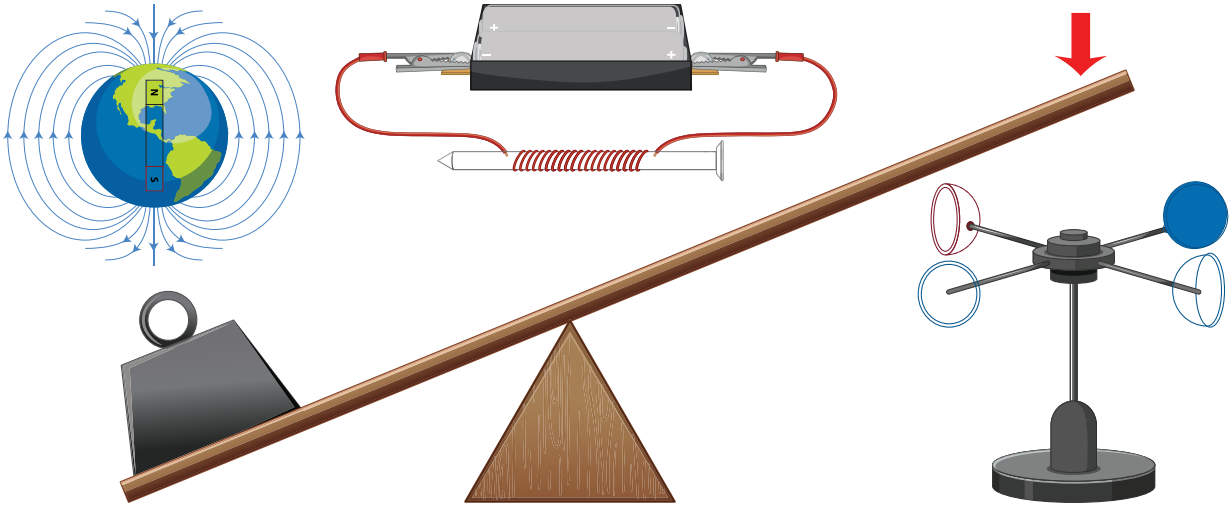

ACCELERATED EDUCATION PROGRAMME

PHYSICS

SYLLABUS

REVISED LOWER SECONDARY (Level 1 and 2)

REPUBLIC OF UGANDA
MINISTRY OF EDUCATION AND SPORTS
NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

ACCELERATED EDUCATION PROGRAMME

PHYSICS

SYLLABUS

REVISED LOWER SECONDARY (Level 1 and 2)

THE REPUBLIC OF UGANDA

MINISTRY OF EDUCATION AND SPORTS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

A product of the National Curriculum Development Centre for the Ministry of Education and Sports with support from the Government of Uganda

Revised Edition

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Contents

Foreword

Education is a fundamental tool for the protection of conflict- and disaster-affected children and youth from harm and exploitation. This is a crucial part of UNESCO's advocacy messages. Under appropriate conditions of security, the provision of education can help protect children and youth from recruitment into fighting forces, forced labour, prostitution, drug abuse and other criminal activities. In post-conflict settings, education contributes to the reintegration into society of former soldiers and other children and youth associated with fighting forces.

Uganda's Education Act of 2008, in Part IX, Miscellaneous Provisions 49, clearly states that "there shall be non-formal education centres" for purposes of providing non-formal education. Examples of non-formal education programmes include Accelerated Education Programmes (AEPs) for the conflict areas at both primary and secondary levels, Alternative Basic Education for Karamoja (ABEK), Basic Education for Urban Poverty Areas (BEUPA), Complementary Opportunity for Primary Education (COPE) and Child-Centred Alternative Non-Formal Community Based Education (CHANCE), among others.

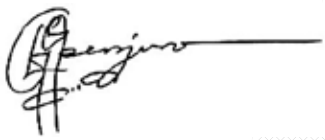
The National Curriculum Development Centre (NCDC), in collaboration with War Child Canada, embraced the Accelerated Education Programme (AEP) and has condensed the lower secondary curriculum to come up with the Lower Secondary Accelerated Education Programme appropriate to learners in refugee camps and the host communities of secondary school age (ages 16–45+).

The AEP at lower secondary school level focuses on completing learning in a shorter period of time, i.e., two years. The AEP is complementary both in providing an alternative route and in matching its curriculum to the 'official' curriculum, thus allowing learners to return to formal schooling at an opportune stage. The programme intends to promote access to education in an accelerated timeframe for disadvantaged groups, out-of-school and over-age children, and youth who missed out or had their education interrupted owing to poverty, violence, conflict or any calamity.

The goal of this programme is to provide learners with competencies equivalent to those in the formal system in an accelerated time frame, with learners either transitioning back into the mainstream education or exiting with some of the competencies required for work.

It is my hope that AEP will register considerable success in meeting the educational needs of these underserved populations not only in terms of access and equity, but also in helping them return to school and complete the education cycle, and especially in getting measurable learning outcomes.

I recommend the AEP and trust that the materials will be valuable in your endeavour to meet the educational needs of the refugee learners and other beneficiaries from the host communities.



Prof. George Openjuru
CHAIRPERSON
NCDC Governing Council

Acknowledgement

The National Curriculum Development Centre (NCDC) would like to express its gratitude to War Child Canada – Uganda for the financial support, their guidance in overseeing and taking timely decisions whenever necessary during the development and production of this AEP Physics Syllabus.

We also express our gratitude to NCDC subject specialists and panel members for their professional guidance and technical assistance.

Furthermore, NCDC recognises the work of the editors who worked with the writers throughout the development of this syllabus.

NCDC takes responsibility for any shortcomings that might be identified in this syllabus and welcomes suggestions for addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through: P.O. Box 7002, Kampala or e-mail admin@ncdc.go.ug.

Dr Grace K. Baguma
Director
National Curriculum Development Centre

Introduction

The UNESCO Education Strategy (2014 – 2021) advocates for a humanistic and holistic vision of education as a fundamental human right that is essential to personal and socio-economic development. UNESCO further recommends societies that are just, inclusive, peaceful and sustainable by 2030. Vision 2040 of Uganda aims to transform Uganda into a modern and prosperous country, while the National Development Plan III (NDPIII) recognises the existing weaknesses in education, including the low efficiency and variable quality at the Secondary level. Furthermore, NDPIII focuses on enhancement of human capital, development, strengthening mechanisms for quality, effective and efficient service delivery as well as improvement of quality and relevance of skills development.

The Sustainable Development Goal 4 advocates for inclusive and quality education. The NRM Manifesto (2016-2021), emphasises continuous assessment examination systems, 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.

The above aspects are lacking and where they exist, it is at a minimum level in implementation of the curriculum.

In alignment with the above policies, 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 for Uganda, although highly regarded, has focused on the needs of a small academically oriented elite leaving out the needs of the majority of learners. 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 following aims of secondary education in Uganda:

The aims of Secondary education in Uganda are to:

- Instil and promote national unity, an understanding of the social and civic responsibilities, strong love and care for others and respect for public property, as well as an appreciation of international relations and beneficial international co-operation;
- Promote an appreciation and understanding of the cultural heritage of Uganda including its languages;
- Impart and promote a sense of self discipline, ethical and spiritual values, personal and collective responsibility and initiative;
- Enable individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy;
- Provide up-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 socio-economic development of Uganda;
- Enable individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment;
- Enable individuals to develop personal skills of problem solving, information gathering and interpretation, independent reading and writing, self-improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs;
- Lay the foundation for further education;
- Enable the individual to apply acquired skills in solving problems of community, and to develop a strong sense of constructive and beneficial belonging to that community;
- Instil positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities;
- Develop a positive attitude towards learning as a lifelong process.

Introduction to The Accelerated Education Programme

Worldwide, substantial alternative schooling programmes are developed to meet the basic education needs of under-reached children. It has been increasingly recognised that the goals of Education for All cannot be achieved unless more attention is paid to educating out-of-school children (UNESCO, Global Monitoring Report, 2008). Indeed, the UNESCO Global Monitoring Report 2010 'Reaching the Marginalised' focused on this issue. In a bid to help developing countries achieve the Sustainable Development Goals (SDGs), there should be initiatives to incorporate elements of accelerated learning to achieve SDG 4.

The Accelerated Education Programme (AEP) in Uganda is a form of curriculum intended to help refugees and host communities not to lose time due to the interruptions caused by war and other calamities. It combines the stronger features of earlier mainstreaming approaches into the new design to raise the success rates for refugee learners and those for the host communities. The AEP secondary school tier is a bigger stride to address the education gap within refugee communities not only in Uganda but also in neighbouring countries. Benchmarking against the Primary AEP, the Secondary AEP intends to condense the entire process of education and its cognitive, emotional and social components.

The AEP at secondary school level focuses on completing learning in a shorter period of time, of two years. The AEP is complementary both in providing an alternative route and in matching its curriculum to the 'official' curriculum, thus allowing learners to return to formal schooling at some stage. The programme intends to promote access to education in an accelerated timeframe for disadvantaged groups, out-of-school and over-age children, and youth who missed out or had their education interrupted owing to poverty, violence, conflict and crises. The goal of this programme is to provide learners with competencies equivalent to those in the formal system in an accelerated timeframe, with learners either transitioning back into mainstream education or exiting with some of the competencies required for work.

Ideally, teaching AEP calls for a methodology that is interactive and learner-centred, incorporating other aspects of multiple-intelligence learning.

Because teaching and learning are accelerated, and the curriculum content is compressed and condensed, the four 'P' elements are at the core of the accelerated learning cycle: processes, psychological, physiological and physical. These core elements provide the physical and psychological space in which the learner can learn more effectively.

It is intentional to include alternative subjects in this programme, e.g., life skills, peace education, environment, HIV and AIDS which are responsive to the context. Learners of AEP need alternative supporting knowledge and life skills to survive in the challenging world. It is equally important to note that this conception of accelerated learning requires an extremely well-resourced classroom and exceptionally well-trained teachers. The expanded learning time from the norm is because the teaching methodology is interactive and learner-centred. It is our hope that the AEP will register considerable success in meeting the educational needs of these underserved populations, not only in terms of access and equity but also in being able to return to school and completion, and most importantly in getting measurable learning outcomes.

Key Changes in the New AEP Curriculum

The key change in the curriculum is a move from a knowledge-based curriculum to a competence and skills- 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 diagrams in Figure 1 and Figure 2 below.

