



Grade **Science**
7 **Teacher's Guide**
(To be implemented from 2016)



Department of Science
National Institute of Education
Maharagama
Sri Lanka.
www.nie.lk

Science

Grade Seven

Teachers' Guide

To be implemented from 2016

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Faculty of Science and Technology

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web: www.nie.lk

email: info@nie.lk

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National Institute of Education

Message from the Director General

The first phase of the new competency based curriculum, with an 8 year curriculum cycle was introduced to secondary education in Sri Lanka in 2007 replacing the existing content based education system with the primary objective of developing the national level competencies recommended by the National Education Commission.

The second phase of the curriculum cycle to be introduced to grades 7 and 11 starts from 2016. For this purpose, the National Institute of Education has introduced a rationalization process and developed the syllabi for these grades making use of the research based outcomes and the suggestions made by concerned stakeholders.

In the rationalization process, vertical integration has been used to systematically develop the competency levels in all subjects from fundamentals to advanced levels using the bottom up approach. Horizontal integration is used to minimize the overlapping in subject content and to reduce content over loading in the subjects to produce a more student friendly and implementable curriculum.

This new Teachers' Guide has been introduced to the teachers with the aim of providing them with the required guidance in the areas of lesson planning, teaching, carrying out activities, measurement and evaluation. These guidelines will help the teachers to be more productive and effective in the classroom. The new Teachers' Guides provide the teachers with the freedom to select quality inputs and additional activities to develop the competencies of the students. These Teachers' Guides are not loaded with the subject content that is covered in the recommended textbooks. Therefore, it is essential for the teacher to use the new Teachers' Guides simultaneously with the relevant textbooks prepared by Education Publications Department to make the Teachers' Guides more effective.

The basic objectives of the rationalized syllabi, the new Teachers' Guides and the newly developed textbooks are to bring about a shift from the teacher centered education system to a student centered system -a more activity based education system in order to develop the competencies and skills of the student body so as to enable the system to produce the required human resources for the world of work.

I would like to take this opportunity to thank the members of Academic Affairs Board, the Council of the National Institute of Education and all resource persons who have contributed immensely to develop these new Teachers' Guides.

Director General

National Institute of Education

Message from the Deputy Director General

Education from the past has been constantly changing and forging forward. In recent years, these changes have become quite rapid. Past two decades have witnessed a high surge in teaching methodologies as well as in the use of technological tools and in the field of knowledge creation.

Accordingly, the National Institute of Education is in the process of taking appropriate and timely steps with regard to the education reforms of 2015.

It is with immense pleasure that this Teachers' Guide where the new curriculum has been planned based on a thorough study of the changes that have taken place in the global context adopted in terms of local needs based on a student-centered learning-teaching approach, is presented to you teachers who serve as the pilots of the schools system.

An instructional manual of this nature is provided to you with the confidence that, you will be able to make a greater contribution using this.

There is no doubt whatsoever that this Teachers' Guide will provide substantial support in the classroom teaching-learning process. The teacher will have a better control of the classroom with a constructive approach in selecting modern resource materials and following guidelines given in this book.

I trust that through the careful study of this Teachers' Guide provided to you, you will act with commitment to produce of a creative set of students capable of helping Sri Lanka move socially as well as economically forward.

This Teachers' Guide is the outcome of the expertise and unflagging commitment of a team of subject teachers and academics in the field Education.

While expressing my sincere appreciation of this task performed for the development of the education system, my heartfelt thanks go to all who contributed their knowledge and skills in making this document such a landmark in the field.

M.F.S.P. Jayawardhana
Deputy Director General
Faculty of Science and Technology

Guidance: Academic Affairs Board
National Institute of Education

Directions: M.F.S.P. Jayawardhana
Deputy Director General
Faculty of Science and Technology,
National Institute of Education

Subject leader:

Mr. R.S.J.P Uduporuwa, Director (Science), National Institute of Education

Subject Committee:

Mr. R.S.J.P. Uduporuwa, Director (Science), National Institute of Education

Mr. A.D.A. De Silva, Senior Lecturer, National Institute of Education

Mr. P. Malavipathirana, Senior Lecturer, National Institute of Education

Mr. L.K. Waduge, Senior Lecturer, National Institute of Education

Ms. M. Ragavachari, Lecturer, National Institute of Education

Ms. H.M. Mapagunaratne, Lecturer, National Institute of Education

Ms. M. Thirunadarajah, Lecturer, National Institute of Education

Mr. M.L.S. Piyathissa, Assistant Lecturer, National Institute of Education

Mr. P. Atchuthan, Assistant Lecturer, National Institute of Education

Ms. D.A.H.U. Warushahannadige, Assistant Lecturer, National Institute of Education

Ms. W.H.S.P. Soysa, Assistant Lecturer, National Institute of Education

Ms. P.T.M.K.C. Tennakoon, Assistant Lecturer, National Institute of Education

External Resource Contribution:

Mr. M.P. Vipulasena, Director of Education (Science) ,Ministry of Education

Mr. W.A.D. Ratnasooriya, Chief Project Office (Retired), NIE

Mr. W.D. Wijesinghe, , Chief Project Office (Retired), NIE

Mr. H.S.K. Wijethilake, SLEAS 1(retired)

Mr. W.D. Vijithapala, In-Service Advisor (Science), Regional Education Office,
Rideegama

Mr. A.M.T. Pigera, SLEAS 111(retired)

Mr. K.D. Bandulakumara Assistant, Commissioner Department of Education Publication

Mr. E. Joseph In-Service Advisor, Divisional educational Office, Colombo

Instructions for the use of the teachers' guide

The new rationalized syllabus for the subject of Science and Technology is going to be implemented from the year 2015. From there onwards, the teachers will have to use this teachers' guide in place of the teachers' instructional manual. The syllabus is included here to make the process easy for the students.

This teachers' guide consists of a compilation of instructions that give direction to the teachers to achieve specific competency levels in the classroom. Further, the specific competencies highlighted are included in the teachers' guide with the time suggested for each competency level.

Learning outcomes to be achieved at the end of each lesson are stated clearly in the guide and it is expected that the teachers will be guided to arrive at a comprehensive conclusion on the behavioral changes expected of the children based on the three domains, knowledge, attitudes and skills. The learning outcomes will help the teachers to determine the depth and width and the limits of the subject content to be considered.

The section on "Instructions for lesson planning" consists of a set of suggestions for the teachers to organize and manage the learning teaching process within the allocated number of periods. The teacher is at liberty to make necessary changes to suit the learning teaching environment they encounter and it is the teacher's sole responsibility to make such changes to ensure that students reach the learning outcomes.

