs, learners investigate and report on the effect of depth on fluid pressure by making holes in a water bottle at different depths and explain the links between depth, pressure and density and how this may be applied for example in irrigation, water supply, etc.
	• In pairs, learners use the expression for fluid pressure i.e. p = hρg to calculate liquid pressure.
	• Groups discuss and use learning about pressure to explain why:
	  • farm tractors have large back wheels with wide tyres
	  • a hippopotamus can walk in mud easier than a goat
	  • dam walls are built so that they are increasingly thick from top to bottom
	  • rivers flow fastest at narrow sections than at wider sections, though the volume of the liquid does not change
		• Listen to groups and pairs of learners as they research investigate, and discuss the meaning of pressure, its causes, effects, and applications. Ask questions to promote deep learning.
		• Observe groups and pairs and intervene to check and secure understanding and ensure that all are making progress towards achievement of the learning outcomes
		• Evaluate learning by assessment of products: graphs, reports, posters / presentations, and calculations, as well as use of scientific notation, posters and presentations, investigation reports, and annotated diagrams.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

	• In groups, learners use Hare's apparatus to, compare the densities of different liquids and explain in a report, using particle theory:
	  • which of the liquids investigated is more dense
	  • why the pressure at a depth of 10 m in the sea is higher than at the surface
	• In groups, learners carry out investigations (using straws, syringes, siphons, and plastic bottles) and research in order to explain the following in a presentation:
	  • how atmospheric pressure is measured using a barometer and why it varies daily
	  • how pressure changes make drinking straw, syringe, siphon and pumps work
	  • how hydraulic machines work
	  • how altitude affects atmospheric pressure and the impact on our breathing, weather, and climate
	  • why a space is left when bottling liquids and why soda bottles do not have flat bottoms.
	• In pairs, learners investigate and report, using diagrams, the impact on atmospheric pressure of air moving over a suspended aerofoil section (the Bernoulli effect) and use it to explain why aeroplanes can fly, even though they are denser than air.
	• In pairs, learners research the main layers of the atmosphere, and using a poster or presentation, describe their characteristics, the importance of each layer, and explain how: pressure and temperature vary with altitude and region of the Earth, and the impact on weather and climate patterns
	• In pairs, learners investigate the forces on a floating body, find the effect of increasing the mass, and explain
	  • why objects weigh less in water than in air and
	  • relate this to density
	• In pairs, learners investigate the relationship between up-thrust and weight of fluid displaced and use the outcomes to inform a presentation on Archimedes' Principle and the law of flotation.
	• In groups, learners apply their learning to explain using a poster or presentation, why ships can float in water, though their material has a higher density than that of water.	

SENIOR 2: TERM 2 — Theme: Mechanics and properties of matter

TOPIC 4: MECHANICAL PROPERTIES OF MATERIALS; HOOKE'S LAW — 12 PERIODS

Competency: The learner should investigate and understand how the mechanical properties of different materials are related to their applications.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand how the mechanical properties of common materials can be utilised in physical structures (u, s, v/a)
b. understand that the tensile strength of materials is determined by the properties of the substances they are composed of (u)
c. understand that heating changes the structure and properties of some materials (u)
	• In groups, learners use prior learning and research to explain in a report the meaning of the following characteristics, and name common materials that exhibit these properties:
	  • brittle
	  • ductile
	  • strong
	  • hard
	  • malleable
	  • flexible
	  • elastic
	• In pairs, learners construct and test to destruction model bridges made out of different materials (wooden sticks, straws, spaghetti) and produce a report in which they:
	  • relate physical properties to their characteristics
	  • identify material used in everyday life and research and relate their use to their properties
	  • explain, in terms of particle theory, why heating materials changes their structure and properties
	• In pairs, learners research on the stress lines of beams under tension and compressive stress, and then explain how reinforcing concrete changes its properties.
	• In groups, learners investigate, research and report on the relationship between the load and the stretching effect on springs or rubber bands of different dimensions and make a presentation to explain:
	• the impact of variation of load on extension of elastic materials in a graph
	• the concepts of stress and strain
	• Hooke's law and its relevance to the findings
	• In groups, learners investigate the relationship between the diameter of a tube and its tensile strength. On a poster, they report the results and relate the findings to the structure of the bone and to the use of materials in construction.
	• In groups, learners investigate and report on the strength of concrete strips made with different proportions of sand and cement, comparing their properties and relating them to the balance of sand/cement.
	• In groups, learners compare the different constructional materials such as glass, wood, ceramics, and steel and make a report.
		• Listen to pairs and groups of learners as they research, plan and investigate. Intervene where appropriate, to ensure that all are making progress towards achievement of learning outcomes.
		• Observe learners engaged in activities and offer guidance to ensure that all participate and acquire the expected knowledge, understanding, and skills.
		• Evaluate quality of learning through assessment of products: outcomes of research, posters/presentation s, and investigation reports.

SENIOR 2: TERM 2 — Theme: Light

TOPIC 5: REFLECTION OF LIGHT BY CURVED SURFACES — 8 PERIODS

Competency: The learner should understand how concave and convex mirrors form images, and also be able to describe the uses of these mirrors in everyday life.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. Understand reflection of light and the formation of images by curved mirrors (u)
b. Use ray diagrams to show how images are formed by curved mirrors and the nature of the images (s)
c. Determine the focal length of concave mirrors using a variety of methods. (s, gs)
	• In groups, learners investigate what happens to the reflection when an object is placed at different distances from a curved mirror, and then record results in a table.
	• In pairs, learners research what is meant by focal length (f) and curvature (c) and use ray diagrams to explain how a concave mirror can:
	  • focus light from a distant object
	  • produce a magnified real image
	• In pairs, learners discuss the characteristics of images formed by curved mirrors and use either side of a shiny spoon (or actual mirrors) to compare and report on the differences between concave and convex mirrors.
	• In groups, learners determine the focal length of concave mirrors and make reports.
	• In pairs, learners research on, and explain using diagrams, why curved mirrors are used in optical instruments such as a telescope and in vehicle headlights.
		• Listen to group and pair discussions and ask probing questions to check understanding and promote critical thinking.
		• Observe how learners work together to develop their understanding about reflection. Intervene to steer activities as necessary.
		• Evaluate the quality of learning through assessment of products, and ensure that learners are making progress toward the learning outcomes and are gaining expected knowledge, understanding, and skills.

Note:

a) The relation r=2f should not be derived.

b) Image distance should be obtained by scale drawing only and not calculated from the mirror formula.

c) Experimental determination of focal length of convex mirrors is not required.