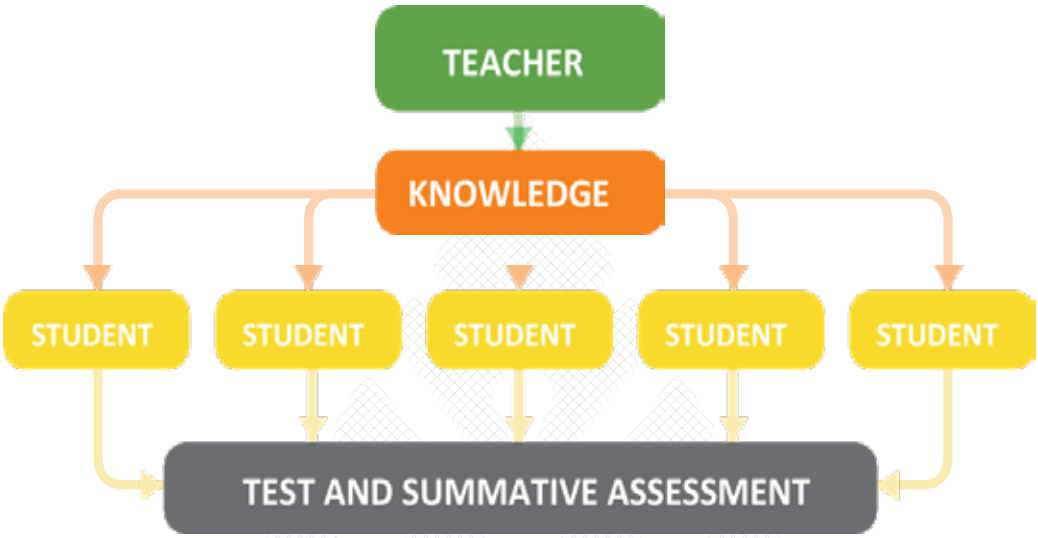


Figure 1: *Knowledge based curriculum*

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

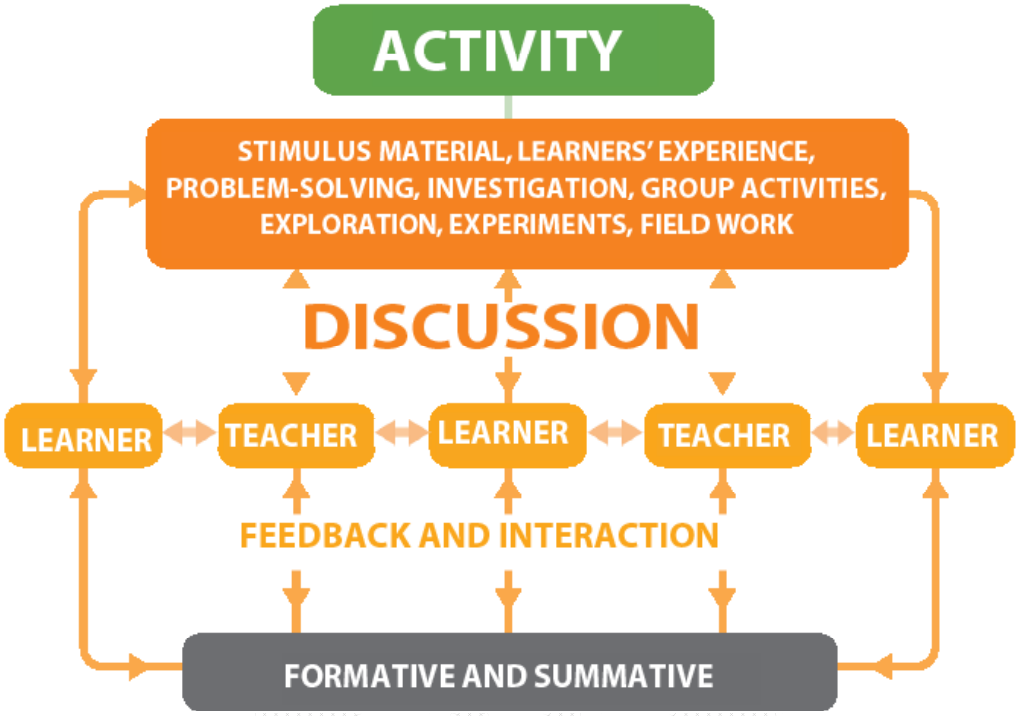


Figure 2: *Competence-based curriculum*

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 the teacher.

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 become 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.

Key Learning Outcomes

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

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

1) Self-assured individuals who:

a) demonstrate self- motivation, self-management and self-esteem.

b) know their preferences, strengths and limitations.

c) adjust their behaviour and language appropriately to different social situations.

d) relate well to a range of personality types.

2) Responsible and patriotic citizens who:

a) cherish the values promoted in the curriculum.

b) promote the development of indigenous cultures and languages; and appreciate diversity, equity and equality.

c) apply environmental and health awareness when making decisions for themselves and their community.

d) are positive in their own identity as individuals and global citizens.

e) are motivated to contribute to the well-being of themselves, their community and the nation.

3) Lifelong learners who:

a) can plan, reflect and direct their learning.

b) actively seek lifelong learning opportunities for personal and professional development.

4) Positive contributors to society who:

a) have acquired and can apply the generic skills.

b) demonstrate knowledge and understanding of the emerging needs of the society and economy.

c) understand how to design, make and critically evaluate products and processes to address needs.

d) appreciate the physical, biological and technological world; and 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:

a) Respect for humanity and the environment.
b) Honesty; upholding and defending the truth at all times.
c) Justice and fairness in dealing with others.
d) Hard work for self-reliance.
e) Integrity; moral uprightness and sound character.
f) Creativity and innovativeness.
g) Social responsibility.
h) Social harmony.
i) National unity.
j) 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 also known by several other names, including key skills, core skills, essential skills, key competencies, necessary skills, transferable skills and employability skills are versatile skills that have wide applicability across various jobs, education, and life situations, contributing to personal and professional success and societal well-being.

Changes in the modern workplace brought about by technology, management innovations, and increased competition in the global marketplace, have led to many concerns about the adequacy of workforce skills. In response to calls to reform education to better prepare young people for the future workforce, changes to the curriculum have emphasised the teaching of general skills (e.g. problem solving, creativity, critical thinking, communication, collaboration).

For this reason, generic skills lie at the heart of every subject. Apart from enabling learners to access and deepen learning across the curriculum, generic skills 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 at school, work and home. 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.

01 Critical thinking and problem-solving skills

a) Plan and carry out investigations
b) Sort and analyse information
c) Identify problems and ways forward
d) Predict outcomes and make reasonable decisions
e) Evaluate different solutions

02 Creativity and innovation

a) Use the imagination to explore possibilities
b) Work with others to generate ideas
c) Suggest and develop new solutions
d) Try out innovative alternatives
e) Look for patterns and make generalisations

03 Co-operation and self-directed learning

a) Work effectively in diverse teams
b) Interact effectively with others
c) Take responsibility for own learning
d) Work independently with persistence
e) Manage goals and time

04 Communication

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

05 Mathematical computation and ICT proficiency

a) Use numbers and measurements accurately
b) Interpret and interrogate mathematical data
c) Use mathematics to justify and support decisions
d) Use technology to create, manipulate and process information
e) Use technology to collaborate, communicate and refine one's work

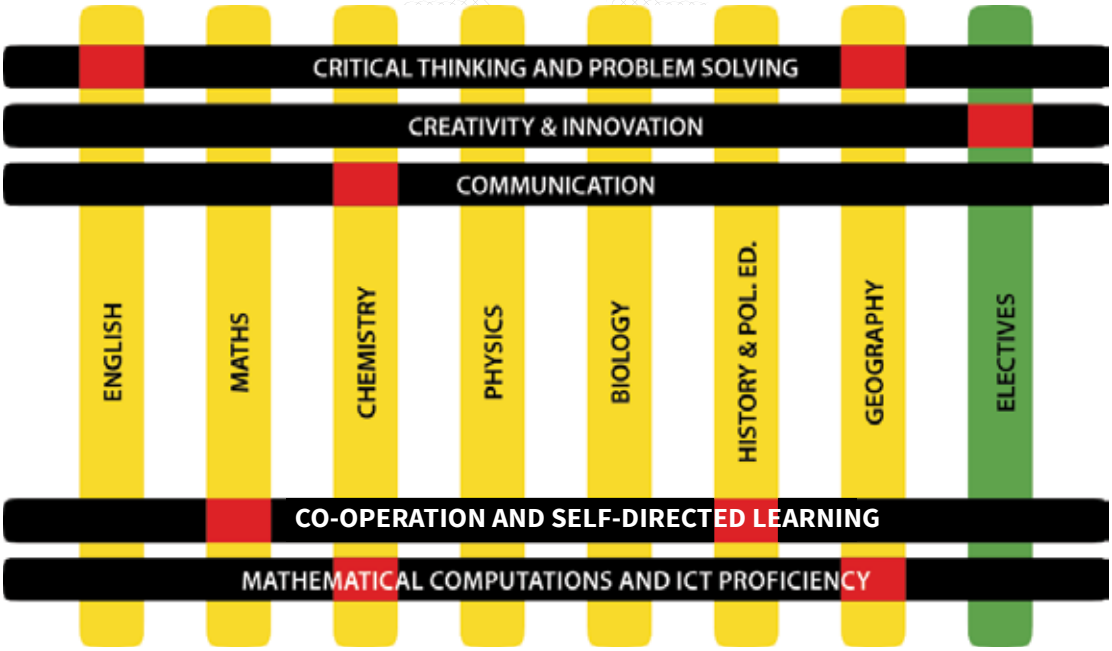
Generic skills within AEP Physics Curriculum

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 both levels; 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 level 1 and then progress to thinking about the much more complex matters in level 2.

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 include the following:

1) Environmental awareness
2) Health awareness
3) Life skills
4) Mixed abilities and involvement
5) Socio-economic challenges
6) Citizenship and patriotism

These have been built into the syllabus 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 in the AEP Curriculum

ICT is embedded as a learning/teaching tool in the different topics. The ICT framework is summarised 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)
a) Fieldwork	Using cameras to take photos and record videos
b) Presentations in class	Using the presentation application
c) Keywords and meanings	Using online dictionary or searching online
d) Drawing/graphics	Using publishing software, word processor

Category of a Task in the Syllabus	ICT Application (How ICT Will be Integrated for the Task Category)
e) Role-play, narrations	Using audio and video recordings
f) Demonstrations	Using audio and video recordings and simulations
g) Locating and putting marks on an area	Using digital/online mapping
h) Presenting findings in graphic and written format	Using desktop publishing software or word processor
i) Showing data charts	Using spreadsheet software
j) Group discussions	Using mind-mapping software
k) Searching for extra reading materials	Downloading files on the Internet or by sharing
l) Writing equations and formulas	Using equation editors
m) Carrying out academic research	Using the Internet and other academic applications like "Encarta", "Britannica" etc.
n) Sharing or learning with people across the world	Forming learning networks, formation of blogs, social media, emails etc.

Integration of Special Needs Education (SNE)

In education system, learners of different abilities study together in the same class and in some developed countries, they are taught separately. In whatever case, the following methods are important when handling the SNE learners.

Category of impairments	SNE Teaching Methods
Blind learners: Learners who cannot see totally	• Through touching • Use of brails • Recorded / audio materials
Low vision learners: Learners who cannot see properly	• Use of large print materials • Use of bold teaching materials • Right placement of learners

Category of impairments	SNE Teaching Methods
Deaf learners: Learners who do not hear at all	• Use sign language • Total communication • Use of illustrations
Hard of hearing learners: Learners who fairly hear	• Total communication • Speak loudly • Right placement of learners • Use of illustrations • Being more practical
Dyslexic learners: Learners with reading difficulties	• Use less written content • Talk more than writing • Breaking tasks into simple steps • Repetition in teaching • Use of audio recordings
Time takers	• Give extra time • Use remedial classes
Hyper learners: Learners with attention deficit	• Use of timely breaks in teaching.
Gifted learners:	• Involve them in extra work • Use of suitable challenging tasks
Physically handicapped	• Use of head pointers • Training to use available limbs • Creating special sitting arrangements in class

Rationale of the Physics Syllabus in AEP

This syllabus is aimed at providing the teacher with the required guidance to teach Physics to learners who will not have gone through the normal four years of Ordinary level classes. It is meant to cover the most critical aspects of Physics without affecting its standards. It will adequately prepare learners for the Uganda Certificate of Education (UCE). However, the creativity of the classroom teacher is important in this case.