The teachers' guide also includes the basic concepts the students are expected to acquire gradually when the competency levels are developed along with essential technical terms. Whether the students have achieved expected mastery levels has to be determined by way of assessment and evaluation.

Compared to the other subjects, teaching of science involves the use of a wide range of equipment and tools since it should happen in a very much practical context with an analytical approach. Minimum requirement of resources necessary for the lesson planning strategies is given here as the quality input. If a teacher intends to introduce lesson planning strategies different from those suggested here, they are expected to make the necessary changes in quality inputs accordingly.

Measuring of whether the learning and teaching process was successful within a particular learning environment paves way to give feedback and to use remedial methods accordingly. At the end of each unit there are evaluation and assessment procedures suggested for the said purpose. Here it is expected to examine whether the students have achieved the expected mastery in a particular competency level. Assessment process may happen during the lesson or at the end of the lesson and the teacher is free to obtain the assistance of their students too in this regard. Here, it is essential to pay special attention to the National Goals, Basic Competencies and the objectives of the science curriculum given at the beginning of the teachers' guide.

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Syllabus

INTRODUCTION

The major aim of the subject Science subject is the personal development of the student through a scientific lifestyle, thereby paving way for national development, thus building a unique and prosperous Sri Lanka that is a wonder.

A series of objectives specific to the subject Science has been established as a foundation for the progressive achievement of this admirable goal. To reach this target, the student who enters the 6th grade after primary education must learn Science with zeal and enthusiasm. We proudly present you the duly equipped Science syllabus.

Sri Lanka claims a significant level of literacy and upholds a level of education on par with the countries reputed for the highest standard of education in the world. This standard is sustained through regular syllabus revision, and improving, developing and updating it every eight years.

Therefore, the syllabus presented in 2015 is merely a further improvement of the existing competency based curriculum. These changes have been made, based on the data and suggestions provided by the erudite community of the educational sphere and the research done by both the National Institute of Education and other educational institutions on the syllabus introduced to the education system in 2007.

Now, more time is provided for the teacher to orchestrate the learning-teaching process in the classroom more effectively. In the construction of the new syllabus, the excessive weight of the previous syllabus has been lessened by reducing the subject content and essential information has been added. Thus the teacher has more freedom to engage in the learning-teaching process in the classroom utilizing his/her own creativity to the maximum effect.

0.1 National goals

1. Based on the concept of respecting human values and understanding the differences between the Sri Lankan multi-cultural society, building up the nation and confirming the identity of Sri Lanka by promoting national integrity, national unity, national coherence and peace
2. While responding to the challenges of the dynamic world, identifying and conserving the National heritage.
3. Creating an environment which comprises the conventions of social justice and the democratic life to promote the characteristics of respecting the human rights, being aware of the responsibilities, concerning each other with affectionate relationships.
4. Promoting a sustainable life style based on the people's mental and physical wellbeing and the concept of human values
5. Promoting the positive feelings needed for balanced personality with the qualities of creative skills, initiative, critical thinking and being responsible
6. Through education, developing the human resources, needed for the progress of the wellbeing of an individual, the nation as well as the economic growth of Sri Lanka.
7. Preparing the people for the changes that occur in a rapidly changing world by adapting to it and controlling them; developing abilities and potentialities of people to face the complex and unexpected occasions.
8. Sustaining the skills and attitudes based on justice, equality, mutual respect which are essential to achieve a respectable place in the international community.

National Education Commission Report (2003).

0.2 Basic Competencies

The competencies promoted through the education mentioned below might help to achieve the above mentioned National Goals.

(i) Competencies in Communication

This first set of competencies is made up of four subsets - Literacy, Numeracy, Graphics and information communication skills:

Literacy : Carefully listening, speaking clearly, reading for comprehension, writing clearly and accurately.

Numeracy: Using numbers to count, calculate, code and to measure, matter, space and time.

Graphics : Making sense of line and form, expressing and recording essential data, instructions and ideas with line, form, colour, two and three-dimensional configurations, graphic symbols and icons

ICT Competencies: Knowledge on computers, and the ability to use the information communication skills at learning or work as well as in the private life

(ii) Competencies relating to the Personality Development

- Generic skills such as creativity, divergent thinking, initiative, decision making, problem-solving, critical and analytical thinking, team work, inter-personal relationships, discovering and exploring
- Values such as integrity, tolerance and respect for human dignity.
- Cognition

(iii.) Competencies relating to the Environment

This is the second set of competencies related to the Social, Biological and Physical environments.

Social Environment: Awareness, sensitivity and skills linked to being a member of society, social relationship, personal conduct, general and legal conventions, rights, responsibilities, duties and obligations.

Biological Environment: Awareness, sensitivity and skills linked to the living world, man and the ecosystem, the trees, forests, seas, water, air and life - plant, animal and human life.

Physical Environment: Awareness, sensitivity and skills relating to space, energy, fuels, matter, materials and their links with human living, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, wastes and excretion, media of communication and transport.
Included here are the skills in using tools to shape and for materials for living and learning.

(iv.) Competencies relating to preparation for the world of work

Employment related skills to maximize their potential and to enhance their capacity to contribute to economic development; to discover their vocational interests and aptitudes; to choose a job that suits their abilities and; to engage in a rewarding and sustainable livelihood

(v.) Competencies relating to religion and ethics

This fourth set of competencies laden with values and attitudes. It is essential for individuals to assimilate values, so that they may function in a manner consistent with the ethical, moral and religious modes of conduct, rituals, practices in everyday living, selecting the most appropriate.

(vi.) Competencies in play and use of leisure

Competencies that link up with pleasure, joy, emotions and such human motivations. These find expression in play, sports, athletics and leisure pursuit of many types. These also link up with such values as cooperation, team work, healthy competition in life and work. Here are included such activities as are involved in aesthetics, arts, drama, literature, exploratory research and other creative modes in human living

(vii.) Competencies relating to 'learning to learn'.

These competencies flow directly from the nature of a rapidly changing, complex and interdependent and crowded world. Whatever one learns, that learning will need updating and review. This requires that one should be aware of, sensitive and skilful in sustained attention, and be willing to persevere and attend to details that matter in a given situation.

Course objectives - Grades 6 - 11 science

- Develop scientific concepts and principles systematically through a joyful learning environment.
- Develop competencies related to problem solving by using processes in science and scientific method appropriately.
- Develop competencies pertaining to managing environmental resources intelligently by understanding the potential of such resources.
- Develop competencies related to the usage of scientific knowledge to lead a physically and mentally healthy life.
- Develop competencies pertaining to becoming a successful individual who will contribute to the development of the nation in collaboration, engage in further studies and undertaking challenging job prospects in the future.
- Develop competencies related to understanding the scientific basis of the natural phenomena and the universe
- Use appropriate technology to maintain efficiency and effectiveness at an optimum level in utilizing energy and force.
- Develop competencies related to evaluation of day to day life experiences and information acquired through media by employing scientific criteria with the background of limitations and dynamic nature of science.