SENIOR 2: TERM 3

Theme: Magnetism

TOPIC 6: MAGNETS AND MAGNETIC FIELD

8 PERIODS

Competency: The learner should investigate and understand the properties of magnets and explain how the Earth behaves as a magnet.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. know that a small number of materials are magnetic, but most are not (k)
b. know how magnets can be made and destroyed (k, s)
c. understand the behaviour of magnets and magnetic fields (u)
d. know that the Earth is a magnet and how a compass is used to determine direction (k, s)
	• In pairs, learners use prior learning to discuss and classify materials in a table into magnetic or non- magnetic: [copper, nickel, iron, steel, cobalt, aluminium, steel, zinc, wood, rubber], then confirm their results with a magnet, and identify any pattern in the results.
	• In pairs, learners plan and carry out investigations using magnets and research to discover and report:
	  • which poles attract and repel
	  • the law of magnetism, and
	  • which pole of a bar magnet is south and which is north
	• In groups, learners use iron filings and paper to plot magnetic fields around a bar magnet and individually draw diagrams to show the lines of force.
	• In pairs, learners do as follows, and produce a report:
	  • investigate the strength of available magnets using a chain of small nails or pins as a measure
	  • investigate what happens when a magnetised needle is suspended freely by a thread
	  • research how the Earth behaves as a magnet and how a magnet can be used to navigate
		• Listen to group and pair discussions and ask probing questions to promote critical thinking.
		• Observe how learners work together and offer support to improve learning.
		• Evaluate the quality of learning through assessment of products: tables, reports, diagrams, and gauge progress towards the learning outcomes.

Note:

Only field lines around magnets should be drawn. Magnetic field lines around current carrying conductors shall be introduced at a later time. Concept of magnetic and geographic meridians should be left out.

ICT Support

Use of ICT to show appearance of geographical meridian and magnetic meridian and related phenomena.

SENIOR 2: TERM 3

Theme: Electricity

TOPIC 7: ELECTROSTATICS

8 PERIODS

Competency: The learner should understand electrostatics and use electrostatics to explain lightning and other phenomena.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand everyday effects of static electricity and explain them in terms of the build-up and transfer of electrical charge (u, s)
b. apply knowledge of electrostatic charge to explain the operation of devices like lightening conductors (u, s, v/a)
	• In pairs, learners research on and discuss everyday examples of the effects of static electricity, such as charging of a balloon (to pick up bits of paper), a comb or some clothing, and explain on a poster:
	  • how friction generates electric charge that builds up on an insulator
	  • how charging by induction occurs
	  • how charge can be transferred
	  • the particles responsible for the charge
	• In groups, learners use a gold leaf electroscope and explain on a poster or presentation how:
	  • it is charged
	  • a buildup of charge is transferred
	  • how opposite charges attract and like charges repel
	• In pairs, learners research and report on:
	  • occurrences of lightning in Uganda
	  • the causes of lightening (a static discharge that builds up due to friction when bodies of air pass over each other) and how lightening conductors work
	  • how to stay safe in a thunderstorm
		• Listen to group and pair discussions; encouraging the use of prior learning, and asking probing questions to promote new thinking and deepen learning.
		• Observe how learners work, and intervene to boost understanding of electrostatics
		• Assess products to ensure that learners gain expected knowledge, understanding, and skills and are all making progress towards achievement of learning outcomes.

Note: The Faraday ice pail experiment and van der Graaf generator should be left out.		
ICT Support Use of internet to search for the recent occurrence of lightning in Uganda and the human casualties involved.		

SENIOR 2: TERM 3 — Theme: Earth and Space

Physics TOPIC 8: THE SOLAR SYSTEM — 18 PERIODS

Competency: The learner should understand the relative movement of the earth and moon in relation to the sun and explain the consequences for the Earth.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. know the relative sizes, positions, and motions of the earth, sun and moon (k, u) b. understand how day and night occur and demonstrate the phases of the moon (u, s) c. understand the roles of the sun, earth and moon in explaining time, seasons, eclipses, and ocean tides (k, u, gs) d. know the components of the solar system and their positions (k) e. know the main characteristics of the inner and outer planets in the solar system (k) f. understand the various views about the origin and structure of the universe (k, v/a)	• In pairs, learners research and explain on a poster; • how the Earth orbits around the sun and the moon around the Earth and the time taken for these orbits • the cause of day and night • why the shape of the moon appears to change over a period of time when viewed from the Earth • how the tilt of the Earth gives rise to seasons in some parts of the world • the implications of the above for activities on Earth • In pairs, learners use a model to explain how the earth and moon move relative to the sun and use it to explain eclipses. • In groups, learners research, discuss and report on the connection between the moon and ocean tides. • In pairs, learners research and report on: • the components of the solar system, and make a scale model of the planets and place them in order showing their relative distance from the Sun • the main characteristics of the inner four and outer four planets • why the Earth is the only planet which supports life • In groups, learners research, discuss and explain, using an appropriate medium: • the asteroid belt and where it is found in the Solar System • the origin and structure of the universe	• Listen to group and pair discussions, asking probing questions to promote thinking, and ensure that learners gain expected knowledge, understanding, and skills. • Observe learners working together, providing guidance to ensure all grasp concepts. • Evaluate quality of learning through assessment of products: posters, planet models, and reports; gauge progress towards the Learning Outcomes.

Note:

a) use of ICT animations is required

b) the use of a globe and torch is recommended

ICT Support

The Learner can use Internet research to study about the relative positions of the sun, moon, and earth and the phases of the moon and the solar system.