The aims of teaching Physics are to:

a) provide, through well-designed studies of experimental and practical science, a worthwhile educational experience for all learners, and to enable them to acquire sufficient scientific knowledge and understanding that prepares them for the challenges of the 21st Century.

b) enable learners to become confident citizens in a technological world, who are able to take or develop an informed interest in scientific matters.

c) enable learners to recognise the usefulness and limitations of Physics, and to appreciate its applicability to other disciplines and to everyday life.

d) enable learners to be suitably prepared for studies beyond Ordinary level.

e) encourage efficient and safety practices both during experimental work and in society.

f) develop attitudes relevant to science in general and Physics in particular such as concern for accuracy and precision, objectivity, integrity, enquiry, inventiveness and innovativeness.

g) promote 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.

h) stimulate interest in and care for the environment and proper utilisation of resources with respect to Uganda.

Programme Planner

The Accelerated Education Programme (AEP) for Physics is divided into ten topics which will be taught in two levels. There is also a general introduction to Physics which aims at orienting the learner into the subject. The topics and the respective sub-topics for the two levels are indicated in the following table.

LEVEL ONE

	TOPIC/SUB-TOPIC	DURATION (HOURS)
TERM 1	**Introduction to Physics**	**3**
	Topic 1: Measurement Physical quantities, units and measurement	**12**
	Topic 2: Forces and Their Effects	
	1. Types of forces	**6**
	2. Turning effects of forces	**9**
TERM 2	3. Energy, work and power	**10**
	4. Motion	**12**
	5. Pressure	**8**
	Topic 3: Light Behaviour of light	**14**
TERM 3	**Topic 4: Waves**	
	1. General wave properties	**8**
	2. Sound	**6**
	Topic 5: Earth and Space Physics	
	1. Sun, Earth and moon systems	**5**
	2. Solar systems	**5**
	3. Stars and galaxies	**5**
TOTAL		**103**

LEVEL TWO

	TOPIC/SUB-TOPIC	DURATION (HOURS)
TERM 1	**Topic 6: Thermal Physics**	
	1. Kinetic model of matter	**3**
	2. Temperature	**4**
	3. Transfer of heat energy	**6**
	4. Expansion of solids, liquids and gases	**4**
	5. Heat quantities	**8**
	Topic 7: Electricity and Magnetism	
	1. Static electricity	**4**
	2. Current electricity	**12**
TERM 2	3. Practical electricity	**8**
	4. Magnets and their properties	**4**
	5. Electromagnets and their applications	**6**
	6.Electromagnetic Induction	**4**
	Topic 8: Atomic and Nuclear Physics	
	1. Atomic structure	**4**
	2. Cathode rays and X-rays	**6**
	3. Radioactivity	**8**
TERM 3	**Topic 9: Satellites and Communication**	**6**
	Topic 10: Digital electronics	**10**
TOTAL		**97**

Time allocation

Physics is allocated 3 hours per week as indicated below.

PHYSICS	Level 1	Level 2
	3 hours a week	3 hours a week

NOTE:

Throughout this Physics Syllabus, emphasis must be put on:

a) Knowledge:

i) Knowledge of terminology
ii) Knowledge of specific facts
iii) Knowledge of conventions and units used in Physics
iv) Familiarity with experiments suggested in the syllabus
v) Knowledge of common laws/principles and generalisation identified in the syllabus

b) Comprehension or understanding: Ability to:

i) explain standard phenomena from laws/principles and models and to describe standard experiments met with before.
ii) translate various forms of information presentation.
iii) use standard methods to solve familiar and unfamiliar numerical types of problems.
iv) draw conclusions from experimental procedures.
v) synthesise ideas from presented data or otherwise.
vi) apply laws and generalisations already learnt to everyday life and new situations.

c) Application to higher abilities and practical skills

Acquisition of the following abilities:

i) Application of knowledge/theory to practical situations
ii) Planning investigations
iii) Stating an appropriate experimental title or heading
iv) Manipulation of the apparatus and performing experiments
v) Making and recording observations accurately in column tables, with proper units
vi) Presentation of data in an appropriate form, especially graphical, with properly labelled axes and using suitable scales
vii) Determining a gradient or slope, intercept or any other required points on the graph
viii) Drawing conclusions from observations made
ix) Assessing the suitability of procedure, experiment and observations made in support of the conclusion
x) Devising projects in which the products employ Physics principles

Features of this new AEP Syllabus

The detailed AEP Physics teaching syllabus has the following features:

1) Competency

This is a general statement of what a learner can exhibit or do as a result of learning all the concepts within each sub-topic. It is stated at the top of the table for each sub-topic in the detailed syllabus. It shows how the content will be applied in different situations.

2) Learning outcomes

These are the expected behaviour which a learner will exhibit after the study of the sub-topic. ***The teacher must ensure that all the outcomes are achieved***. They have been provided to help the teacher clarify content and scope. Where a higher outcome is stated, lower outcomes are implied. The teacher should use learning outcomes to plan his/her teaching strategies. Learning outcomes also guide in evaluation at the end of the learning process.

The learning outcomes are classified as knowledge (k), understanding (u), skill (s), generic skill (gs), values/attitudes (v/a), which are indicated in front of each learning outcome. They are meant to guide the teacher on how to approach the learning outcomes.

3) Duration

This has been provided for each sub-topic. It is meant to guide the teacher in planning so as to cover all the content appropriately. However, the allocated time should allow for flexibility in order to cater for remedial teaching and carrying out practical activities where possible.

4) Suggested learning activities

These provide the teacher with guidance, for example, on the tasks which the learners must accomplish to acquire the learning outcomes. However, these are not the only activities since other tasks as may be suggested by the teacher must be used. The teacher should use an appropriate strategy, e.g., individual or group work, for learners to carry out the activities effectively. Teachers should also encourage learners to use a variety of resources such as the library and ICT.

5) Sample assessment strategy

These are meant to test the level of understanding for each sub-topic. However, other assessment strategies as suggested by the teacher and textbooks that are appropriate to the sub-topic should be used to assess the learners' achievement. The sample assessment strategies are not meant to be a spot work for end-of-cycle examinations but rather to assist the teacher in formative assessment. Some of this assessment is done by observation and can be used to assess attributes like teamwork, confidence, scientific literacy, communication, leadership and organisational skills of learners.

6) Hint to the teacher

These further clarify the scope and depth of coverage for some sub-topics. They should be taken seriously to avoid leaving out content or giving content beyond the scope of the learners.

7) ICT support

This shows the ICT resources that the teacher should use to further the understanding of the different concepts. The teacher should note that these are optional and only applied where they are available.

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

LEARNING OUTCOMES	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
The knowledge, understanding, skills, generic skills, values and attitudes 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 situation

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

LEVEL 1

Introduction to Physics

Duration: 3 Hours

Competency

The learner understands the meaning and importance of Physics.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the meaning of Physics. (k, u) 2) explain why it is important to study Physics, and relate it to different technologies and careers. (k, u) 3) identify some Physics apparatus and their use. (k, u) 4) explain why it is important to follow the laboratory rules and regulations. (k, u, v/a)	1) Learners, in groups, discuss the different aspects of science they have studied in primary school and ask them to identify the branches of science. 2) In groups, learners discuss some of the natural phenomena whose occurrence can be explained using the understanding of Physics. 3) Guided by the teacher, learners conduct a tour of the Physics laboratory or Science room or any facility used for keeping Physics apparatus and: • identify some physics apparatus. • discuss the importance of some of the apparatus. • discuss how to stay safe in the laboratory.	1) Ask learners, in groups, to discuss the importance of studying Physics. Focus should be put on: • the meaning of physics. • Physics technologies. • how the technologies can improve life. 2) After learners have made a tour of the physics laboratory and have observed some Physics apparatus, let them formulate some of the laboratory rules and discuss why they should follow them.

Hint to the Teacher

Ask learners to make and display a simple project from what they learnt in Science in Primary school. Use the display to guide the learners about what is more related to the study of Physics. This will help them understand the meaning of Physics.

Topic 1: Measurements

SUB-TOPIC: Physical Quantities, Units and Measurement

Duration: 12 Hours

Competency: The learner estimates and measures length, mass, time, volume and density and expresses them using appropriate units.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) show understanding that all physical quantities consist of a numerical magnitude and a unit. (k, u) 2) explain how they choose the right measuring instrument and the right units and explain how to use the instruments, ensuring accuracy. (k, u) 3) recall the following base quantities and their units: mass (kg), length (m), time (s), current (A), temperature (K), amount of substance (mol). (k) 4) use the following prefixes and their symbols to indicate decimal sub-multiples and multiples of the SI units: milli (m), centi	1) In groups, learners discuss instances in everyday life where measurement is applied and explain what is done in each case. 2) Learners estimate and measure length for a variety of objects such as a desk, one's height, height of the classroom etc., express the readings using different units and compare their readings. 3) Learners measure mass for different objects and compare their answers, then	1) Learners work together to estimate, measure and record each of the following with the right accuracy: • The length of a football pitch • The width of the classroom • The area of the desk top • The thickness of the desk top • The time a friend takes to walk 20 paces • The mass of a pen

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
(c), deci (d), kilo (k), mega (M). (k, u) 5) measure a variety of lengths with appropriate accuracy by means of tapes, rules and interconvert units of lengths. (k, u, s) 6) measure a short interval of time including the period of a simple pendulum with appropriate accuracy using stopwatches or appropriate instruments. (k, u, s) 7) state the meaning of mass and measure masses of different objects. (k) 8) express measured and calculated values to the right significant figures and be able to express them in scientific notation. (k, u) 9) express derived quantities in terms of base quantities and derive their units. (k, u) 10) carry out measurement of area,	they discuss why their answers are different. 4) Learners record time for short events such as writing a sentence and express the answer with appropriate units. 5) In groups, learners measure the volume of regular and irregular objects by the displacement method or otherwise and describe the steps they undertake. 6) In groups, learners collect various figures from a Mathematics book under the topic STATISTICS, and then express them to different significant figures, and also in scientific notation, with guidance from the teacher. 7) In groups, learners plan and carry out	2) Task learners to calculate density and express it in gcm-3 and kgm-3 for a block of material of mass 600 g and volume 200 cm3 and predict whether this block will float or sink in water. Assess how learners state formulae and substitute. 3) Let learners determine the density and relative density of an irregular solid. Assess the following: planning, setting up apparatus, procedures,

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
volume, density and relative density and express them with appropriate units. (k, u, s) 11) calculate the density of objects and relate it to sinking and floating. (k, u)	experiments to determine densities of solids of different materials such as cork, plastic, wood and glass blocks and predict whether they float or sink in water.	observations, and conclusion.

Hint to the Teacher

1) The accuracy of the instruments should be emphasised throughout the syllabus.
2) The use of significant figures and scientific notation throughout the syllabus is required.
3) Learners should practise measuring using a metre rule/ruler, stop clock and a variety of balances as much as possible (e.g., from shops, scrap yards, maize mills etc.).
4) Learners should carry out the inter-conversion of units for all the quantities as much as possible.
5) Allow learners to estimate these quantities, especially in instances where accurate measurements may not be required.

Topic 2: Forces and their Effects

SUB-TOPIC 1: Types of Forces

Duration: 6 Hours

Competency: The learner explores the nature, types and effects of forces on objects.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the meaning of force and state its units. (k, u) 2) identify the types of forces and where they occur and their consequences. (k) 3) explain the meaning of weight and compare it with mass. (k, u) 4) measure weight and apply the relationship weight = mass × acceleration due to gravity to solve related problems. (k, u) 5) explain the meaning of friction and its effects (positive and negative). (k, u)	1) As individuals or groups, learners push a wooden block into plasticine/ clay, an inflated balloon/ used water bottle, or another block and use the observations to discuss what a force is and the effects of forces on objects. 2) Learners measure the weight and mass of different objects using appropriate instruments and use the results to explain the	1) Using two springs, a stretched one and a compressed one, learners debate the effects of a pulling force and a pushing force 2) Ask learners to calculate the weight of a 10 kg rock on Earth and what it is expected to be on the moon and compare the two values. 3) Learners explain, in a brief write-up, the following observations in terms of friction: a) Grease is applied to the moving parts of a machine.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
6) describe methods of minimising friction in bodies. (k, u) 7) explain what is meant by scalar and *vector* quantities and give common examples of each. (k, u) 8) add two or more vectors to determine a resultant by a graphical method and calculation for linear and perpendicular vectors only. (k, u)	relationship between mass and weight. 3) In groups, learners carry out experiments to investigate the factors that affect frictional force between two surfaces in contact and summarise their findings.	b) Heavy objects can be more easily moved on rollers than dragged. c) Objects slide more easily across a smooth surface than a rough surface. d) Car tyres become smoother and thinner with time. e) It is easier to write with a pencil on paper than on glass.