Teaching Sequence

School term	Competency level	Time (periods)
1 st term	1.1 Investigates morphological features of flowering plants	10
	1.2 Investigates diversity of major parts of the flowering plants	
	3.1 Develops concepts related to static electricity	08
	3.2 Demonstrate applications of basic principles related to static electricity	
	3.3 Demonstrate electromagnetic induction	12
	3.4 Conducts simple activities related to generation of electricity	
	2.1 Demonstrate the function of water	06
	2.2 Classify things found in the vicinity of home as acids and bases	07
	1.3 Give criteria to distinguish vertebrates from invertebrates	08
1.4 Investigate adaptations of organisms to their environments		
2 nd term	1.5 Use dichotomous keys to classify organisms	03
	3.5 Conducts simple activities to demonstrate the usage of energy forms	08
	4.1 Constructs and uses models to demonstrate the structure of the earth	08
	3.6 Demonstrates phenomena related to formation of shadows	10
	3.7 Conducts simple activities to demonstrate the nature of images formed by mirrors	
	1.6 Uses microscope correctly	08
	3.8 Conducts simple experiments related to generation and propagation of sound	07
	1.7 Explores levels of organization of life	08
	1.8 Explores structural and functional relationships related to human digestive system and respiratory system	
4.2 Shows knowledge on the atmosphere	08	
3 rd term	3.9 Uses thermometer correctly	10
	3.10 Demonstrates transference of heat and its effects	10
	4.3 Conducts simple activities to investigate structure and components of soil	
	3.11 Conducts simple experiments to demonstrate distance, displacement and force by understanding relevant concepts.	08
	1.9 Conducts simple experiments to identify nutritious constituents of food	08
	4.4 Exhibits knowledge on the importance of minerals and rocks as natural resources	05
4.5 Takes necessary actions to use energy sources sustainably	05	

Competency: 1.0. Explores life and life processes in order to improve the productivity of biological systems.

Competency level	Content	Outcomes	Time(peri-ods)
<p>1.1 Investigates morphological features of flowering plants</p> <p>1.2 Investigates the diversity of major parts of flowering plants</p>	<ul style="list-style-type: none"> • Morphological features of flowering plants <ul style="list-style-type: none"> • Parts of plants • Different types of seeds, fruits, roots, stems, leaves, • Parts of a flower (dicot) 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State examples of flowering and non-flowering plants • Name the major parts of a flowering plants • Express the diversity of seeds, fruits, roots, stems and leaves • Identify the parts of the flower • State the role of major parts of flower • Examine external features of monocot and dicot plants and identify their major parts • Differentiate between monocot and dicot plants using specimens • Collect different seeds and prepare a seed box • Draw different types of seeds, fruits, stems and leaves • Draw and label the parts of a dicot flower • Appreciate the diversity of organisms 	10
<p>1.3 Gives criteria to distinguish vertebrates from invertebrates</p> <p>1.4 Investigates adaptations of organisms to their environments</p>	<ul style="list-style-type: none"> • Animals <ul style="list-style-type: none"> • External features of animals (Using a typical vertebrate and an invertebrate) • Adaptations to different environments- Shape, Color 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Compare vertebrates and invertebrates with respect to their unique characteristics • Explain adaptations of organisms to their environment with relevant examples • Examine organisms in the environment and group them as vertebrates and invertebrates using unique characteristics of each group • Demonstrate experimentally, how shape and color are important for animals to survive in their environment • Appreciate the diversity of animals 	08
<p>1.5 Uses dichotomous key to group organisms</p>	<ul style="list-style-type: none"> • Classification – based on dichotomous keys 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State that dichotomous keys can be used to group organisms • Use dichotomous keys to group plants and animals 	03

<p>1.6 Uses the microscope correctly</p>	<ul style="list-style-type: none"> • Some important tools of a biologist <ul style="list-style-type: none"> • Simple microscope • Compound microscope • Electron microscope (introduction only) • Magnification and resolution power of a microscope (introduction only) 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Identify major parts of simple and compound microscopes • Describe functions of different parts of a compound microscope • Explain the importance of using electron microscope in the field of biology • Express the terms magnification and resolution power • Use the microscope correctly • Observe plant and animal cells properly under the microscope • Accept that microscope should be handled carefully 	<p>08</p>
<p>1.7.Explores levels of organization of life 1.8 Explores structural and functional relationships related to the human digestive system and the respiratory system</p>	<ul style="list-style-type: none"> • Levels of organization <ul style="list-style-type: none"> • Cell • Tissue • Organ • System • Organism • Digestive system • Respiratory system 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State that there is a hierarchy in the organization up to the organism level • Observe organisms using specimens to identify different levels of organization • Explain the structure of the human digestive system using diagrams • Explain the structure of the human respiratory system using diagrams • Construct models to demonstrate the human digestive and respiratory systems • Appreciate the complexity of organization of the living world 	<p>08</p>
<p>1.9 Conducts simple experiments to identify nutritious constituents of food</p>	<ul style="list-style-type: none"> • Food nutrients • Food tests 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State that food contains nutrients such as carbohydrates, proteins, lipids, vitamins and minerals • Give examples of items of food rich in carbohydrates, proteins, lipids, vitamins and minerals • Conduct simple tests to identify starch, protein and lipids • Accept that a balanced diet contains all nutrients needed in sufficient quantities 	<p>08</p>

Competency: 2.0. Investigates matter, properties of matter and their interaction to enhance the quality of life

Competency level	Content	Outcomes	Time (periods)
2.1 Demonstrates the functions of water	<ul style="list-style-type: none"> • Functions of water as <ul style="list-style-type: none"> • a solvent • a coolant • a medium 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Give examples of the usage of water as a solvent, a coolant and a medium • Point out the importance of water as a medium for life • Demonstrate functions of water as a solvent, and a coolant • Appreciate the importance of water as a solvent, a coolant and a medium 	06
2.2 Identify acidic and basic substances that are used in day to day life	<ul style="list-style-type: none"> • Acids and bases <ul style="list-style-type: none"> • Identification of acids and bases using indicators • Acids and bases available at home and in the school laboratory 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • List acidic and basic substances that are available at home and in the school laboratory • Name substances that are not either acidic or basic as neutral substances • State that there are substances which can be used to differentiate between acids and bases • Observe color changes occurring in different solutions in the presence of given plant extracts • Differentiate between given substances as acids and bases using litmus and pH paper • Accept that substances can be categorized based on their acidic, basic or neutral nature. 	07