SENIOR 3: TERM 1 Theme: Mechanics and Properties of Matter

Topic 1: Linear and non-linear motion 30 PERIODS

Competency: The learner should be able to devise activities to measure distance and short time intervals, and he/she should be able to use the data to calculate the speed and acceleration of a moving object and explain their implications.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand and apply the relationship between speed, distance, and time (u, s)
b. understand the terms: linear motion, speed, average speed, acceleration, and be able to investigate resistance to motion (u, s)
c. know and use the equations of motion (u, s)
d. understand the acceleration of bodies moving in a circle and the effect of gravity and air resistance on moving bodies (u, s)
e. understand linear momentum and that it is conserved during collisions (u, s)
f. understand that momentum is conserved during a collision and the implication of this (u, s, v/a)
g. understand and apply Newton's laws of motion (u, s, v/a)
h. understand the differences between vector and scalar quantities, and give examples of each (u)
i. understand that a number of forces acting on a body can be represented by a single resultant force (u, s)
	• In groups, learners plan and carry out an investigation to find the speed of someone walking, running, riding a bicycle, and travelling in a car between two points, using speed = distance/time.
	• In pairs, learners:
	  • interpret and construct distance/time graphs and velocity-time graphs
	  • calculate the average speed of objects moving between two points, and explain, on a poster, linear motion and the difference between speed and average speed.
	• In groups, learners measure acceleration using a ticker timer and explain in a report the graph for uniform acceleration and linear motion.
	• In groups, learners use data to solve problems, using the formula v=u+at and other equations.
	• In groups, learners plan and report on an investigation into the motion of a body falling in a viscous fluid, and the effects of shape/streamlining on the motion. They should explain distance/time graphs for this motion, and the implications of shape in birds, fish and planes.
	• In pairs, learners research and explain on a poster, the speed and acceleration of bodies moving in a circle and describe the effect of gravity and air resistance on the motion
	• In groups, learners research what momentum is, and report on their findings and use the relation p=mv in various ways.
	• In groups, learners use an air track to investigate and explain to the class the conservation of linear momentum and how it is affected by changes to mass and velocity
	• In groups, learners draw on prior learning to explain with a presentation or a poster:
	  - the Newton as a unit of force
	  - the effect on velocity of applying forces of different size to objects of different mass
	  - the use of the formula F=ma.
		• Listen to group and pair discussions; asking probing questions to clarify understanding and deepen learning.
		• Observe learners carrying out activities, offering advice and guidance to ensure that all engage fully and make good progress.
		• Evaluate quality of learning through assessment of reports and ensure progress towards the learning outcomes.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

	• In pairs, learners research on Newton's laws and their implications and explain the following in a report, with examples:
	  • how action and reaction are equal and opposite
	  • the difference between vector and scalar quantities
	• In groups, learners use pulleys to investigate and report on the direction and size of the result force when two forces act at right angles on the same object.	

Note:

a) The derivation of the equations of motion is not required.

b) Numerical problems on motion in a circle are not required.

c) Problems related to objects projected at an angle to the horizontal are beyond the scope of this syllabus.

ICT Support

- Use a data collection tool such as a motion sensor to capture speeds of everyday events.
- The learner can use spreadsheets to record and analyse experimental data and draw the velocity-time graphs.
- Learner observes a video on collisions and how their effects are minimised.

SENIOR 3: TERM 1 — Theme: Light

TOPIC 2: REFRACTION, DISPERSION, AND COLOUR — 16 PERIODS

Competency: The learner should be able to understand the phenomenon of refraction and its effects.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand that light may be refracted as it passes from one medium to another and that this has both consequences and uses (u, s, v/a)
b. understand the concept of refractive index (u, s)
c. understand the concept of total internal reflection(u)
d. know that white light can be split into coloured light by refraction (k, s)
e. know that white light results from the superimposition of light of all colours of the visible spectrum (u, k)
f. determine refractive index of glass (s, gs)
	• In groups, learners:
	  • investigate and explain with diagrams, how a ray of light is refracted as it passes between two adjacent media
	  • explain phenomena such as the apparent bending of a stick in water and determine refractive index of glass
	• In groups, learners use light boxes and glass prisms to:
	  • investigate and report on total internal reflection and critical angle
	  • explain on a poster how prisms can be used instead of plane mirrors in periscopes
	• In groups, learners:
	  • investigate and report on the causes of light dispersion and how a prism splits white light into coloured light by refraction
	  • explain dispersion of light, such as oil on water and rainbows
	• In groups, learners use light filters to investigate and report on why coloured objects appear coloured.
	• In pairs, learners research and report on how a whole range of different colours is shown on a television screen, although each point on the screen receives only red, green, and blue light.
		• Listen to group and pair discussions and evaluate learning by assessment of group and individual reports.
		• Observe groups and pose questions to promote thinking.
		• Check understanding and progress towards the learning outcomes through assessment of products.

Note:

a) Numerical problems involving real and apparent depth should not be included.

b) Variety of experiments involving glass block are recommended.

ICT Support

The learner can use ICT to display what occurs during refraction and dispersion.

SENIOR 3: TERM 2 — Theme: Light

TOPIC 3: LENSES AND OPTICAL INSTRUMENTS — 18 PERIODS

Competency: The learner should be able to understand that lenses refract light to form images and these lenses can be applied in different optical instruments.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. know the properties of converging and diverging lenses, and how they are used in everyday life (k, u, s)
b. understand how lenses are used in optical systems such as the magnifying glass, correcting sight in the human eye and in camera lenses (k, u, v/a)
	• In groups, learners:
	  • investigate and report on how converging lenses focus light from a distant object and determine the focal length of a convex lens
	  • draw and present ray diagrams to show the effects of converging and diverging lenses on parallel rays of light
	  • determine focal length of convex lens, and make reports
	  • report on how lenses are used in optical instruments such as the magnifying glass, camera, microscope, and telescope
	• In pairs, learners research and explain in a presentation:
	  • the optical properties of both converging and diverging lenses using the terms: principal axis, principal focus, and focal length
	  • the structure and function of the human eye [link with Biology]
	  • the use of lenses in correcting eye defects
		• Observe and listen to learners as they research on lenses and discuss the applications. Evaluate and promote progress towards the learning outcomes.
		• Check understanding through assessment of quality of reports, diagrams and presentations; taking opportunities to further develop and deepen learning.

Note:

(i) Details on the operation of a projector, compound microscope, and telescopes should be left out.

(ii) Details of how photographs are processed in lens cameras are not required.

(iii) The lens formula should be left out.

SENIOR 3: TERM 2

Theme: Waves

TOPIC 4: GENERAL WAVE PROPERTIES

16 PERIODS

Competency: The learner should be able to investigate the properties of transverse and longitudinal wave forms and explain how waves transmit energy.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand that energy is transferred by waves, and these may be transverse or longitudinal (k, u)
b. know and use the relationship between velocity, frequency, and wavelength (k, s)
c. understand the propagation, properties, and uses of electromagnetic waves, and that white light is a mixture of frequencies but that light from a laser is a single frequency (k, u, v/a)
	• In pairs, learners research and present on:
	  • how waves transfer energy,
	  • the basic features of waves (e.g. amplitude, wavelength, frequency, and period);
	  • examples of waves as
	  ▪ mechanical and electromagnetic
	  ▪ transverse and longitudinal
	  ▪ progressive and stationary
	• In groups, learners use a ripple tank to investigate the nature of transverse and longitudinal waves, present their findings and use the equation: velocity = wavelength x frequency to solve simple numerical problems.
	• In pairs, learners research and explain:
	  ▪ the propagation and properties of electromagnetic waves and their applications
	  ▪ the nature of white light and light from a laser and its uses
	  ▪ the effects of over-exposure to ultraviolet (UV) and other forms of high frequency electromagnetic radiation
	  ▪ the production, applications, and effects of X-rays as a form of electromagnetic waves
		• Listen to group and pair discussions and ask probing questions to promote critical thinking.
		• Observe group and pair work to gauge understanding, and intervene to offer guidance.
		• Evaluate quality of learning and progress towards learning outcomes through assessment of products.