ICT Support

Use the Internet as a source of research for information about gravity on Earth and other planets.

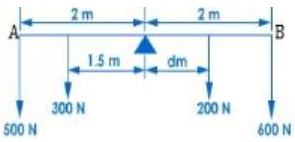
Hint to the Teacher

1) The concept of resultant force can be illustrated using a tug-of-war game.
2) Forces to be mentioned should include weight, cohesion, adhesion, friction, magnetic, electrostatic, surface tension, centripetal, nuclear forces.
3) The relation F=ma will be met under motion.
4) Fluid friction/viscosity may be mentioned but numerical treatment of friction is not required.
5) Only the resultant of linear and perpendicular vectors should be treated using simple mathematical analysis.

SUB-TOPIC 2: Turning Effect of Forces

Duration: 9 Hours

Competency: The learner investigates the relation between turning effect of forces and stability of bodies.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner be able to: 1) describe the moment of a force in terms of its turning effect and relate this to everyday examples. (k, u) 2) apply the relationship: moment of a force (or torque) = force × perpendicular distance from the pivot to new situations or to solve related problems. (k, u, s) 3) state the principle of moments for a body in equilibrium and verify it experimentally. (k, u) 4) apply the principle of moments to several experiments and to	1) Learners open a door using one finger placed at different positions from the fixed end/pivot and use this activity to discuss the factors that determine turning effect. 2) Learners, in groups, carry out experiments to determine the mass of a metre rule and compare their results. 3) In groups, learners find out how far from the pivot of a seesaw a student of mass 80 kg should sit in order to exactly balance a student of mass 60 kg who is sitting 2 m from the pivot. 4) Learners, in groups, cut pieces cardboard of different irregular	1) Let learners determine the value of distance **d** in the figure below, if AB is balanced.  Consider how learners analyse and resolve the diagram using the principle of moments. 2) Ask learners, in a conversation, to explain why buses with loads in the underside boot are more stable than those where the load is in the rack at the top.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
solve related problems. (k, u, s) 5) show understanding of the centre of gravity and how it can be located for irregular shapes. (k, u, s) 6) distinguish between the different types of equilibria. (k, u) 7) describe qualitatively the factors effecting the stability of objects. (k, u)	shapes to determine the centre of gravity of the cardboard. The learners then try to check for the actual centre of gravity of the pieces cardboard by balancing them on a finger and make reports. 5) Learners, in groups, slightly displace a ball, plastic funnel and other small objects from rest positions and use the observations to discuss the various types of equilibrium.	3) Ask learners to narrate their experience in relation to loading vehicles and allow them to critique their peers.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing applications of the turning effect of forces, e.g., walking on a tightrope etc.

Hint to the Teacher

1) Examples of moments should involve one or two pivots/turning points only.
2) A variety of examples and practical activities using a metre rule are recommended.
3) Assessment of other practical abilities such as recording observations, data analysis and graphical work is recommended.

SUB-TOPIC 3: Energy, Work and Power

Duration: 10 Hours

Competency: The learner explores the relationship between force, distance and time in relation to energy, work and power in the operation of simple machines.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the meaning of energy and identify examples of different forms/types of energy. (k) 2) identify sources of energy and categorise them as renewable and non-renewable. (k) 3) apply the formulae Ek = ½ mv2 and Ep = mgh to solve numerical problems (for KE and PE respectively). (k, u) 4) state the principle of the conservation of energy and apply the principle to different situations and to solve related problems. Describe energy changes involved in various processes. (k, u) 5) mention devices which convert from one form of energy to another. (k)	1) In groups, learners brainstorm the different forms/types of energy in their communities and what they are used for. 2) In groups, learners drop a small object to the ground and describe all the energy transformations that take place. 3) In groups or as individuals, learners lift blocks or bricks of different masses through different vertical distances and calculate the work done in each case. Then the learners use their results to discuss the factors that determine the value of work done. 4) In groups or as individuals, learners lift blocks of known mass through a known distance in a given time	1) Ask learners to calculate the work done and the power developed when a student lifts a mass of 40 kg through a vertical height of 5 m in 20 s. Critique how the learners identify the quantities, the formula to use, the substitution and how the final answer is stated. 2) Learners, in a class discussion, identify the energy transformations that take place: • at a waterfall; • when a fruit falls to the

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
6) relate energy, work and power and solve related numerical problems. (k, u) 7) explain terms related to simple machines. (k, u) 8) explain how levers, pulleys, wheel and axle, gears etc. work. (k, u) 9) calculate MA, VR and efficiency of machines. (k, u) 10) explain how the efficiency of machines can be improved. (k, u)	and calculate the power developed. 5) In groups, learners are provided with a variety of levers such as pliers, an opener, a knife etc. or their pictures if the machines are not readily available. Using positions of load, effort and fulcrum, learners classify the levers into the three classes. 6) In groups, learners discuss instances in which each simple machine is applied.	ground from a tree; • when a generator is used to provide light; and • when a torch is used to provide light. 3) Learners explain the causes of power loss in simple machines and how it can be minimised, using practical examples.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing different types of machines and how they work, e.g., pulley systems, winch, gears etc.

Hint to the Teacher

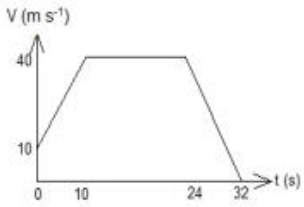
1) Practical demonstrations in which work is done, energy is transformed and power is expended are recommended.
2) The principle of conservation of energy should be demonstrated using a simple pendulum, falling bodies.
3) Energy transformation can be demonstrated using lighting of bulbs and other appropriate illustrations.
4) Using real machines such as openers, scissors, knives, wheelbarrows etc. to demonstrate levers and other simple machines is recommended.

SUB-TOPIC 4: Motion

Duration: 12 Hours

Competency: The learner investigates the concept of motion, its laws and their implications in everyday life.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain what is meant by displacement, speed and velocity. (k, u) 2) calculate speed and average speed. (k, u) 3) plot and/or interpret displacement-time graphs when a body is at rest, moving with uniform velocity, or moving with non-uniform velocity and use it to calculate velocity. (k, u, s) 4) explain what is meant by acceleration and apply the equations of motion to solve numerical problems. (k, u) 5) explain uniform velocity and uniform acceleration. (k, u) 6) plot and/or interpret a velocity-time graph and use it to determine displacement and acceleration. (k, u, s)	1) In groups, learners mark two points which are 100 m apart on a playing field. They measure the time taken by a student: • walking; • running; • riding a bicycle between the points, if possible; and • who remains at the same point. 2) Using the above data, learners calculate the average speed of the student in each case. 3) Learners carry out an activity to determine acceleration due to gravity by measuring the time taken for a stone to fall from a known	1) Ask learners to sketch a velocity-time graph for this data: A body moving at 5 ms^{-1} accelerates uniformly until its velocity becomes 15 ms^{-1} in 5 s. It then maintains a constant velocity for 10 s and is finally brought to rest 20 s from the start. Assess the labelling of axes, the fitting of variables and the use of the graph to calculate total distance covered. 2) Let learners explain their feeling when they are sitting in a stationary vehicle that suddenly starts to move. 3) Learners solve this problem: A force of

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
7) explain the term "acceleration due to gravity" and determine it experimentally. (k, u, s) 8) explain momentum and conservation of linear momentum. (k, u) 9) state Newton's laws of motion and describe their implications/applications. (k, u) 10) apply the relationship resultant *force* = *mass* × acceleration to solve related numerical problems. (k, u)	height to the ground and compare their results to the quoted value. 4) Learners interpret the graph shown below (describing the motion of a body as shown by the graph).  	20 N acts on a mass of 500 g. Find the acceleration of the mass. Assess how learners substitute in a right equation and how they simplify the expression and express the final answer.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing motion-related concepts and their applications, e.g., inertia, conservation of momentum, explosions etc.

Hint to the Teacher

1) Derivation of the equations of uniformly accelerated motion is not required.
2) Derivation of the equation F=ma is not required.
3) A variety of problems are required for this sub-topic.
4) Allow learners to draw a variety of graphs and interpret them.
5) In the practical activity to determine the acceleration due to gravity, assist learners to develop other practical skills such as data presentation and data analysis.

SUB-TOPIC 5: Pressure

Duration: 8 Hours

Competency: The learner determines pressure in solids and fluids and explains its implication in everyday life.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the term pressure and derive its units. (k, u) 2) apply the relationship pressure = force / area to explain situations and to solve numerical problems related to minimum and maximum pressure. (k, u) 3) demonstrate the factors that affect liquid pressure. (k, u, s) 4) explain the transmission of fluid pressure and its applications. (k, u) *5)* apply the relationship p = h×ρ×*g* to different situations and to solve related numerical problems	1) In groups or as individuals, learners place a stool standing on its legs then on its flat surface onto a flat heap of sand or clay and compare how much the sand or clay is depressed by the different sides. 2) In groups, learners measure the length, width and thickness of a rectangular block/ brick. Then they measure its mass and use these readings to calculate the least and greatest pressure it exerts on a smooth table. 3) Learners, in groups or as individuals, make holes on a used water bottle at different and same depths and pour water into the bottle. Then they discuss what they observe.	1) Learners explain the following phenomena using knowledge of pressure: • Farm tractors have large wheels with wide tyres. • A hippo can walk more easily in mud than a goat. • A lady walks more easily on soft ground/sand in flat shoes than in high heels. 2) Learners calculate the pressure a drawing pin exerts in a soft board if its tip area is 1mm^2 and the force used to push it is 2N. Assess how the units are harmonised. 3) Task learners to: • explain why the pressure at a

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
(derivation of the equation not required). (k, u) a) describe the cause, effects and applications of atmospheric pressure. (k, u) b) describe construction and use of a mercury barometer. (k, u) c) describe the use of a manometer in the measurement of pressure difference. (k, u)	4) In groups or as individuals, learners plan and carry out an activity to demonstrate the existence of atmospheric pressure by: • crushing a can. • siphoning. • using a partial vacuum. 5) In groups, learners plan an activity to demonstrate the hydraulic press using syringes and straws.	depth of 10 m in the sea is higher than that on the surface and its implication. • suggest reasons why dams are built so that they become increasingly thicker from top to bottom. Assess scientific literacy and communication in this activity.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing applications of pressure, e.g., force pump, siphon, variation of pressure with altitude etc.

Hints to the Teacher

i) Minimum and maximum pressure should be demonstrated practically.
ii) Effort should be made to try out demonstrations before presenting them to students.
iii) Everyday life implications and applications of solid, liquid and gas pressure should be emphasised.