Competency: 3.0. Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency level	Content	Outcomes	Time (periods)
3.1 Develops concepts related to static electricity 3.2 Demonstrates applications of basic principles related to static electricity	<ul style="list-style-type: none"> • Static electricity <ul style="list-style-type: none"> • Charging an object • Attraction and repulsion • Electric charges <ul style="list-style-type: none"> • Positive charges • Negative charges • Capacitors <ul style="list-style-type: none"> • Charging and discharging 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State briefly the historical perspective of identifying electrostatic charges • Express the ways of generating positive and negative charges in objects using the convention • State that there are two types of electrical charges namely positive and negative • State that the capacitor is a device used to store electrostatic charges temporarily • Construct activities to charge an object using rubbing method • Design and conduct activities to show that there are two different types of electrical charges by showing attraction and repulsion • Conduct an activity to show charging and discharging properties of a capacitor 	08
3.3 Demonstrates electromagnetic induction 3.4 Conducts simple activities related to generation of electricity	<ul style="list-style-type: none"> • Electric sources <ul style="list-style-type: none"> • Chemical cell • Dynamo • Solar cell • AC and DC 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • List various chemical cells • State that electromagnetic induction is the principle of the dynamo • Identify the solar cell as a source of electricity • Classify electric current as AC and DC • Construct a simple cell to generate electricity • Demonstrate the phenomenon of electromagnetic induction • Construct a simple dynamo • Conduct simple activities using solar panels • Demonstrate an AC and DC generation using AC-DC generator (or suitable device) • Accept that electric sources can be used in innovative ways 	10

<p>3.5 Conducts simple activities to demonstrate the usage of forms of energy</p>	<ul style="list-style-type: none"> • Forms of energy <ul style="list-style-type: none"> • Mechanical • Electrical • Sound • Light • Thermal • Chemical 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Give examples of various forms of energy • List different devices that use various forms of energy • Demonstrate various forms of energy in usage based on simple activities • Appreciate the uses of different forms of energy 	<p>08</p>
<p>3.6 Demonstrates phenomena related to formation of shadows 3.7 Conducts simple activities to demonstrate the nature of images formed by mirrors</p>	<ul style="list-style-type: none"> • Light <ul style="list-style-type: none"> • Formation of shadows • Image forming <ul style="list-style-type: none"> • Plane mirror • Curved mirror 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Differentiate between point sources and extended sources of light • Describe factors affecting formation of shadows • Describe the nature of images formed in plane mirrors and curved mirrors • State the uses of different types of mirrors • Demonstrate formation of the shadow by an opaque object • Design activities to demonstrate umbra and penumbra • Conduct simple activities to demonstrate nature of shadows using converging, diverging and parallel light beams • Conduct simple activities to observe the nature of images formed in plane mirrors and curved mirrors • Accept that the formation of shadows and images are different phenomena 	<p>10</p>
<p>3.8 Conducts simple experiments related to the generation and propagation of sound</p>	<ul style="list-style-type: none"> • Sound <ul style="list-style-type: none"> • Origin of sound (vibration) • Propagation of sound <ul style="list-style-type: none"> • Speed • Medium 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Express that sound is generated by vibration • State that a medium is necessary for the propagation of sound • Explain that the speed of sound is different in different media • Generate sound by vibrating suitable objects • Design and conduct activities to show the propagation of sound is different in different media • Accept that sound is generated by vibration • Accept that the medium affects the speed of sound 	<p>07</p>
<p>3.9 Uses thermometer correctly 3.10 Demonstrates transference of heat and its effects</p>	<ul style="list-style-type: none"> • Heat and temperature <ul style="list-style-type: none"> • Measuring temperature • Thermometer and units of temperature 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State that there are different types of thermometers based on the liquid (thermometric substance) used and the scale • Express the units of temperature as degree Celsius, degree Fahrenheit and Kelvin 	<p>10</p>

	<ul style="list-style-type: none"> • Transference of heat <ul style="list-style-type: none"> • Conduction • Convection • Radiation • Land breeze and sea breeze 	<ul style="list-style-type: none"> • Express the terms ‘boiling point’ and ‘melting point’ • State that human body temperature is constant (37 °C) and clinical thermometer could be used to diagnose feverish conditions • Explain the methods of transference of heat • Describe land breeze and sea breeze using convection • Use a Celsius thermometer correctly to measure temperature of air, water and soil • Use a clinical thermometer correctly to measure body temperature • Conduct simple activities to demonstrate conduction, convection and radiation of heat • Accept that proper handling of instruments and taking measurements accurately is important in day-to-day life 	
3.11 Conduct simple experiments to demonstrate distance, displacement and force by understanding relevant concepts.	<ul style="list-style-type: none"> • Force and motion <ul style="list-style-type: none"> • Distance and displacement • Force 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Give examples of distance and displacement • Differentiate between the concepts of distance and displacement • State units of distance and displacement • Describe force as a push or a pull giving examples • State that force could be expressed in terms of a magnitude and direction • State the SI unit of force as ‘newton’ • Conduct simple activities to differentiate between the concepts of distance and displacement • Design simple activities to demonstrate force as a push or a pull • Accept the importance of force in day-to-day life 	08

Competency: 4.0. Explores nature, properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization

Competency level	Content	Outcomes	Time (periods)
4.1 Constructs and uses models to demonstrate the structure of the earth	<ul style="list-style-type: none"> • The planet earth <ul style="list-style-type: none"> • Structure of the Earth • Plates and plates tectonic 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Describe core, mantle and crust of the earth • Explain modes of movement of plates • Demonstrate the structure of the earth’s interior using suitable activities • Make models to illustrate the structure of the earth • Conduct simple activities to demonstrate plate tectonics • Accept that the earth’s crust is dynamic 	08
4.2 Shows knowledge on the atmosphere	<ul style="list-style-type: none"> • Atmosphere <ul style="list-style-type: none"> • Layers of atmosphere • Air and its composition 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Describe the variation of pressure and temperature qualitatively across the layers of the atmosphere • State the composition of the air in the troposphere (lower atmosphere) • Illustrate layers of the atmosphere and their properties using diagrams • Realize the importance of atmosphere for the existence of life on earth 	08
4.3 Conducts simple activities to investigate structure and components of soil	<ul style="list-style-type: none"> • Soil <ul style="list-style-type: none"> • Types • Composition of soil <ul style="list-style-type: none"> • Soil air, soil water, soil organisms, decaying matters • Soil erosion 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Name soil types • Compare and contrast different soil types • State the composition of soil • Describe constituents of soil and their functions • Make a model of a soil profile • Conduct simple activities to show the presence of air, water, organisms and decaying matter in soil • Conduct simple activities to observe constituents of different 	10