ICT Support The learner can use ICT to show how waves are generated and the features of waves		

SENIOR 3: TERM 2

Theme: Waves

TOPIC 5: SOUND WAVES

14 PERIODS

Competency: The learner should be able to describe the nature of sound waves and how they are transmitted by vibrations in a medium.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

understand that sound is an example of a wave form that requires a medium through which to travel, and determine its velocity in air by the echo method (k, s)	• In pairs, learners plan, carry out and report on investigations, using tuning forks to:
	  • show how sound is produced as a form of energy, making observations relating to vibrations, loudness, and pitch
	  • explore the transmission of sound through air, water and different solids, explaining transmission in terms of density and particle theory
	• In groups, learners plan, carry out and report on investigations to find the velocity of sound in air over 50+ metres, using the echo method, and explain the reasons for the outcomes.
		• Observe and listen to pairs and groups engaged in investigations; posing questions to ensure understanding and the correct use of terms.
		• Evaluate quality of learning and progress towards the learning outcomes through assessment of investigation reports.

Note: The concept of resonance and vibrations in strings and pipes should be left out.		

SENIOR 3: TERM 3 — Theme: Heat

TOPIC 6: HEAT QUANTITIES AND VAPOURS — 20 PERIODS

Competency: The learner should be able to explain heat capacity and latent heat, and know common applications.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand and use the concepts of heat capacity and latent heat (k, u, s)
b. know and explain the implications of the high values of the specific latent heat and the specific heat capacity of water (k, u)
c. carry out calculations and investigations on specific heat capacity and specific latent heat (u, s)
d. understand the concept of latent heat and change of state, and use them to explain melting and boiling point (u, s)
e. understand the meaning of saturated and unsaturated vapours, saturated vapour pressure, and how these terms relate to boiling and evaporation (u)
f. appreciate the cooling effect of evaporation and how this contributes to maintaining constant body temperature (k, u, s, v/a)
	• In groups, learners plan, carry out and report on an investigation to find the effect of heat energy on the temperature of different materials of the same mass and explain heat capacity.
	• In pairs, learners research, discuss and explain in presentations/posters:
	  • the applications and implications of the high specific latent heat and heat capacity of water
	  • the role that oceans play in global temperature regulation
	  • the loss or gain of heat when a material changes state in terms of the particle theory
	  • the origins of the energy in a storm
	  • why land and sea heat up and cool at different rates and the implications for the direction of sea breezes at different times of day
	• In groups, learners plan, carry out and report on an investigation to find out how stearic acid changes with temperature and explain the findings in terms of the loss or gain of heat.
	• In pairs, learners research and report on the total heat energy required to convert ice to steam, draw the heating curve and explain:
	  • the specific latent heat of fusion of ice, and
	  • the application of latent heat in refrigerators
	• In pairs, learners research the difference between saturated and unsaturated vapour, review prior learning and explain in a report:
	  • boiling and evaporation in terms of particle theory
	  • how perspiring maintains constant body temperature in mammals
	  • why water boils at a temperature less than 100 ^{0}C at the top of a mountain
	  • how a pressure cooker works.
		• Listen to group and pair discussions and ask probing questions to check understanding about the nature of heat changes and promote critical thinking.
		• Observe learners' engagement in activities and intervene to avoid misconceptions.
		• Evaluate quality of learning through assessment of reports to ensure learners gain expected knowledge, understanding, and skills, and make progress towards the learning outcomes.

Note:

- Determination of heat quantities should only be limited to the method of mixtures.

ICT Support

The learner can use an online simulation to investigate the effect of temperature on materials and vapours.

SENIOR 3: TERM 3 Theme: Earth and Space Physics

TOPIC 7: STARS AND GALAXIES 14 PERIODS

Competency: The learner should be able to understand the life-cycle of stars and the source of their energy.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. know the source of energy in stars and appreciate the importance of the energy produced by the sun to the people on Earth (k, u)
b. appreciate that stars vary in colour and brightness (u)
c. know that stars have life cycles and that the fate of stars (white dwarfs, neutron stars and black holes) depends on their initial size (k, u)
	• In pairs, learners research and explain in a diagram:
	  • how the sun produces the energy needed for life to survive
	  • that the sun is a relatively small star which will eventually become a red giant, and then a white dwarf
	  • the approximate amount of energy produced by the sun per second, the proportion of the sun's energy reaching the Earth's surface and the proportion of that which is captured for photosynthesis
	• In pairs, learners research, explain, and report on:
	  • the variation in colour and brightness of stars in the Milky Way in terms of their size and distance from Earth
	  • the different stages in the life cycle of a star
	  • how the nuclear reactions that provide the energy in stars change as they grow older, and that they get hotter
	  • what neutron stars and black holes are and how they were formed
	  • what a supernova is and how it arises
		• Listen to learners as they research and discuss the nature of stars and the source of energy; posing questions to deepen learning and secure understanding.
		• Observe groups and intervene appropriately to guide their work.
		• Assess products to ensure all are making progress towards achievement of learning outcomes.

ICT Support The learner can use Internet research to study the formation of stars and galaxies		

SENIOR 3: TERM 3 Theme: Earth and Space Physics

TOPIC 8: SATELLITES AND COMMUNICATION 14 PERIODS

Competency: The learner should be able to explain what artificial satellites are and how they are applied in space exploration and other fields.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand what artificial satellites are and how we make use of them in research and in everyday life (u, s)
b. appreciate the importance of space exploration (u, v/a)
	• In pairs, learners research and report on types of artificial satellite, particularly geostationary satellites and explain:
	  • how they are used in GPS navigation systems
	  • the value of photographs such as those taken by the Hubble Space Telescope.
	  • the purpose of the International Space Station and its role in space exploration
		• Observe and listen to learners as they research and discuss satellites, offering guidance to deepen learning.
		• Assess learning through quality of reports and intervene appropriately to ensure that all are making progress towards achievement of learning outcomes.

ICT Support The learner can use the Internet to obtain images of satellites and how they work.		