Topic 3: Light

SUB-TOPIC: Behaviour of Light

Duration: 14 Hours

Competency: The learner demonstrates the behaviour of light in different media and explains its implications and applications.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) demonstrate that light travels in straight lines (rectilinear propagation of light). (k, u, s) 2) explain how shadows and eclipses are formed. (k, u) 3) describe the terms related to reflection at plane surfaces. (k) 4) describe and perform experiments to demonstrate the laws of reflection and use them in different situations. (k, u, s) 5) describe image formation in plane mirrors and its applications. (k, u)	1) Learners, as individuals or as groups, make an artificial eclipse using items such as the globe, bulb, balls etc. and make a report. 2) In groups, learners carry out activities on measuring the angles of reflection for different angles of incidence and discuss the results. 3) As individuals, learners observe themselves through plane mirrors and discuss the nature of the images formed.	1) Task learners to draw a diagram of the solar eclipse and label the umbra and penumbra. Then let them explain why it happens that way. 2) Task learners to determine how far the image of X is behind the mirror from this kind of data: An object X is 4 cm behind a second object Y. Object Y is 6 cm from a plane mirror. Assess how learners sketch a diagram that they use to solve the problem.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
6) describe how curved mirrors form images and their applications (scale drawings may not be required). (k, u) 7) describe the terms related to refraction at plane surfaces. (k) 8) describe and perform an experiment to demonstrate the laws of refraction and apply them to different situations (e.g., effects of refraction, determining refractive index). (k, u, s) 9) explain the terms *critical angle* and *total internal reflection* and their implications/applications. (k, u) 10) describe the properties and action of lenses (both converging and diverging) (construction of scale ray diagrams not required). (k, u)	4) Learners observe themselves using curved mirrors and describe the nature of the images formed by the mirrors. 5) Carry out activities to determine the refractive index of glass using a variety of methods. 6) Carry out activities to show the splitting of white light and discuss what causes it. 7) Observe objects of different colours in different coloured lights and discuss why the objects appear that way. 8) Observe objects of different colours through filters and discuss why the objects appear that way.	3) Task learners to describe, using appropriate ray diagrams, the characteristics of the image formed by a concave mirror when object is: • at a distance less than f. • at f. • between f and r. • at r. • at a distance greater than r. 4) Ask learners to identify and observe the effects of refraction of light in everyday life and summarise what they see. 5) Ask learners to confidently explain why some objects appear coloured and others black when

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
11) determine the focal length of a convex lens. (k, u, s) 12) describe applications of lenses. (k, u) 13) explain the dispersion of white light, its implications and application. (k, u) 14) describe the appearance of coloured objects in coloured light. (k, u)	9) Carry out activities to determine the focal length of a convex lens, by estimation and accurate methods. 10) Carry out activities to demonstrate the dispersion of white light and identify the colours.	viewed in different coloured lights. 6) Ask learners to draw ray diagrams to show what happens to parallel rays of light passing through: • a converging lens. • a diverging lens when objects are at different positions.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing the formation of shadows, eclipses, total internal reflection, dispersion etc.

Hints to the Teacher

1) Emphasise the difference between reflection and refraction of light and where they are applied.
2) Emphasise the rays used for locating images in curved mirrors for different object positions.
3) Accurate scale drawings for both the curved mirrors and lenses may be left out. However, you can support learners who show curiosity in this aspect.
4) Provide learners with a variety of practical activities involving plane mirrors, concave mirrors, the glass block and convex lenses.
5) Operation of the projector, compound microscope and telescopes should be left out.
6) The lens formula should not be taught.

Topic 4: Waves

SUB-TOPIC 1: General Wave Properties

Duration: 10 Hours

Competency: The learner investigates the properties of transverse and longitudinal wave forms and explains how waves transmit energy and its applications.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) describe what is meant by wave motion as illustrated by vibrations in ropes, springs and disturbances in water. (k, u) 2) explain the meaning of speed, frequency, wavelength, period, amplitude, crest and trough. (k, u) 3) apply the relationship $v = f\times\lambda$ where v is velocity, f is frequency and λ is the wavelength to solve related problems. (k, u) 4) compare transverse and longitudinal, mechanical and electromagnetic waves and state suitable examples of each. (k)	1) Using ropes or water in a basin or pond, learners demonstrate what waves are and make a report. 2) Carry out an activity to demonstrate the movement of transverse and longitudinal waves using a slinky spring or other methods. 3) Investigate reflection, refraction, diffraction and interference of water waves using a ripple tank and discuss the observations. 4) In groups or as individuals, learners search	1) Task learners to compare longitudinal and transverse waves using appropriate sketches. 2) In a ripple tank, the distance between 10 successive crests is 18 cm and the frequency of the ripples is 50 Hz. Ask learners to find the speed of the ripples and assess how they substitute. 3) Task learners to draw sketches of wave patterns obtained when waves are reflected and diffracted in different cases.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
5) describe the behaviour of waves in terms of reflection, refraction, diffraction and interference. (k, u) 6) identify the components of the electromagnetic spectrum in order of their frequencies and wavelength. 7) describe the properties of the electromagnetic waves. (k, u) 8) describe the uses/applications and dangers of each of the components of the electromagnetic spectrum. (u, v/a)	and display the components of the electromagnetic spectrum, their sources, frequencies, wavelengths and their uses. 5) Learners solve a numerical problem such as: calculate the wave length of radio waves transmitted from a station that broadcasts at a given frequency, e.g., 150MHz.	Allow for peer assessment. 4) Task learners to identify the applications of X-rays, visible light, radio waves, ultraviolet radiation, infra-red radiation and micro-waves and their associated dangers and make a peer assessed presentation.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing transverse and longitudinal waves, mechanical and electromagnetic waves, amplitude, frequency, period, wavelength, reflection, refraction, diffraction and interference of waves.

Hints to the Teacher

1) Provide a variety of opportunities for the learners to explore the behaviour of waves, e.g., use of ropes/strings and a ripple tank (can be improvised if not available).
2) The use of the equation $v=f\lambda$ should be emphasised in a variety of situations.
3) Learners should not memorise the values of the frequencies and wavelength of electromagnetic waves but should consider the order increasing/decreasing magnitude of these parameters among the electromagnetic waves since their applications/dangers are related to frequencies and wavelengths.

SUB-TOPIC 2: Sound

Duration: 6 Hours

Competency: The learner investigates the nature of sound waves, how they are transmitted in different media and their applications.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) describe the production of sound by vibrating sources. (k, u) 2) describe the longitudinal nature of sound waves in terms of the processes of compression and rarefaction. (k, u) 3) explain that a medium is required in order to transmit sound waves and that the speed of sound differs in air, liquids and solids. (k, u) 4) describe the echo method for the determination of the speed of sound in air	1) Learners carry out an activity to produce sound and discuss what happens during the process. 2) In groups, learners demonstrate that sound requires a medium to travel. 3) Learners carry out an activity to show that sound waves undergo interference and diffraction. 4) In groups, learners plan and carry out an activity to measure the velocity of sound in air using the echo method and discuss the	1. Task learners to compare sound and light waves in a group discussion and assess how learners express themselves. 2. Ask learners to solve this problem: A student standing 100 m from a large building claps his hands once and hears the echo after 0.6 s. Calculate the speed of sound in air. Assess how learners select the formula and substitute in the variables to obtain the final answer.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategies
and make the necessary calculation. (k, u) 5) relate loudness of a sound wave to its amplitude and pitch to its frequency. (k, u) 6) describe refraction, diffraction and interference of sound waves and their implications. (k, u)	limitations of the method. 5) In groups, learners demonstrate the difference between loudness and pitch.	

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia demonstrating requirement of a material medium for the propagation of sound, reflection, refraction, diffraction and interference of sound.

Hints to the Teacher

1) Emphasis on sound needing a material medium in order to travel.
2) A comparison of sound and light as forms of wave motion should be emphasised.

Topic 5: Earth and Space Physics

SUB-TOPIC 1: Sun, Earth and Moon Systems

Duration: 5 hours

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	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) know the relative sizes, positions and motions of the Earth, sun and moon. (k) 2) understand how day and night occur and demonstrate the phases of the moon. (k, u) 3) understand the roles of the sun, Earth and moon in explaining time, seasons, eclipses and ocean tides. (k, u)	1) 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.	1) Listen to group and pair discussions, asking probing questions to promote thinking, and ensure that learners gain expected knowledge, understanding and skills. 2) Observe learners working together, providing guidance to ensure that all grasp concepts. 3) Evaluate the quality of learning through assessment of posters, models and reports, and gauge progress towards the learning outcomes.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
	2) In pairs, learners use a model to explain how the Earth and moon move relative to the sun and use it to explain eclipses. 3) In groups, learners research, discuss and report on the connection between the moon and ocean tides.	

Hints to the Teacher

1) The use of ICT animations is required.
2) 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.

SUB-TOPIC 2: Solar Systems

Duration: 5 Hours

Competency: The learner should understand the characteristics of inner and outer planets and their orbits, relative movement of the planets in relation to the sun and explain the consequences for the Earth.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) know the components of the solar system and their positions. (k) 2) know the main characteristics of the inner and outer planets in the solar system. (k) 3) understand the various views about the origin and structure of the universe. (k, v/a)	1) 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. 2) 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.	1) Listen to group and pair discussions, asking probing questions to promote thinking, and ensure that learners gain expected knowledge, understanding, and skills. 2) Observe learners working together, providing guidance to ensure that all grasp concepts. 3) Evaluate the quality of learning through assessment of products: posters, planet models, and reports; gauge progress towards

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
	3) In groups, learners search and draw a table showing all the planets in the solar system and their characteristics, e.g., radius, distance from the sun, time for one rotation, time for one revolution etc.	achieving the learning outcomes. 4) Each group presents the characteristics of one of the planets.

Hints to the Teacher

1) The use of ICT animations is required.

5) 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.

SUB-TOPIC 3: Stars and Galaxies

Duration: 5 Hours

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

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
The learner should be able to: 1) 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) 2) appreciate that stars vary in colour and brightness. (u) 3) 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.	1) 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. 2) Observe groups and intervene appropriately to guide their work. 3) Assess products to ensure all are making progress towards the achievement of learning outcomes. 4) Each group presents the characteristics of one of the stars or galaxies.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
	• 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. In groups, learners search and draw a table showing stars and galaxies and their characteristics and discuss their implications, e.g., radius, distance from the Earth etc.	

Hint to the Teacher

Guide learners to understand and appreciate the scale on which stars and galaxies are in relation to planets and moons, i.e., the light year as a unit of distance.

ICT Support

The learner can use Internet research to study the formation of stars and galaxies and their characteristics.

LEVEL 2

Topic 6: Thermal Physics

SUB-TOPIC 1: Kinetic Model of Matter

Duration: 3 Hours

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

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner be able to: 1) compare the properties of solids, liquids, gases and plasma. (k, u) 2) describe qualitatively the molecular structure of solids, liquids, gases and plasma, relating their properties to the forces and distances between molecules and to the motion of the molecules. (k, u) 3) infer from Brownian motion and diffusion experiments the evidence for the movement of molecules. (k, u) 4) describe the factors that determine the motion of	1) In groups, learners investigate the properties of solids, liquids, gases and plasma (shape, pouring and compressing using common substances like sand, water and air). 2) Learners observe and describe the motion of dust particles when a room is being swept and light is entering from one end. 3) As individuals or groups, learners plan and carry out an activity to demonstrate how	1) Ask learners to use models (from local materials) to explain the difference between solids, liquids and gases in terms of arrangement of particles. 2) Learners use Brownian motion to explain why the smells of objects spread fastest during hot weather rather than cold weather.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
molecules in matter. (k, u) 5) describe changes of states of matter as processes of energy transfer without a change in temperature. (k, u)	diffusion takes place in gases and liquids. 4) In groups, learners discuss the importance of change of state in everyday life and present a report.	