		<p>types of soil</p> <ul style="list-style-type: none"> • Conduct simple activities to illustrate soil erosion • Collect articles and pictures regarding soil composition and erosion 	
4.4 Exhibits knowledge on the importance of minerals and rocks as natural resources	<ul style="list-style-type: none"> • Rocks and minerals <ul style="list-style-type: none"> • Characteristics • Types of rocks and minerals • Weathering of rocks • Rock cycle 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • State characteristics of rocks and minerals • Differentiate between rocks and minerals • Explain mechanisms of weathering of rocks • Explain rock cycle • Collect different types of minerals and prepare a mineral box • Illustrate rock cycle with diagrams/photographs • Realize the importance of rocks and minerals as natural resources • Accept that rocks and minerals are limited and should be used sustainably 	05
4.5 Takes necessary action to use sources of energy sustainably	<ul style="list-style-type: none"> • Energy sources <ul style="list-style-type: none"> • Renewable • Non-renewable 	<p>Students will be able to;</p> <ul style="list-style-type: none"> • Describe the terms ‘renewable sources of energy ‘and ‘non-renewable sources of energy’ • Give examples for renewable and non-renewable sources of energy • Conduct simple activities to strengthen the concepts of renewable and non-renewable sources of energy • Accepts the importance of sustainable use of sources of energy 	05

Guidance for Learning-Teaching Process

DRAFT

Competency: 1.0

Explores life and life processes in order to improve productivity of biological systems

Competency levels

1.1 Investigates morphological features of flowering plants

1.2 Investigates the diversity of major parts of flowering plants

Learning outcomes

Students will be able to:

- State examples of flowering and non-flowering plants
- Name the major parts of flowering plants
- Examine monocot and dicot plants and identify their major parts
- Identify the observable external parts of the flower
- Draw and label the parts of a dicot flower
- Express the diversity of seeds, fruits, roots, stems and leaves
- Differentiate between monocot and dicot plants using specimens
- Collect different seeds and prepare a seed box
- Draw different types of seeds, fruits, stems and leaves
- Appreciate the diversity of organisms

Time 10 periods

Instructions for lesson planning

- Display some specimens/pictures/videos/diagrams of flowering and non-flowering plants to the class and guide student to identify them as flowering and non-flowering.
- Let them identify the parts of a flowering plant.
- Distribute different flowers to groups of students, guide them to identify the parts of the flowers, draw and label them and make them present the role of each part.
- Conduct a field visit to observe the diversity (seeds, fruits, roots, stems and leaves) of flowering plants.
- Ask the students to bring and draw different types of flowers, seeds, fruits, roots, stems and leaves.
- Guide students to tabulate parts of plants (flowers, seeds, fruits, roots, stems and leaves) and their parts adapted related to functions.
- Provide students with some specimens/pictures/videos of monocot and dicot plants. Let them identify the Major parts and differentiate between them as monocot and dicot.
- Instruct the students to prepare a field book with different types of specimens/diagram of roots, stems, fruits, leaves, flowers etc.

- Ask the students to prepare a seed box with the collected seeds
- Arrange a visit to a botanical garden / forest reserve /plant nursery or a similar location

Key words and concepts

Monocot plants, dicot plants, flowering plants, non- flowering plants, petals, sepals, calyx, anther, stigma, style, ovary, fibrous root, tap root, venation

Quality inputs

Note book, knife, hand lenses, pencil, specimen jar, tray, spade

Assessment and evaluation

- Assess students' participation in the field visit using the following criteria
 - preparation
 - team work
 - concern for the environment
 - recording
 - reporting

Assess students' performance in identifying the parts and roles of flower

- Correct identification
- Proper labeling
- Proportion of the diagram
- Presentation

Competency: 1.0.

Explores life and life processes in order to improve productivity of biological systems.

Competency levels

- 1.3 Gives criteria to distinguish vertebrates from invertebrates
- 1.4 Investigates adaptations of organisms to their environments

Learning outcomes

Students will be able to;

- Examine organisms in the environment and group them as vertebrates and invertebrates using unique characteristics of each group
- Compare vertebrates and invertebrates with respect to their unique characteristics
- Demonstrate experimentally, how shape and color are important for animals to survive in their environment
- Explain adaptations of organisms to their environment with relevant examples
- Appreciate the diversity of animals

Time 08 periods

Instructions for lesson planning

- Ask each student in the class to write one name of an animal on the board. Make sure names of animals are not repeated.
- Instruct students to tabulate invertebrates and vertebrates from the above list.
- Ask students to collect photographs, diagrams and drawings of vertebrates and invertebrates and guide them to present information on the wall paper.
- Conduct simple activities to show the importance of body colour to an animal.
- Get student groups to demonstrate the advantages of the colour of the skin/ feathers to an animal using relevant examples .
- Conduct simple activities to show the importance of the shapes of the body of animals for an efficient life.
- Get student groups to demonstrate the advantages of the shape of their body for an animal using relevant examples.

Key words and concepts

Vertebrate, invertebrate, adaptation, camouflage, mimicry, streamlined body

Quality inputs

Clay, paper, card board, tooth picks, glue, pastel, Scissor, okra/ladies fingers (“bandakka”)

Assessment and evaluation

- Assess student group’s performance in demonstrating their knowledge on the adaptation of animals using the following criteria
 - Use of appropriate examples
 - Relevance of models/ photographs/ actual species
 - Method of presentation
- Assess the students work in preparing a wall paper based on the following criteria
 - Collect information relevant to the theme
 - Following instructions
 - Effective communication
 - Working cooperatively
 - Making appropriate decisions

Competency: 1.0.

Explores life and life processes in order to improve the productivity of biological systems.

Competency levels

1.5 Use dichotomous keys to group organisms

Learning outcomes

Students will be able to;

- State that dichotomous keys can be used to group organisms
- Use dichotomous keys to group plants and animals

Duration 03 periods

Instructions for lesson planning

- Guide students to explore the external features of given organisms using prepared dichotomous keys.
- Allow students to match the relevant organisms with respect to their external features which were aligned in the form of a dichotomous key.

Key words and concepts

External features

Quality inputs

Prepared dichotomous key, specimens/ photographs/ diagrams of organisms

Assessment and evaluation

Assess students' performance during the 'matching' exercise using correct identification of external features of the organisms.

Competency: 1.0. Explores life and life processes in order to improve the productivity of biological systems.