SENIOR 4: TERM 1

Theme: Electricity

TOPIC 1: INTRODUCTION TO CURRENT ELECTRICITY

18 PERIODS

Competency: Learners should appreciate that electric current is the transfer of charge through a conductor, either by electrons or by ions.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. Understand what e.m.f is (u)
b. understand that cells convert chemical energy into electrical energy, producing current and also the force needed to create a flow of current in a circuit (u, s)
c. understand that electric cells are very useful but have their limitations (u, v/a)
d. understand the nature of electric current, its sources, what makes it flow around circuits and how and it is measured (u, s)
e. know that some materials are electrical conductors and other are insulators (k)
f. recognise, understand and apply knowledge of series and parallel circuits (k, u, s, v/a)
g. appreciate that circuits may be represented as circuit diagrams consisting of an agreed set of symbols to represent components (k, u, s)
	• In groups, learners revisit prior learning about electricity, carry out research and explain using annotated diagrams:
	  • the structure of a simple cell and how chemical reactions can produce electricity
	  • the flow of electricity around a circuit powered by an electric cell in terms of both the current / flow of charge
	  and the potential difference created by the cell
	• In pairs, learners brainstorm, research and report on:
	  o common practical applications of electric cells
	  o recent advances in cell technology
	  o applications for which cells are not appropriate and the reasons why
	  o other sources of e.m.f apart from simple cell
	• In pairs learners:
	  • research and use diagrams to explain the symbols used in a circuit diagram and the differences between series and parallel circuits
	  • investigate and report the relationship between voltage and the brightness of bulbs
	  • explain the practical implications of this relationship
	• In groups, learners plan and report on an investigation, using an electric circuit with batteries and bulbs, to explore the electrical conductivity of different materials (e.g. copper, wood, plastic, iron, aluminium, graphite, rubber, cardboard, glass, wool).
	• In groups, learners plan and report on an investigation using batteries, bulbs, and an ammeter to measure the current flowing through different parts of series and parallel circuits, and then explain why domestic circuits are in parallel.
	• In pairs, learners research and contribute to a presentation to explain how an electric current involves the transfer of a charge by electrons or ions.
		• Observe pairs and groups engaged in practical activities and offer guidance to aid learning.
		• Listen to group/pair discussions and ask questions to deepen learning.
		• Evaluate quality of learning and progress towards the learning outcomes through assessment of reports and presentations.

SENIOR 4: TERM 1 — Theme: Electricity

TOPIC 2: VOLTAGE, RESISTANCE AND OHM'S LAW — 18 PERIODS

Competency: The learner should understand the concept of electrical resistance and apply Ohm's law.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a) understand electrical resistance, how it is measured, its relationship to current and voltage, and the factors that affect it (k, u, s)
b) know the function and use of a diode, transistor, thermistor, LDR. LED and potentiometer (k, s)
	• In pairs, learners research on electrical resistance and the flow of current through a conductor. Plan and report on practical investigations to:
	  • find the resistance of bulbs, heating coils, electric motors, and dry cells
	  • measure current and voltage and apply Ohm's Law to calculate resistance
	  • use Ohm's Law to predict current and voltage or resistance, before checking predictions with actual measurements
	  • find the effective resistance when a number of resistors are connected in series and in parallel
	• In groups, learners research, investigate, discuss, and report on the functions in a circuit of diodes, transistors, thermistors, LDRs, LEDs and potentiometers.
		• Listen to group and pair discussions and observe learners involved in activities. Ask probing questions to deepen knowledge and understating about resistance.
		• Evaluate quality of learning and progress towards the learning outcomes through assessment of reports and discussion.

Note:

a) Emphasis should be put on the significant figures of ammeters and voltmeters.

b) Derivation of the resistor network formulae is not required; only their uses/applications in solving numerical problems should be emphasised

c) Variety of practical activities involving ammeters, voltmeters, switches, bulbs and resistance wire are recommended.

ICT Support

Learner uses computer programme to analyse data in Ohm's law experiment.

SENIOR 4: TERM 1 — Theme: Magnetism

TOPIC 3: ELECTROMAGNETIC EFFECTS — 12 PERIODS

Competency: The learner should know and understand how magnetic fields interact with electric fields and the applications of this phenomenon.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. investigate the behaviour of magnets and magnetic fields (s)
b. understand that a current carrying conductor produces a magnetic field that can be detected. (u, s)
c. understand the application of electromagnets in devices such as motors, bells, and generators (u, s)
d. understand the difference between a.c. and d.c (u)
e. know how a.c. and d.c. can be interconverted using rectifiers and inverters (k)
f. understand the action and applications of transformers (u, s, v/a)
	• In groups, learners revisit prior learning about the characteristics of magnets, the magnetic fields around a bar magnet and electromagnets.
	• In pairs, learners research how to make an electromagnet and use their learning to investigate the relationship between the number of coils and the strength of the magnet, and then make a presentation of their results.
	• In groups, learners research, discuss and explain in a presentation how electromagnet technology is applied in an electric bell, a d.c. motor, a relay, a telephone receiver, and a loudspeaker, using circuits to demonstrate principles where possible.
	• In pairs, learners research the difference between a.c. and d.c. and prepare a presentation to:
	  • explain how a.c. and d.c. can be interconverted
	  • classify domestic appliances according to whether they operate on a.c. or d.c.
	  • explain the advantages of using a.c. in commercial supplies and why a d.c. motor will not work when connected to an a.c. supply
	• In groups, learners research, discuss and design a simple transformer and show how it works using a presentation or poster.
	• In pairs, learners produce a report to explain why transformers are not 100% efficient and how their efficiency can be improved
		• Listen to group and pair discussions about magnetism and pose questions to promote critical thinking.
		• Check understanding through the quality of products: presentation and demonstration.
		• Observe learners involved in activities, offering support to deepen learning and avoid misconceptions.

ICT Support

- The learner can use ICT simulations showing how current is produced in magnetic fields.
- The learner can use an online or downloaded simulation to illustrate how the d.c and a.c motors work.