ICT Support

Learners us the Internet to do research on the plasma state.

Hints to the Teacher

1) Introduce the sub-topic by reviewing with the learners the meaning of matter.
2) Assessment should consider other factors that determine motion of particles as well.

SUB-TOPIC 2: Temperature

Duration: 4 Hours

Competency: The learner describes the construction and use of thermometers.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner be able to: 1) explain the difference between temperature and heat. (k, u) 2) explain and give examples of thermometric properties. (k) 3) compare mercury, alcohol and water as thermometric liquids. (k, u) 4) describe how the upper and lower fixed temperature points are determined. (k, u) 5) solve numerical problems related to temperature scales, including the Kelvin scale. (k, u) 6) describe the construction and use of a clinical thermometer. (k, u, s)	1) As groups, learners make an improvised thermometer. 2) As individuals or in groups, learners discuss the features of a clinical thermometer and the laboratory thermometer and the best practices of caring for a clinical thermometer and make a report. 3) In groups, learners measure their body temperature and compare it with the known value. 4) Learners debate the motion: **"Mercury is a better thermometric liquid than alcohol"**.	1) Ask learners to write a brief note describing the care of clinical thermometers. Consider how learners effectively communicate scientific literacy. 2) Provide learners with corresponding values of Celsius and Kelvin temperatures and asks the learners to develop a relationship between them.

ICT Support

Use animations to demonstrate the determination of fixed points.

Hints to the Teacher

1) Digital thermometers or temperature guns may be used to measure body temperature.
2) Gas and resistance thermometers should **NOT** be discussed at this level.

SUB-TOPIC 3: Transfer of Heat Energy

Duration: 6 Hours

Competency: The learner investigates the modes of heat transfer and their applications.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
The learner should be able to: 1) show understanding that thermal energy is transferred from a region of higher temperature to a region of lower temperature. (k, u) 2) describe, in molecular terms, how heat transfer occurs in solids. (k, u) 3) describe and perform experiments to compare the rates of conduction of different solids. (k, u, s) 4) describe, in terms of density changes, convection in fluids. (k, u) 5) describe heat transfer by radiation. (k, u) 6) investigate the factors that affect the rate of heat transfer by radiation. (k, u) 7) describe applications of heat transfer in everyday life. (k, u)	1) In groups, learners hold one end of a metallic material such as a knife and a piece of wood in a fire flame and discuss what happens and state where this behaviour is applied. 2) In groups, learners put water in a volumetric flask and add coloured material. Then they apply a small flame at the bottom and discuss what they observe and how it can be applied. 3) Learners use a thermos flask and discuss in groups how it keeps heat transfer to a minimum.	Ask learners to explain the examples of the applications of heat energy transfer by conduction, convection and radiation in cooking food or in nature such as land and sea breezes or any other activity and allow for peer assessment.

ICT Support

Use animations to demonstrate global warming in relation to heat transfer.

Hint to the Teacher

1) Aspects of global warming and the greenhouse effect should be discussed in relation to heat transfer.
2) It is important to discuss other forms of flasks, e.g., food flasks, which are not vacuum flasks.
3) A wide range of the applications of each of the modes of heat transfer should be discussed.

SUB-TOPIC 4: Expansion of Solids, Liquids and Gases

Duration: 4 Hours

Competency: The learner explains the applications and disadvantages of the expansion of solids, liquids and gases.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 4) explain the term expansion and explain what causes it. (k, u) 5) design experiments to compare the rates of expansion of solids and liquids. (k, u) 6) explain daily observations of expansion of gases, e.g., bursting of balloons and tyres during hot weather. (k, u) 7) describe applications of expansion of materials in	1) In groups, learners plan, carry out activities and present a report to show that when solids, liquids and gases are heated, they expand. 2) In groups, learners carry out an activity to investigate and compare the rates of expansion of solids and liquids and discuss instances where the results are applied. 3) In groups, learners discuss how to minimise the dangers due to expansion in structures like bridges, railway lines, pipelines etc.	1) Ask learners to use the knowledge of the kinetic model of matter to: • explain why gases expand more easily than solids and liquids at the same temperature. • explain why tyres are safer when driving at night than during a hot day on the same road surface. 2) Learners draw a sketch graph and explain how the volume and density of water changes between 0°C and 100°C. Consider how learners indicate axes and how they explain

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
everyday life. (k, u) 8) describe the anomalous expansion of water and its significance. (k, u)	4) In groups, learners discuss why ice forms on the surface of water and not within the water and the biological significance of this phenomenon.	the shape of the graph.

ICT Support

Learners should search the Internet for applications and dangers of expansion and contraction.

Hints to the Teacher

1) Gas laws may not be used to explain expansion of gases. Numerical treatment of gas expansion may not be required. Only simple illustration of gas expansion in everyday life is required. However, if some learners can show enthusiasm about gas laws, you can support them.
2) Emphasise the expansion of solids and liquids in assessment using local examples.

SUB-TOPIC 5: Heat Quantities

Duration: 8 Hours

Competency: The learner explores the concept of heat capacity and latent heat and their implications for real life.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) describe the change in temperature of a body in terms of a change in its internal energy. (k, u) 2) explain the terms heat capacity and specific heat capacity. (k, u) 3) apply the relationship heat energy = mass × specific heat capacity × change in temperature to solve numerical problems. (k) 4) determine the specific heat capacity of a material, e.g., cork by a method of mixtures. (k, u) 5) explain the difference between boiling and evaporation. (k, u) 6) explain the terms *latent heat* and *specific latent heat.* (k, u)	1) Learners carry out an activity to investigate the effect of supplying the same amount of heat energy **(heat from the** same source supplied for the same period) on the temperature of different materials of the same mass. 2) Learners plan and carry out an activity to obtain a cooling/heating curve for a substance, e.g., water and naphthalene,	1) Ask learners to explain land and sea breeze. Consider how learners use the concept of heat capacities in this explanation. 2) Solving numerical problems like: Hot water is poured into three times its mass of water at 20°C. The resulting temperature of the mixture is 30°C. Find the temperature

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
3) apply the relationship heat energy = mass × specific latent heat to solve numerical problems. (k, u) 4) explain latent heat in terms of molecular behaviour. (k, u) 5) describe implications and applications of the high heat capacity and latent heat of water. (k, u) 6) sketch and interpret cooling/heating curves. (k, u)	and explain the shapes obtained. 3) With guidance from the teacher, learners in groups, discuss the applications of latent heats in devices such as refrigerators, power stations, generators, etc. and make reports.	of the hot water before mixing. 3) Ask learners to calculate the total heat energy required to convert 5 kg of ice at -20^{0}C to steam at 100^{0}C and draw the heating curve.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing concepts such as latent heat, refrigerator etc.

Hints to the Teacher

1) Emphasise to learners the relationship between temperature, kinetic energy of particles and internal energy.
2) Give learners a variety of numerical activities related to the heat quantities so that they become familiar with the concept.
3) Emphasise that the difference in temperature between land and sea is caused by a difference in their heat capacities.
4) The concept of vapours should **NOT** be emphasised.

Topic 7: Electricity and Magnetism

SUB-TOPIC 1: Static Electricity

Duration: 4 Hours

Competency: The learner investigates static electricity and its implications and applications.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
The learner should be able to: 1) explain how charges are produced on insulators. (k, u) 2) state the law of electrostatics and use it to explain electrostatic induction. (k, u) 3) distinguish between conductors and insulators. (k, u) 4) describe the structure of a gold leaf electroscope (GLE) and its uses. (k, u) 5) explain the meaning of electric field and sketch electric field patterns for different situations. (k, u) 6) explain how lightning occurs and describe	1) In groups, learners carry out an activity in which a plastic pen/ruler rubbed with cotton or hair attracts small pieces of paper and explain why. 2) Learners bring a charged plastic rod near the cap of a charged and uncharged GLE and discuss the observation. 3) In groups, learners use ICT or other sources to search for recent destruction caused by lightning in Uganda and write a report, highlighting	1) Let learners explain in a conversation, why two balloons suspended together will move away from each other when they have been rubbed with a dry cloth. 2) Ask learners to confidently explain why it would be very unwise for a person to walk holding an opened umbrella during a thunderstorm. 3) Let learners sketch electric field patterns for the following cases: • between similar charges.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
how the lightning conductor works. (k, u) 7) state other applications of electrostatics. (k)	the places/regions most prone to lightning strikes and why.	• between two oppositely charged parallel plates.

ICT Support

Learners use the Internet to for pictures, videos, and other multimedia showing the gold-leaf electroscope, the lightning conductor, etc.

Hints to the Teacher

1) There is need to emphasise the meaning of static electricity at the beginning of this sub-topic.
2) Use a variety of examples related to charges at rest, e.g., holding a comb near hair, chains in vehicles etc.
3) Emphasise precautions in avoiding lightning strikes.
4) Emphasise that the leaf is not made of real gold but any metal can do, e.g., aluminium.
5) The operation of a van der Graff generator and ice pail experiment should be left out.

SUB-TOPIC 2: Current Electricity

Duration: 12 Hours

Competency: The learner investigates what an electric current is, its sources and explores the concept of electrical resistance.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain what is meant by electric current and state its units. (k, u) 2) apply the relationship charge = current × time to solve related numerical problems. (k) 3) differentiate between potential difference (p.d.) and electromotive force (e.m.f.) and identify the sources of e.m.f. (k, u) 4) distinguish between primary and secondary cells. (k, u) 5) describe the structure and action of a simple cell and a dry cell. (k, u) 6) describe how electric current and p.d. are measured. (k, u, s, gs) 7) draw circuit diagrams with power sources (cell, battery, d.c. supply or a.c. supply), switches, lamps, resistors (fixed and variable), fuses, ammeters and voltmeters. (k, u, s)	1) Learners construct a simple cell using materials such as oranges, wires etc. and describe how it works. (N.B. Use a galvanometer to detect current.) 2) In groups, learners design working series and parallel circuits with bulbs, cells and switches, and discuss the differences in lighting of the bulbs. 3) In groups and with guidance from the teacher, learners design a circuit containing a resistor, battery, voltmeter, ammeter and switch and take the readings to appropriate accuracy. Then they change the resistance several	1) Ask learners, in a class discussion to analyse the advantages and disadvantages of the various sources of electricity, with reference to Uganda. Assess the self-confidence of the learners. 2) Ask individual learners to explain why domestic electric devices are always connected in parallel. They should make a brief write-up for this task.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
8) state Ohm's Law and define electrical resistance. (k) 9) apply the relationship R = V/I to solve related problems. (k, u) 10) describe an experiment to verify Ohm's law. (k, u) 11) describe the properties of series and parallel resistor networks and use them to solve related numerical problems (derivation not required). (k, u) 12) investigate the factors that affect the resistance of a conductor. (u,s,gs)	times and note the differences in the readings. 4) In groups, learners carry out an activity to investigate Ohm's law and present and analyse their results appropriately. 5) In groups, learners calculate the total resistance when three resistors of values 1 Ω, 2 Ω and 5 Ω are connected in parallel and in series and compare their answers.	3) Ask learners to draw a circuit diagram showing how the instruments should be positioned to measure the current and potential difference across a bulb. In a conversation, ask learners to give reasons for that arrangement.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing flow of charge, series and parallel connections, measurement of current and voltage/e.m.f. etc.

Hints to the Teacher

1) Derivation of the resistor network formulae is not required but only their applications in solving numerical problems should be emphasised.
2) Make thorough preparations of learning materials to enable learning by exploration and experimentation.
3) Emphasis should be put on the significant figures/accuracy of ammeters and voltmeters.
4) A variety of practical activities involving ammeters, voltmeters, switches, bulbs and resistance wire are recommended.