Competency levels

1.6 Uses microscope properly

Learning outcomes

Students will be able to;

- Identify major parts of simple and compound microscopes
- Describe functions of different parts of a compound microscope
- Use the microscope properly
- Observe plant and animal cells properly under the microscope
- Express the terms magnification and resolution power
- Explain the importance of using electron microscope in the field of biology
- Accept that the microscope should be handled carefully

Time 08 periods

Instructions for lesson planning

- Assist students to identify major parts of the microscope.
- Ask students to draw a microscope and label its important parts.
- Get students observe and draw outline diagrams of various animal and plant tissues under different magnifications. Guide the students to indicate respective magnifications on their drawings.
- Conduct simple activities to demonstrate resolution power.
- Ask students to write the differences between simple and compound microscopes.

- Guide student groups to observe electron micrographs of various cells.
- Let students find out the importance of microscopes.

Key words and concepts

Light microscope, lens, magnification, resolution power

Assessment and evaluation

Assess students for correct microscopic observation using the following criteria

- Correct observation
- Exhibiting essential features in their diagrams

Quality inputs

Electron micrographs, marker pens, ruler, prepared slides, light microscopes, hand lens

Competency: 1.0

Explores life and life processes in order to improve the productivity of biological systems

Competency levels:

1.7 Explores levels of organizations of life

1.8 Explores structural and functional relationships related to the human digestive system and the respiratory system

Learning outcomes:

Students will be able to;

- State that there is a hierarchy in the organization up to the organism level
- Observe organisms using specimens to identify different levels of organization
- Explain the structure of the human digestive system using diagrams
- Explain the structure of the human respiratory system using diagrams
- Construct models to demonstrate the human digestive and respiratory systems
- Appreciate the complexity of organization of the living world

Duration: 08 periods

Instructions for lesson planning:

- Introduce the cell as the basic unit for the structure as well as function of a living organism.
- Make students to understand the simplicity of the single cellular organism and the complexity of the multi-cellular organisms by referring to bricks and buildings or other similar examples.
- Use diagrams/ photographs/ video clips/ specimen slides to explain how a single cell forms a complete multi cellular organism through various organizational levels such as tissues, organs and organ systems.
- Guide student groups to construct suitable models to illustrate that, cells are held together to form tissues, tissues are held together to form organs, organs are held together to form organ systems and organ systems are held together to form individual organisms.
- Provide unlabelled diagrams of the digestive system and the respiratory system of a human to the student groups. Assist students to label these diagrams and state the importance of necessary organs.
- Guide students to tabulate the structural and functional relationships of major organs and parts of the digestive and respiratory systems of human.
- Assist student groups to construct appropriate models to demonstrate the mechanism of the respiratory system.

Key words and concepts:

Cell, tissue, organ, organ system, organism, digestive system, respiratory system, accessory organs, absorption, inhalation, exhalation, diaphragm, rib cage, trachea, alveoli

Assessment and evaluation:

- Assess student's performances in making models of digestive and respiratory systems using the following hints;
 - Planning and designing
 - Selection of materials
 - Working efficiently
 - Time management
 - Finishing of the product
- Assess student's performance in demonstrating their knowledge of the complexity of a multi cellular organism due to various biological organizational levels using the following criteria;
 - Use of appropriate examples
 - Relevance of models/photographs/specimens
 - Method of presentation

Quality inputs:

Specimen slides of various organizational levels of organisms, diagrams of digestive and respiratory systems, polystyrene, clay, cardboard, scissors, DVDs containing video clips, glue, drawing pins etc

Competency: 1.0

Explores life and life processes in order to improve productivity of biological systems

Competency levels:

1.9 Conduct simple experiments to identify nutritious constituents of food.

Learning outcomes:**Students will be able to;**

- State that food contains nutrients such as carbohydrates, proteins, lipids, vitamins and minerals
- Give examples of items of food rich in carbohydrates, proteins, lipids, vitamins and minerals
- Conduct simple tests to identify starch, proteins and lipids
- Accept that a balanced diet contains all nutrients needed in sufficient quantities.

Duration: 08 periods

Instructions for lesson planning:

- Guide students to explore the major constituents of the food they consume in their day-to-day meals (carbohydrates, proteins, lipids, vitamins, minerals, water and fibres).
- Organize group activities to carry out appropriate tests to identify the presence of starch, lipid and protein in the given food samples.
- Instruct and assist the students to make tables, charts, graphs, and diagrams to categorize items of food based on their major nutritional constituents (Use various sources such as labels of food items that exist in the market, internet, books etc.).
- Assign student groups to identify major constituents that exist in a given food sample.
- Conduct a discussion highlighting a balanced diet and its importance.
- Assign students groups to compile a small booklet with recipes which assure a balanced diet, for a week.

Key concepts expected to be highlighted:

Carbohydrates, lipids, proteins, fibres, minerals, vitamins, balanced diet

Quality inputs:

Biurette reagent (alkaline $\text{CuSO}_{4(\text{aq})}$), iodine in KOH, sudan III reagent, bristol board, colour pens, blank papers (white)

Assessment and evaluation:

- Assess student group's performances while performing experiments, using the following hints;
 - understanding of dependent and independent variables
 - Working efficiently
 - Safety precautions taken
 - Exhibiting essential practical skills
 - Methods applied to confirm the reliability and validity of the experiment
- Assess student's performance in demonstrating their knowledge of items of food rich in carbohydrates, proteins, lipids, vitamins, minerals and fibre using the following criteria;
 - Use of appropriate examples
 - Relevance of charts/graphs/diagrams/photographs
 - Method of presentation
 - Diversity of information presented in the recipe booklet

Competency: 2.0.

Investigates matter, properties of matter and their interaction to enhance the quality of life

Competency level:

2.1 Demonstrates the functions of water

Learning outcomes**Students will be able to;**

- Give examples of the usage of water as a solvent, a coolant and a medium
- Point out the importance of water as a medium for life
- Demonstrate functions of water as a solvent and a coolant
- Appreciate the importance of water as a solvent, a coolant and a medium

Time 06 periods

Instructions for lesson planning:

- Facilitate student groups to involve themselves in activities that are planned to become familiar with the usages of water as a solvent, a coolant and a medium.
- Conduct a whole group discussion to highlight the usage of water as a solvent, a coolant and a medium.
- Provide further examples of the usages of water as a solvent, a coolant and a medium.
- Guide student groups to explore the importance of water as a medium for life and let them present their findings.
- Assign each student to prepare a poster to illustrate usages of water as a solvent, a coolant and a medium.

Key concepts to be highlighted

Solvent, coolant , medium

Assessment and evaluation

- Assess students' performance while they are engaged in activities based on the following criteria.
 - Planning and conducting activities
 - Recording observations
 - Working collaboratively in groups
 - Time management
- Evaluate students' posters based on the following criteria.
 - Illustrating correct information
 - Creativity
 - Attractiveness
 - Presentation of poster

Quality inputs

Solutes such as sugar, glucose, potassium permanganate, copper sulphate, ethanol, colored ink, balsam plants, moth balls, Liebig condenser, round bottomed flask, tripod stand, Bunsen burner, water bath, cotton wool, thermometer

Competency: 2.0.