SENIOR 4: TERM 2 — Theme: Electricity

TOPIC 4: ELECTRIC ENERGY DISTRIBUTION AND CONSUMPTION — 24 PERIODS

Competency: The learner should be able to describe how electric energy is distributed and consumed in order to ensure electric power saving and safety.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the distribution of electricity from the source to consumer units (u)
b. understand the energy transformations in common domestic electrical devices and how energy can be saved (u)
c. understand how to use mains electricity safely and know the insulation colour codes used in domestic wiring (u, k, s)
d. know the dangers of mains electricity and understand how these may be minimised by safety devices, and by sensible precautions (k, u, v/a)
e. know how to read a domestic electricity meter and its significance (k, u, s)
f. appreciate the importance of the use of energy saving appliances (u, s, v/a)
	• In pairs, learners research how electricity is transmitted from the power station to the consumer and explain using a presentation/ poster:
	  • the advantages of using a.c. in commercial electricity supplies
	  • the dangers associated with high voltage power lines
	• In pairs, learners identify domestic appliances that convert electrical energy into each of the following:
	  • heat energy
	  • heat and light energy
	  • sound energy
	  • sound and mechanical energy
	  • heat, sound and mechanical energy
	• In groups, learners plan, carry out and report on an investigation, using a transformer and wires of different thickness, to find out how the heating effect on the wire is affected by current and the thickness of the wire.
	• In pairs, learners research and report on:
	  • the power ratings of domestic electrical appliances, and
	  • their calculations of the cost of the electrical energy per day for each item
	  • suggestions regarding ways to save energy (including the use of efficient, low energy appliances)
	• In pairs, learners practise wiring a three-pin plug correctly and research on and explain the importance of the earth pin.
	• In pairs, learners research and explain in a presentation and/or a poster:
	  • how fuses and earthing of electrical appliances can protect appliances and save lives
	  • why fuses, switches and circuit breakers are positioned on the livewire of a circuit
	  • safe use of mains electricity
	  • how to read a domestic electricity meter
		• Listen to group and pair discussions and ask probing questions to deepen learning.
		• Observe practical activities, and intervene to ensure that practice is safe, investigations are well planned and conducted, and all are fully engaged.
		• Gauge progress towards the learning outcomes by assessing the quality of products: presentation/poster, reports, and wiring a plug.

SENIOR 4: TERM 1 — Theme: Modern Physics

TOPIC 5: ATOMIC MODELS — 16 PERIODS

Competency: The learner should be able to appreciate the different atomic models and how they are used to explain the basic structure of atoms.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the structure of an atom in terms of a positive nucleus and negative electrons (u)
b. understand the terms: atomic number, mass number, and isotopes, and use them to represent different nuclides (k, u)
c. understand the methods by which electrons are ejected from /matter atoms and how these electrons are useful (u, v/a)
	• In pairs, learners revisit prior learning about atoms, (atomic number, mass number, nuclides, isotopes) and research on the representation of different atoms
	• In groups, learners research and compare the Dalton model and Rutherford model of the atom. Explain atomic structure and components of a range of elements and isotopes in a report and on a poster.
	• In groups, learners research on and explain in a presentation:
	  • how thermionic emission and the photoelectric effect occur
	  • how cathode rays and X-rays differ
		• Listen to group and pair discussions and pose questions to check and secure knowledge and understanding.
		• Evaluate quality of learning and progress towards the learning outcomes through assessment of reports and presentations.

Note:

1. Laws of photoelectric effect are not required
2. Numerical problems related to acceleration of electrons are beyond this level.

ICT Support

Learner watches computer simulations about thermionic emission and photoelectric effect.

SENIOR 4: TERM 3

Theme: Modern physics

TOPIC 6: NUCLEAR PROCESSES

20 PERIODS

Competency: The learner should understand how nuclear processes occur, their uses, and the dangers associated with them

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the processes of nuclear fission and fusion and the associated energy changes (u)
b. understand the spontaneous and random nature of nuclear decay and interpret decay data in terms of half-life (k, u, s)
c. know the applications of radioactivity and the dangers associated with exposure to radioactive materials. (k, u)
d. understand and appreciate that there are significant social, political, and environmental dimensions associated with use of nuclear power. (u, v/a)
	• In groups, learners research and use knowledge of atomic structure to explain in a presentation/on a poster:
	  • the processes of nuclear fission and nuclear fusion and balance nuclear reactions
	  • how energy is produced in a controlled way in a reactor
	  • how nuclear energy is used
	• In groups, learners research and prepare a presentation on:
	  • the penetrating and ionizing powers of different types of radiation
	  • the decay of radioactive isotopes using balanced nuclear reactions
	  • the meaning of half-life and how it may be used
	  • background radiation and its origin
	  • why waste containing radioactive isotopes with long half-lives presents a serious environmental problem
	  • the medical and industrial uses of nuclear material
	• In pairs, learners research on the advantages and disadvantages of the use of nuclear materials with reference to world events; the regulations about the use and control of radioactive materials.
		• Listen to group and pair discussions and observe activities, asking probing questions to promote critical thinking and deepen learning.
		• Assess the quality of posters and presentations to evaluate and accelerate progress towards the learning outcomes.

Note:

a) Calculation of half-life using decay law equation is not required at this level. However, graphical method should be emphasized

b) Details of how radiations damage the body are not required. However, occurrence of recent world nuclear accidents needs to be mentioned.

ICT Support

Learner watches computer simulations about thermionic emission and photoelectric effect.

SENIOR 4: TERM 3

Theme: Modern physics

TOPIC 7: DIGITAL ELECTRONICS

20 PERIODS

Competency: Learners should understand how electronic components combine in digital circuits.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand how resistors are used to make potential dividers in control and logic circuits (u, s)
b. understand elementary logic and memory circuits that exploit devices such as bistable and astable switches, logic gates and resistors as potential dividers (u, s)
c. know that logic circuits are able to store and process binary information and that this can be exploited in an increasingly wide variety of digital instruments (k, u, s)
	• In groups, learners research potential dividers and report on how:
	  • to construct potential dividers using different sized resistors
	  • to measure the potential difference between different points
	• the volume control on a radio acts as a potential divider and draw a simple circuit to explain how a potential divider works.
	• In groups, learners research and prepare a presentation on how:
	  • to construct truth tables for AND, NAND, OR and NOR gates
	  • to use logic gates in control circuits
	  • to construct a bistable switch from two NOR gates and represent this in a diagram
	  • bistable switches may be used in a binary counting circuit
	  • logic circuits store and process binary information, and how digital instruments use binary information
		• Observe and listen to learners as they research on and discuss digital electronics, asking questions to promote critical thinking.
		• Evaluate learning by assessment of reports and presentations, and gauge progress towards the learning outcomes.

ICT Support The learner can use Internet technology to obtain simulations/ animation/ videos to aid the understanding of logic gates.		

ASSESSMENT

Assessing the new expectations for learning

The new curriculum sets new expectations for learning, with a shift from Learning Outcomes that focus mainly on knowledge to those that focus on skills and deeper understanding. These new Learning Outcomes require a different approach to assessment.

The "Learning Outcomes" in the syllabuses are set out in terms of Knowledge, Understanding, Skills, Values, and Attitudes. This is what is referred to by the letters k, u, s, v/a.

It is not possible to assess values and attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that values and attitudes are not important. It means that we must value things that we cannot easily assess.

So this guidance booklet focuses on knowledge, skills and understanding. Each has its own implications for learning and assessment.

Knowledge	The retention of information.
Understanding	Putting knowledge into a framework of meaning – the development of a 'concept'.
Skills	The ability to perform a physical or mental act or operation.
Values	The inherent or acquired behaviours or actions that form a character of an individual.
Attitudes	A set of emotions, beliefs or behaviours toward a particular object, person, thing or event.