SUB-TOPIC 3: Practical Electricity

Duration: 8 Hours

Competency: The learner explores how electric energy is distributed and consumed in order to ensure electric power saving and safety.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) identify domestic electrical appliances and describe the energy transformations that occur in them. (k, u) 2) apply the relationships energy, E = V I t and power, P = V I to solve related numerical problems. (k) 3) read and interpret the power ratings of electrical appliances. (k, u, v/a) 4) interpret the kWh and Ah and relate it to joules. (k, u, v/a) 5) calculate the cost of using electrical appliances. (k, u) 6) identify the non-renewable and renewable sources of electricity and discuss their merits and demerits. (k, u, v/a) 7) state the hazards of using electricity in the following situations: i) damaged insulation; ii) overheating of cables; and	1) In groups and with guidance from the teacher, learners: a) carry out an activity to demonstrate the heating effect of a conductor. b) read the power ratings on kettles, bulbs and other related appliances and discuss their implications. c) solve the problem: Calculate the electric power dissipated in a device that draws a certain voltage when a certain amount of current passes through. d) In groups, learners discuss how they	1) Ask learners to identify domestic appliances that convert electrical energy into each of the following: i) Heat energy ii) Heat and light energy iii) Sound energy iv) Sound and mechanical energy v) Heat, sound and mechanical energy 2) Ask learners to calculate the cost of

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
iii) damp conditions. (k, u) 8) explain the use of fuses and circuit breakers in electrical circuits and of fuse ratings. (k, u) 9) explain the need for earthing metal cases and for double insulation. (k, u) 10) state the meaning of the terms live, neutral and Earth and their colour codes. (k) 11) describe the wiring in a mains plug. (k, u) 12) explain why switches, fuses, and circuit breakers are wired into the live conductor. (k, u)	can identify bare live wires in domestic wiring and which action they should take. e) Learners open and draw the inside of a three-pin plug and label the live, neutral and Earth pins, and identify the colour codes of the wires related to them. f) Discuss the safety measures in wiring a house.	running a 100 W filament bulb for one day if each unit of electricity costs Shs 524 and the amount of money that would be saved if a 15 W energy saver bulb of the same brightness was used.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing domestic wiring, earthing and electric power consumption.

Hints to the Teacher

1) Students should be exposed to the real electrical appliances as much as possible.
2) Care should be taken to avoid electric shock.

SUB-TOPIC 4: Magnets and their Properties

Duration: 4 Hours

Competency: The learner investigates the properties and applications of magnets.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) state the properties of magnets including the law of magnetism. (k) 2) describe methods of magnetisation and demagnetisation, using the domains. (k, u) 3) demonstrate and describe the plotting of magnetic field lines with a compass/iron filings. (k, u) 4) demonstrate and draw the magnetic field patterns around magnet(s) in different situations. (k, u) 5) describe practices of storage of magnets. (k, u)	1) In groups, learners move magnets towards and away from other magnets and use the observations made to state the law of magnetism. 2) In groups, learners carry out an activity to magnetise a steel nail/bar using single touch and test for its polarity. 3) In groups, learners hold a magnet that has attracted a chain of small nails or pins and use the observation to discuss the concept of	1) Task learners to test for the presence of magnets. Assess how learners arrange their apparatus and how they state/write the procedure and observations. 2) Ask learners to draw diagrams to show the magnetic domains of a magnetised and un-magnetised metal bar and use this to explain the process of magnetisation and magnetic saturation. 3) Task learners to sketch magnetic field patterns for two bar magnets

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
6) investigate the properties of soft and hard magnetic materials. (k, u) 7) state the general applications of magnets. (k)	magnetic induction. 4) In groups, learners move a magnet repeatedly under a paper on which iron filings are sprinkled and use the observations to discuss magnetic fields.	arranged in various ways.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing magnets and their properties.

Hint to the Teacher

1) Only field lines around magnets should be drawn.
2) Magnetic field lines around current-carrying conductors shall be introduced in the next sub-topic.
3) Concept of magnetic and geographic meridians should be left out.

SUB-TOPIC 5: Electromagnets and their Applications

Duration: 6 Hours

Competency: The learner explores the interaction between magnetic fields and electric fields and how this interaction is applied.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the meaning of electromagnet. (k, u) a) demonstrate the existence of a force on a current-carrying conductor in a magnetic field. (k, u) b) investigate the factors which affect the size of the force on a current-carrying conductor placed in a magnetic field. (k, u) c) investigate the direction of force on a current-carrying conductor in relation to the direction of current and magnetic field. (k, u) d) sketch magnetic field patterns around current-	1) In groups, learners carry out an activity to demonstrate the existence of a force around a current-carrying conductor in a magnetic field and how this force can be varied. a) Learners, with guidance from the teacher, carry out an activity to investigate the direction of force on a current-carrying conductor in relation to the direction of the current and magnetic field. b) Guided by the teacher, learners construct an	1) Observe how individual learners draw a diagram to show the magnetic field: • around a wire carrying an electric current in a magnetic field. • around a solenoid carrying an electric current. 2) Task learners in a group project to design an electric bell using readily

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
carrying conductors in various situations. (k) e) describe the construction and operation of an electric bell, d.c. motor, and loudspeakers. (k, u)	electric bell and a d.c. motor and describe how they operate.	available materials and describe how it works.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing electromagnets and their applications.

Hint to the Teacher

1) Provide as much support as possible to the learners.
2) The effect of magnetic field on a current-carrying conductor should be investigated practically.

Sub-topic 6: Electromagnetic Induction

Duration: 4 Hours

Competency: The learner investigates how electricity is obtained from magnets and the applications of this phenomenon.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner be able to: 1) demonstrate electromagnetic induction. (k, u, s) 2) investigate the factors that determine the size of the e.m.f./current induced in a conductor in a magnetic field. (k, u) 3) describe the construction and operation of simple forms of a.c. and d.c. generators. (k, u) 4) sketch a graph of voltage output against time for a simple a.c. and d.c. generators. (k, u) 5) describe the structure and principle of operation of a simple transformer. (k, u)	1) In groups and with guidance from the teacher, learners carry out an activity to demonstrate that current/e.m.f. is induced in a conductor in a changing magnetic field and show how to vary the current/e.m.f. 2) In groups or as individuals, learners construct a simple transformer and describe how it works. 3) In groups, learners discuss the importance of each of the components of the	1) Ask learners in groups to discuss the difference between a step-up and a step-down transformer. Assess how learners identify instances where both are applied. 2) Ask learners to calculate the output voltage of a transformer that has 50 turns on the primary coil and 500 turns on the secondary coil if the primary coil is connected to a 240 V supply. Observe how learners make the right substitution in the right formula and

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
6) explain why practical transformers are not 100% efficient. (k, u) 7) solve numerical problems related to transformers. (k, u) 8) describe the transmission of electricity from the station to the consumer and deduce the advantages of high voltage transmission. (k, u)	electricity transmission line. 4) In groups, learners search for cases of accidents resulting from high voltages in the recent past.	how they simplify the expressions. 3) Ask learners to analyse the uses of the components of a power transmission line.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia demonstrating electromagnetic induction and its applications.

Hints to the Teacher

1) Engage learners in simple projects involving the construction of a simple d.c. generator and a transformer.
2) The stepping up and down of a transformer should be demonstrated

Topic 8: Atomic and Nuclear Physics

SUB-TOPIC 1: Atomic Structure

Duration: 4 Hours

Competency: The learner describes the fundamental particles in an atom and their arrangement.

Learning Outcomes	Suggested Teaching & Learning Activity	Sample Assessment Strategy
The learner should be able to: 1) name the fundamental atomic particles and state their properties. (k) 2) explain the models of the atom according to Dalton and Rutherford (include electronic configurations). (k, u) 3) explain the meaning of atomic number, mass number and isotopes and represent different nuclides. (k, u)	In groups, learners use ICT or other sources to search for the Rutherford model and write a report about his work in relation to the structure of the atom.	Task learners to use local materials to make a design of a Rutherford model of an atom whose atomic number is 8, 10 and 20. Assess how the learners plan the activity and how they communicate.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing the Dalton model and Rutherford model of the atom, isotopes etc.

Hint to the Teacher

Engage learners in a variety of activities involving mass number, atomic number and isotopes.

SUB-TOPIC 2: Cathode rays and X-rays

Duration: 6 Hours

Competency: The learner describes how electrons are emitted from matter and the applications of the emitted electrons

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategy
The learner should be able to: 1) explain the meaning of thermionic emission. (k, u) 2) state properties of cathode rays. (k) 3) describe the structure of a cathode-ray oscilloscope (CRO) and explain how it works. (k, u) 4) describe the uses of CRO. (k, u) 5) describe how X-rays are produced in an X-ray tube. (k, u) 6) describe properties and applications of X-rays. (k, u) 7) explain the dangers of exposure to X-rays and the safety precautions. (k, u)	1) Learners watch simulations about the thermionic emission. 2) Learners draw diagrams of X-ray tubes and CRO and display them in class. 3) In groups, learners discuss best safety practices against the effects of X-rays.	1) Ask individual learners to write a poster for a health centre explaining the dangers associated with the use of X-rays. Assess how the learners communicate confidently and the values they develop in advising the public.

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing thermionic emission, photoelectric effect, CRO, CRT, X-ray tube and their applications.

Hints to the Teacher

1) Experiments showing that thermionic emission occurs are required. You may include a comparison with photoelectric effect to show that there are other methods of electron ejection from surfaces.
2) Laws of photoelectric effect are NOT required.
3) Numerical problems related to acceleration of electrons are beyond this level.
4) Illustrations/diagrams/computer simulations should be used as much as possible.

Sub-topic 3: Radioactivity

Duration: 8 Hours

Competency: The learner explores how nuclear processes occur, their applications and dangers.

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) explain the meaning of radioactivity. (k, u) 2) identify the three types of the radiations emitted from radioactive substances and their properties. (k) 3) write balanced equations for nuclear reactions. (k, u) 4) describe how nuclear radiations can be detected using a cloud chamber and electric fields. (k, u) 5) explain the meaning of half-life and solve numerical problems related to half-life	1) In a group discussion, learners compare the three radiations emitted by radioactive materials in terms of ionisation, penetration and deflection in electric fields. 2) In groups, learners discuss the social, health, political and environmental dimensions associated with the use of	1) Ask learners to sketch a graph to show how the activity of a radioactive source changes over time until it almost ceases to be radioactive. Also show how the graph can be used to determine half-life. 2) Ask learners to explain why radioactive waste presents a serious environmental problem. In a conversation, assess how learners approach this global issue. 3) Ask learners to copy and complete the diagram in figure 1 below this table to show

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
(including graphical methods). (k, u) 6) explain nuclear fission and fusion and their applications. (k, u) 7) identify the applications of radioisotopes. (k, u) 8) state the dangers of radioisotopes and the associated safety measures. (u, v/a)	radioactive materials.	the different penetrating powers of three types of radiation. Ask learners to explain the basis of their answers.

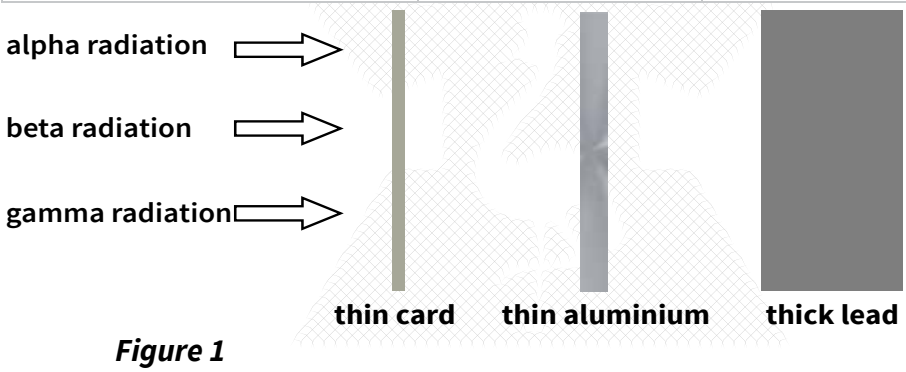


Figure 1

ICT Support

Learners use the Internet to search for pictures, videos and other multimedia showing cloud chamber tracks, nuclear reactions and their applications.