Investigates matter, properties of matter and their interaction to enhance the quality of life

Competency levels:

2.2 Identify acidic and basic substances that are used in day to day life

Learning outcomes

Students will be able to;

- List acidic and basic substances that are available at home and in the school laboratory
- Name substances that are not either acidic or basic as neutral substances
- State that there are substances which can be used to differentiate between acids and bases
- Observe color changes occurring in different solutions in the presence of given plant extracts
- Differentiate between given substances as acids and bases using litmus and pH papers
- Accept that substances can be categorized based on their acidic, basic or neutral nature.

Time 07 periods

Instructions for lesson planning

- Demonstrate colour changes that occur in saffron powder solutions by adding lime juice, vinegar, soap solution and lime water, separately.
- Introduce lime juice and vinegar as acidic substances and ask students to provide further examples.
- Introduce lime water and soap solution as basic substances and ask students for further examples.
- Introduce saffron powder solution as an indicator solution.
- Let students extract a few indicator solutions from the plant material that are available in the surroundings.

- Assign students to observe and report on colour changes that occur in the addition of acidic and basic substances into the prepared indicator solutions
- Introduce and let students become familiar with acidic and basic substances that are available in the school laboratory.
- Let students test acidic, basic or the neutral nature of different substances using the indicators they prepared and those that are available in the laboratory
- Direct students to explore some other plant materials that can be used to prepare indicator solutions.

Key concepts to be highlighted

Acids, bases, indicators

Assessment and evaluation

- Assess students' performance while they are engaged in activities based on the following criteria
 - Planning and conducting activities
 - Recording observations
 - Working collaboratively in groups
 - Taking care of own safety and that of others
 - Time management
- Evaluate students' by conducting a practical test to identify a given substance as acidic, basic or neutral.
 - Planning and conducting activities
 - Recording observations
 - Drawing conclusions
 - Taking care of own safety and that of others
 - Time management

Quality inputs

Lime juice, tamarind, vinegar, orange juice, citric acid, dilute hydrochloric acid, dilute acetic acid, lime water, soap solution, sodium hydroxide, ammonia solution, plant materials that can be used as indicators, phenolphthalein, methyl orange, litmus, pH papers

Competency: 3.0

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency levels:

3.1 Develops concepts related to static electricity

3.2 Demonstrates applications of basic principles related to static electricity

Learning outcomes:

Students will be able to;

- Construct activities to charge an object using the rubbing method
- Design and conduct activities to show that there are two different types of electrical charges by showing attraction and repulsion
- State that there are two types of electrical charges namely positive and negative
- Express the ways of generating positive and negative charges in objects using the convention
- State briefly the historic perspective of identifying electrostatic charges
- State that the capacitor is a device used to store electro static charges temporarily
- Conduct an activity to show charging and discharging properties of a capacitor

Duration: 08 periods

Instructions for lesson planning:

- Guide students to perform a simple activity such as the attraction of small pieces of paper to a pen or comb after rubbing it on dry hair.
- State that attraction occurs due to the electrostatic charge of the pen or comb.
- Conduct group activities to show the attraction and repulsion of charged objects.
- Charge a glass rod by rubbing using a silk cloth.
- Charge an ebonite rod by rubbing using a woollen cloth.
- Investigate the repulsion and attraction between charged objects.
- Let students experience that the like charges repel and unlike charges attract.
- State that there are two types of charges and name the charges in a glass rod as positive, and the charge in an ebonite rod as negative.
- Explain that charges are removed from one object due to the rubbing and therefore, one object is charged positively and the other is charged negatively.
- State that these types of charges are found in any object and the amount is equal.
- Conduct a discussion to elaborate on the historical ideas of electricity.
 - William Gilbert (1600)
 - Benjamin Franklin (1733)
- Guide students to construct a simple capacitor using an aluminium foil and a polythene sheet. Charge and discharge it with a 6 V battery through a galvanometer to show the action of a capacitor.
- Introduce the capacitor as a component in electrical circuits that it is used to store charges.
- Demonstrate charging and discharging properties of a commercially available capacitor. (e.g. capacitor; 500,3V battery and an LED).

Key concepts expected to be highlighted:

Positive charge, negative charge, charged object, charging, discharging, capacitor

Assessment and Evaluation:

- Assess students' performance during group activities using the following criteria.
 - Active participation
 - Taking observations through activities
 - Following instructions
 - Constructing working models
 - Handling of apparatus safely

Quality inputs:

Glass rod, ebonite rod, wool cloth, silk cloth, aluminium foil, polythene sheet, capacitor (500 , 6V), LED, connecting wires

Competency: 3.0

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency levels:

3.3 Demonstrates electromagnetic induction

3.4 Conducts simple activities related to the generation of electricity

Learning outcomes:**Students will be able to;**

- Construct a simple cell to generate electricity.
- List various chemical cells
- Identify the solar cell as a source of electricity.
- Conduct simple activities using solar panels.
- Demonstrate the phenomenon of electromagnetic induction.
- State that electromagnetic induction is the principle of the dynamo.
- Construct a simple dynamo.
- Classify electric current as AC and DC
- Demonstrate an AC and DC generator (or suitable device)
- Accept that electric sources can be used in innovative ways

Duration: 12 periods

Instructions for lesson planning:

- Guide student groups to construct a simple cell or battery (e.g. using Cu and Zn plates sandwiched with paper / filter paper soaked in dilute sulphuric acid) to demonstrate the generation of electricity. Take necessary precautions in handling dilute sulphuric acid.
- Use solar cells to demonstrate the generation of electricity.
- Assist students to demonstrate the generation of electricity using a bicycle dynamo or laboratory dynamo model.
- Introduce electromagnetic induction through a simple activity (e.g. use the same activity conducted in grade 6 with two LEDs).
- Assign student groups to explore various types of cells, batteries and dynamos. Allow them to investigate their uses as well as other relevant information. Ask them to present their findings.
- Assist students to demonstrate activities such as lighting a bulb, rotating a motor and heating a coil, to understand the applications of cells, batteries and dynamos.
- Assist students to identify cells, batteries, and dynamos as sources of electricity.
- State those sources of electricity are used to obtain electric current.
- State that electric current flows from the positive terminal to the negative terminal of the sources of electricity.
- State that there are two types of electric currents and name them as DC and AC
- Explain the differences of AC and DC.
- Give examples of AC and DC.
- State that large scale electricity generation is based on electromagnetic induction.
-

Key concepts expected to be highlighted:

Cell, battery, dynamo, electric source, positive terminal, negative terminal, electric current, AC, DC

Assessment and evaluation:

- Assess students' group presentations on various types of sources of electricity using the following criteria.
 - Relevance of information

- Presentations skills
- Innovative ideas in the presentation
- Time management
- Different types of sources

Quality inputs:

Batteries, dynamos, bulbs, connecting wire, holders, solar cell, Cu plates, Zn plates, dilute sulphuric acid, centre zero galvanometers, motor, LEDs, copper coil and bar magnet (used in grade 6)

Competency: 3.0

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency levels:

3.5 Conducts simple activities to demonstrate the usage of forms of energy.

Learning outcomes:

Students will be able to;

- Demonstrate various forms of energy in usage based on simple activities.
- Give examples of various forms of energy.
- List different devices that use various forms of energy.
- Appreciate the uses of different forms of energy.