To assess knowledge, skills, and understanding we need to look for different things. Knowledge can be assessed to some extent through written tests, but the assessment of skills and deeper understanding requires different approaches. Because of this, the role of the teacher in assessment becomes much more important.

Knowledge

Knowledge is the easiest to assess because it is fairly straightforward to find out whether or not a learner has retained some information; a simple question can usually find this out. We ask them to name something, state something, or label a diagram.

Skills

Skills are the ability to perform a mental or physical operation, so we have to observe the skill being performed, look at the product, or outcome of the skill; for example: a piece of writing, a picture or diagram. Some skills, such as speaking and physical education do not have a product so they need to be observed.

Understanding

Assessing deeper understanding is much more difficult, so we usually ask learners to explain, compare or outline a process. This can be done orally (in conversation) or in writing, and will give us some idea of the extent of learners' understanding.

Values and Attitudes

Values and Attitudes determine how we interact with others, working in a team, meeting deadlines, being self-driven, holding democratic values, and having respect for democracy, race, gender, disability, human dignity, culture, nation, life, and social justice.

ASSESSMENT

Examinations

There will be examinations or tests set at the end of every year. There will also be a summing up of on-going teacher assessments made in the context of learning.

Formative Assessment

Assessments are used for a wide range of purposes in schools and education systems. Just as academic lessons have different functions, assessments are typically designed to measure specific elements of learning e.g., the level of knowledge a student already has about the concept or skill the teacher is planning to teach or the ability to comprehend and analyse different types of texts and readings. This syllabus focuses on the evaluation of progressive day-to day classroom learning; hence Formative Assessment.

Formative assessment refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, or activity.

The general purpose of formative assessment is to improve learning and achievement; give educators in-process feedback about what students are learning or not learning so that instructional approaches, teaching materials, and academic support can be modified accordingly. Formative assessments are usually not scored or graded, and they may take a variety of forms, from more formal quizzes and assignments to informal questioning techniques and in-class discussions with students.

The general goal of formative assessment is to collect detailed information that can be used to improve instruction and student learning while it's happening. What makes an assessment "formative" is not the design of a test, technique, or self-evaluation, per se, but the way it is used, that is, to inform in-process teaching and learning modifications.

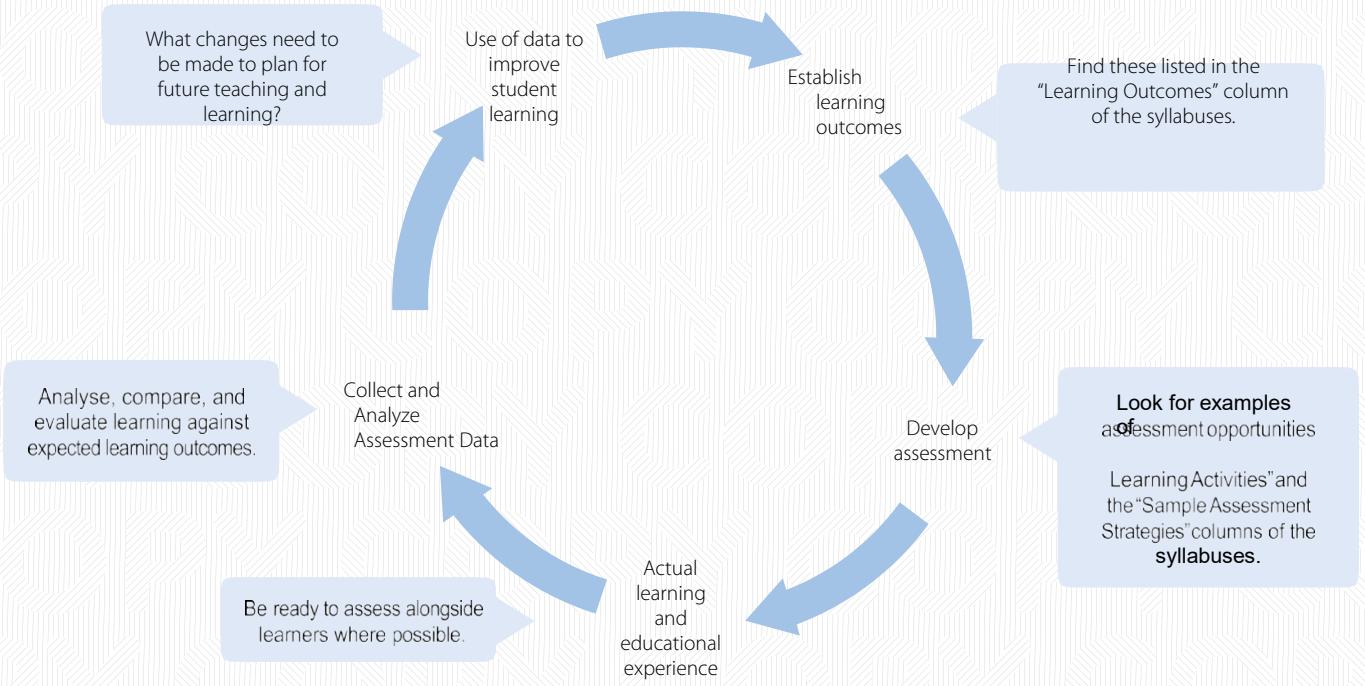
The final examination at the end of Senior 4 will be very different in nature, and will focus on the learners' ability to apply their learning in new situations, rather than on the ability to recall information.

If assessment is to make a difference to teaching and learning, then teachers must use the information they gain from assessment to make **some change** to the teaching and learning process. The changes that can be made include decisions about:

- What needs to be learned next?
- Whether an element of the syllabus needs to be taught again in a different way.
- Changing teaching approaches if necessary
- Identifying learners who need more support, or who are making exceptional progress.
- Enabling learners to understand what they have to do to improve.

ASSESSMENT

The process of teaching, making formative assessments and then changing the teaching and learning in some way can be seen as a cycle:



FORMATIVE ASSESSMENT INVOLVES USING ALL PARTS OF THE CYCLE.

ASSESSMENT

How do we find the opportunity to make formative assessments?