Hints to the Teacher

1) Calculation of half-life should only be based on simple decay series or graph but NOT the decay law formula.
2) Use a variety of sources to discuss the accidents and dangers posed by radioactive materials.

Topic 9: Satellites and Communication

Duration: 6 Hours

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	Suggested Teaching & Learning Activities	Sample Assessment Strategy
The learner should be able to: 1) understand what satellites and artificial satellites are and how we make use of the min research and in everyday life. (u,s) 2) appreciate the importance of space exploration. (u,v/a)	In pairs, learners research and report on satellites, 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.	1) Observe and listen to learners as they research and discuss satellites, offering guidance to deepen learning. 2) Assess learning through the quality of reports and intervene appropriately to ensure that all are making progress towards the achievement of learning outcomes.

ICT Support

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

Topic 10: Digital Electronics

Duration: 10 Hours

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

Learning Outcomes	Suggested Teaching & Learning Activities	Sample Assessment Strategies
The learner should be able to: 1) understand how resistors are used to make potential dividers in control and logic circuits. (u,s) 2) understand elementary logic and memory circuits that exploit devices such as automatic switches, logic gates and resistors as potential dividers. (u,s) 3) 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)	1) 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. 2) 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. • logic circuits store and process binary information, and how digital instruments use binary information.	1) Observe and listen to learners as they research and discuss digital electronics, asking questions to promote critical thinking. 2) Evaluate learning by assessment of reports and presentations, and gauge progress towards the achievement of learning outcomes.

ICT Support

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

Hint to the Teacher

Practical building of logic circuits is optional.

Assessment in AEP

The new AEP 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, generic skills, Values and Attitudes. This is what is referred to by the letters k, u, s, v/a and gs. 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 section 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.
Generic skills	A set of skills that enable the learner to access and deepen learning across the whole curriculum

To assess knowledge, skills and understanding we need to look for different things. Knowledge can be assessed based on written tests such as multiple-choice questions, fill-in-the-blanks, or other forms of recall-based assessments; understanding may be assessed based on short-answer questions, essays, or other forms of application-based assessments; but the assessment of skills may use the following strategies: performance-based assessments in which learners demonstrate their skills by performing a task or activity, observation of learners as they perform a task or activity to assess skills, such as communication skills, respect of each other's opinions, time management and teamwork, and peer assessments where learners evaluate each other's skills and providing feedback especially for promoting collaboration and communication skills.

The assessment of k, u, s, v/a is elaborated in the following graphic.

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.

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 section focuses on the evaluation of progressive day-to-day classroom learning (formative assessment) and how summative assessment will be done both at school and at the national level.

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.

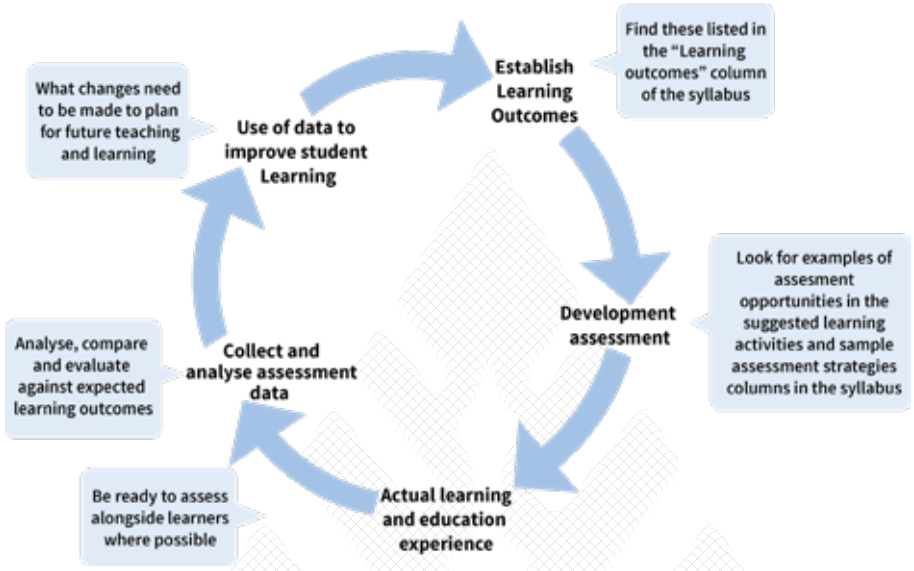
The general purpose of formative assessment is to improve learning and achievement, and give educators in-process feedback about what learners are learning or not learning so that instructional approaches, teaching materials, and academic support can be modified accordingly. Formative assessments are 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 learners.

The general goal of formative assessment is to collect detailed information that can be used to improve instruction and learning while it is 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.

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

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

The process of teaching, formative assessments and improving the teaching and learning is shown in the following cycle.



How do we find the opportunity to make formative assessment?

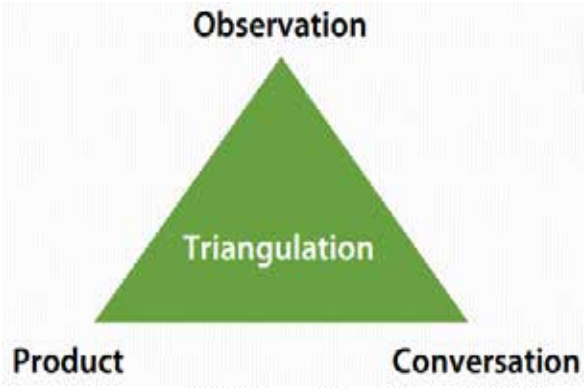
In the AEP curriculum, the teacher's assessment role is not to write tests for learners but to make professional judgments about learner's learning in the course of the normal teaching and learning process. The professional judgment is about how far the learner meets the learning outcomes that are set 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.

These assessments occur in three forms and are often referred to as:

- **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 detailed syllabus for each topic. 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 firms 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

Values and 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.

Summative Assessment

This will be done in two ways:

1) **School-based summative assessment**

   This will be done by teachers assessing learners through activities of integration at the end of every topic or sub-topic and project work. This will cumulatively be collected at school and will be submitted to the national assessment body (Uganda National Examinations Board [UNEB]) to contribute 20% of the final score.

2) **Examinations**

   There will be examinations at the end of Level One to test the suitability of the learners for promotion to Level Two. There will also be national examinations at the end of Level Two or at the end of S.4 if learners transit to the normal school.

Recordkeeping

Keeping detailed records of learners' individual progress is always difficult with very large numbers of learners. 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 a record of assessments of learners' learning made in terms of each topic or unit. This means recording the ongoing 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 or, for the topic as a whole to be achieved.

This will vary with the subject and topic.

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

Descriptor
Some LOs achieved, but not sufficient for overall achievement
Most LOs achieved, enough for overall achievement
All LOs achieved – achievement with ease

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 judgement 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 easily identify 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 three descriptors. If numbers (1–3) 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
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

This method will give much more information than using a tick. For example, at a glance it can be seen that learners A and B are achieving much higher than learners C and D. It can be seen that learner C has improved during the year.

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, together with project work.

Glossary of key terms

TERM	DEFINITION
Competency-based Curriculum	focuses on specific skills, knowledge and abilities that learners should acquire. It is learner-centred and adaptive to the changing needs of learners, teachers and society.
Differentiation	The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities.
Formative Assessment	refers to a wide variety of methods or strategies that teachers use to conduct in-process evaluations of learners' comprehension, learning needs, and academic progress during a lesson or topic to help teachers identify concepts that learners are struggling to understand, skills they are having difficulty acquiring, or learning standards they have not yet achieved so that adjustments can be made to the lessons and instructional techniques.
Generic skill	also known as transferable skills, are essential skills that can be applied across various subjects, occupations and contexts. They are not specific to a particular subject area but are essential in contributing to a learner's overall success in the learning of all subjects.
Inclusion	An approach to planning learning experiences which allows each learner to feel confident, respected and safe and equipped to learn at his or her full potential.
Learning Outcome	refers to a statement which specifies what the learner should know, understand, or be able to do within a particular aspect of a subject.
Process Skill	is a capability acquired by following the programme of study in a particular Learning Area; enables a learner to apply the knowledge and understanding of the Learning Area.

TERM	DEFINITION
Sample Assessment Activity	refers to an activity which gives a learner the opportunity to show the extent to which she/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	refers to an activity that is designed to support learners in achieving specific learning outcomes. It is typically provided by the teacher or educational resource as a way to guide learners in their learning and help them achieve their goals.

Appendix

A list of equipment /apparatus that will support the teaching and learning of the AEP Physics Syllabus is provided below. However, even improvised apparatus can be used to support the teaching of Physics in some instances.

- A globe
- A torch
- Ammeter (0 – 1.0A) and (0 – 5.0A)
- Boiling tubes
- Bulb holders
- Bunsen burners/stoves
- Burettes (50 ml)
- Calorimeter jackets
- Capillary tubes (diameter 0.5 – 4.0 mm)
- Cell holders (single and double)
- Chemical balance
- Connecting wires
- Constantan wires (SWG, 20, 22, 24, 26, 28, 30 and 32)
- Contact switches
- Converging/concave mirrors (focal length 10, 15 and 20 cm)
- Convex/converging lens (focal length 10, 15 and 20 cm)
- Convex/diverging mirror (focal length 10, 15 and 20 cm)

- Copper calorimeters (150 ml, 200 ml and 300 ml)
- Copper wire (SWG 20 – 30)
- Crocodile clips
- Diverging/concave lenses (focal length 10, 15 and 20 cm)
- Dry cells
- Galvanometers (centre zero)
- G-clamps
- Glass beakers (100 ml, 150 ml, 500 ml and 600 ml)
- Glass blocks (rectangular 11 x 6 x 2 cm)
- Glass marbles
- Glass prisms (60° x 60° equilateral and right-angled)
- Keys (contact and tapping)
- Lead shots/ball bearings
- Lens/mirror holders
- Magnets and plotting compass
- Measuring cylinders (10 ml, 25 ml, 100 ml, 250 ml and 1,000 ml)
- Metre rules/half-metre rules
- Nichrome wires (SWG 22, 24 and 26)
- Optical pins
- Pendulum bobs
- Plane mirrors
- Plastic beaker/mugs (250 ml)
- Plasticine
- Pulleys (single and double)
- Retort stands and clamps
- Rheostats (0 – 50Ω)
- Rubber bungs (various sizes)
- Screens with a hole fitted with wire gauze
- Slotted masses on hangers (5 g, 10 g, 20 g, 50 g and 100 g)
- Softboard
- Spiral spring (Nuffield type)
- Spring balances
- Standard resistors (1, 2, 3, 5 and 10Ω)

- Stirrers (aluminium, copper and glass)
- Stop clocks/watches
- Test tubes, test tube racks and test tube holders
- Thermometers (-10° – 110°C)
- Threads
- Thumb pins
- Touch bulbs
- Tripod stands
- Voltmeters (0 – 3.0V) and (0 – 5.0V)
- Wedges/knife edge
- White screens
- Wire gauzes
- Wooden blocks (various sizes)
- Wooden corks (various sizes)

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