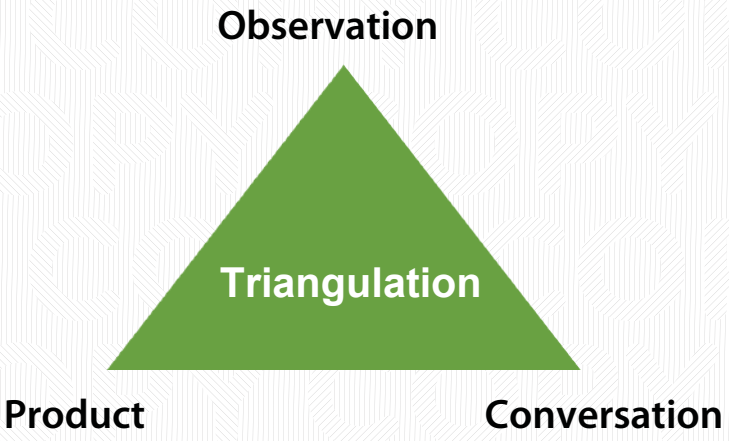
In the new curriculum, the teacher's assessment role is not to write tests for learners, but to make professional judgements about learners' learning in the course of the normal teaching and learning process. The professional judgement is about how far the learner meets the Learning Outcomes that are set out in this syllabus. To make these judgments, the teacher needs to look at how well the learners are performing in terms of each Learning Outcome.

School-based formative assessment is a part of the normal teaching and learning process, and so the assessment opportunities will also occur during this normal process. It is not something that needs to be added on after learning; it is an integral part of it.

These opportunities occur in three forms and are often called:

- Observation – watching learners working (good for assessing skills and values)
- Conversation – asking questions and talking to learners (good for assessing knowledge and understanding)
- Product – appraising the learner's work (writing, report, translation, calculation, presentation, map, diagram, model, drawing, graphs, painting, etc.). In this context, a "product" is seen as something physical and permanent that the teacher can keep and look at, not something that the learner says.

When all the three are used, the information from any one can be checked against the other two forms of assessment opportunity (e.g. evidence from "observation" can be checked against evidence from "conversation" and "product"). This is often referred to as "triangulation".



Triangulation of assessment opportunities

To find these opportunities, look at the syllabus topics. These set out the learning that is expected and give "Sample Assessment strategy" and in doing so they contain a range of opportunities for the three forms of assessment.

Generic Skills

The Generic Skills have been built into the syllabuses and are part of the Learning Outcomes. It is, therefore, not necessary to assess them separately. It is the increasingly complex context of the subject content that provides progression in the Generic Skills, and so they are assessed as part of the subject Learning Outcomes.

Attitudes

It is not possible to assess attitudes in the same way as knowledge, understanding, and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess.

Record keeping

Keeping detailed records of learners' individual progress is always difficult with very large numbers of pupils. For the purposes of school-based formative assessment, it is not even always necessary to keep such detailed records anyway. If feedback is given immediately and action is taken, then learning is changed and the record would soon become out of date and redundant.

Most formative class-based assessments are dynamic in that they feed straight back into the teaching and learning process. Therefore, detailed records of these are not appropriate.

What is needed is record of assessments of learners' learning made in terms of each Topic or unit. This means recording the on-going summative assessments of each unit. There is no need to make separate records of each of the Learning Outcomes because this would be very time-consuming and also unnecessary. It is much more useful to make an overall assessment about whether or not each learner met the Learning Outcomes for each Topic as a whole.

Each Topic is made up of a number of Learning Outcomes. Therefore, teachers need to consider all the Learning Outcomes when making an overall judgement about the Topic as a whole. It is not always necessary for every individual Learning Outcome to be achieved for the Topic as a whole to be achieved. This will vary with the Subject and Topic.

By looking at the Learning Outcomes within each Topic, it is possible to identify four broad groups of learners in terms of their achievements:

Descriptor
No Learning Outcome (LO) achieved
Some LOs achieved, but not sufficient for overall achievement
Most LOs achieved, enough for overall achievement
All LOs achieved – achievement with ease

ASSESSMENT

These overall assessments should be made on the basis of the many formative assessments that the teacher has made during the course of teaching the topic. If teachers have been working with the learners over the course of the topic, they will be able to make a broad judgment about which learners have achieved or have failed to achieve the topic's overall Learning Expectation. These "Authentic Assessments" will be more valid and valuable than a test set by the school.

Recording these overall assessments will be simple, manageable and, yet valuable, and can be recorded on a sheet such as the one below in which the categories are indicated with a number.

Although a very simple process, these four categories will give rich data when a comparison is made between the learners in each category for different subjects and units. They will also identify easily those learners who need extra support or who may not be ready to move on to the next grade at the end of a year.

If records are kept of the learning outcomes of each syllabus unit through the year, then there will be no need for an end of year test. Teachers will already have a record of those learners who have met the learning outcomes, and those who have not done so. Therefore, teachers will know if there were any learners not ready to progress to the next grade.

An overall record should be made of the individual unit assessments by subject in terms of the 4 descriptors. If numbers (0-3) are used as identifiers, then it will be possible to arrive at an overall number for a year by aggregating the identifiers for each topic.

Descriptor	Identifier
No Learning outcome achieved	0
Some LOs achieved, but not sufficient for overall achievement	1
Most LOs achieved, enough for overall achievement	2
All LOs achieved – achievement with ease	3

In the example below, the table shows the end-of-unit assessment for six learners.

Physics										
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
Learner A	3	3	2	3	3	3	3	2	3	3
Learner B	2	2	3	2	3	2	2	2	3	2
Learner C	1	1	2	1	1	2	2	3	2	3
Learner D	1	1	2	1	1	2	1	1	2	1
Learner E	0	1	2	1	0	1	0	1	1	1
Learner F	0	0	1	0	0	1	0	0	1	0

This method will give much more information than using a tick. For example, at a glance it can be seen that learners A & B are achieving much higher than learners E & F. It can be seen that Learner C has improved during the year. We can even see that more learners achieved success in Topic 9 than Topic 7.

All of this is very valuable assessment information and can be used to improve learning.

This summative teacher assessment will contribute 20% to the final grade of the School Leaving Certificate as elaborated in the Assessment Framework.

Glossary of Key Terms

TERM	DEFINITION
Competency Curriculum	One in which learners develop the ability to apply their learning with confidence in a range of situations.
Differentiation	The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities.
Formative Assessment	The process of judging a learner's performance, by interpreting the responses to tasks, in order to gauge progress and inform subsequent learning steps.
Generic skill	Skills which are deployed in all subjects, and which enhance the learning of those subjects. These skills also equip young people for work and for life.
Inclusion	An approach to planning learning experiences which allows each student to feel confident, respected, safe, and equipped to learn at his or her full potential.
Learning Outcome	A statement which specifies what the learner should know, understand , or be able to do within a particular aspect of a subject.
Process Skill	A capability acquired by following the programme of study in a particular subject; enables a learner to apply the knowledge and understanding of the subject.
Sample Assessment Strategy	A strategy which gives a learner the opportunity to show the extent to which s/he has achieved the Learning Outcomes. This is usually part of the normal teaching and learning process, and not something extra at the end of a topic.
Suggested Learning Activity	An aspect of the normal teaching and learning process that will enable formative assessment to be made.

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