Duration: 08 periods

Instructions for lesson planning:

- Assign student groups to bring devices which operate on different forms of energy (e.g. Battery operated portable cassette recorder / portable DVD player, winding or battery operated toys, torch with filament bulb, greeting cards with musical notes, wall clocks)
- Conduct a group discussion to explore various forms of energy used in the devices they have brought.

- Ask students to tabulate various forms of energy and their applications.
- Assist students to conduct simple activities to demonstrate the usages of various forms of energy.
- Let each student design and construct a simple device to demonstrate the usage of a particular form of energy (to exhibit the usage of a particular energy form, the device may use more than one energy form). Organize an exhibition of devices to demonstrate the students' working models.

Key words and concepts

Forms of energy

Assessment and evaluation:

- Assess students' products based on the following criteria.
- Finish of the product
- Working condition
- Designing skills
- Demonstrating ability
- Innovation of the product

Quality inputs:

Material needed to construct devices

Competency: 3.0.

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency levels:

3.6 Demonstrates phenomena related to the formation of shadows

3.7 Conducts simple activities to demonstrate the nature of images formed in mirrors

Duration: 10 periods

Learning outcomes:

Students will be able to;

- Differentiate between point sources and extended sources of light
- Describe factors affecting formation of shadows
- Demonstrate formation of the shadow by an opaque object
- Design activities to demonstrate umbra and penumbra
- Describe the nature of images formed in plane mirrors and curved mirrors
- State uses of different types of mirrors
- Conduct simple activities to observe the nature of images formed by plane mirrors and curved mirrors
- Accept that the formation of shadows and images are different phenomena

Instructions for lesson planning:

- Guide students to apply shadows to demonstrate enjoyable events creatively.
- Conduct a discussion highlighting the fact that shadows are so formed due to rectilinear propagation of light.
- Demonstrate the nature of shadows formed due to a point source (e.g. torch bulb) and an extended source of light (e.g. 25 W filament bulb / candle flame) by a simple activity and conduct a discussion highlighting the nature of shadows in the two situations.
- Guide students to identify umbra and penumbra of the shadow of an opaque object.
- Introduce to students the plane mirrors available in the school laboratory.
- Guide them to observe the nature of images formed in plane mirrors.
- State that the images are formed due to the reflection of light rays.
- Assign students to find and present events and occasions where lateral inversion is used (e.g. find letters in the English alphabet that remain unchanged after the formation of the image in the plane mirror).
- Guide students to identify the properties of images formed in plane mirrors (qualitatively - size of the image, lateral inversion).
- Guide students to perform a simple activity fixing two plane mirrors at an angle of 30° , 45° , 60° , 90° to each other and observe the images after placing an object in between the mirrors.
- Guide students to construct a kaleidoscope and observe the images formed. Ask students to draw the pattern of the images they have seen.
- Introduce to students, concave and convex mirrors available in the school laboratory.
- Guide them to observe the nature of images formed in concave and convex mirrors.
- Conduct a discussion highlighting the nature of images formed in convex and concave mirrors based on the observations of students.

- Demonstrate to students how the nature of the image changes with the distance between object and mirror through a simple activity using concave and convex mirrors (size of the image, whether the image can be flashed on to a screen, erectness).
- Demonstrate to students the converging and diverging nature of a parallel beam of light incident on a concave or convex mirror.
- Ask students to explore and report on the applications of concave and convex mirrors they experience in their day-to-day life.
- Convince students about the difference between shadows and images.

Key words / concept:

Reflection, Plane mirror, lateral inversion, concave mirror, convex mirror, converging, diverging

Assessment and evaluation

- Assess students while they are engaged in activities using the criteria such as
 - Handling equipment safely
 - Recording observations
 - Attractiveness of presentations
 - Listening to the teacher's instructions
 - Creativeness of the constructions (e.g. kaleidoscope)

Quality inputs

A set of plane mirrors, a set of convex mirrors, a set of concave mirrors, torch, a 25 W filament bulb, candles, optical pins

Competency: 3.0.

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency level:

3.8 Conducts simple experiments related to the generation and propagation of sound

Duration: 07 periods

Learning outcomes:

Students will be able to;

- Generate sound by vibrating suitable objects
- Express that sound is generated by vibration
- State that a medium is necessary for the propagation of sound
- Explain that the speed of sound is different in different media
- Describe that propagation of sound is different in different media
- Accept that sound is generated by vibration
- Accept that the medium affects the speed of sound

Instructions for lesson planning:

- Guide groups of students to produce sound using different suitable objects (e.g. tuning fork, stretched string, small drum). Let them observe the changes in the object which leads to the production of sound.
- Allow students to express their experiences and highlight the phenomena of vibrations.
- State that sound is originated due to vibrations, but in some situations we are unable to see vibrations with the naked eye (e.g. vibrations of a tuning fork of a high frequency).
- Demonstrate to students that a medium is needed for the propagation of sound by conducting a simple activity (Use bell-jar apparatus or any other relevant apparatus).
- Conduct a discussion highlighting that the speed of sound is different in different media (e.g. water, air, and metal, wood). (qualitative interpretation only)
- State that sound takes about three seconds to travel one kilometer in the air.

Key words and concepts

Vibrations, propagation of sound, speed of sound

Assessment and evaluation

- Assess students while they are performing activities using the following criteria.
 - Vibrating the given object following the relevant method
 - Expressing their experiences clearly
 - Active participation in the discussion
 - Following the teacher's instructions correctly
- Conduct a written test to evaluate the students' knowledge of generation and propagation of sound.

Quality inputs

Tuning forks, a stretched string, a small drum, a bell-jar apparatus, a musical greeting card sound generator and large syringe, connecting wire, batteries

Competency: 3.0.

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency level

3.9 Uses the thermometer correctly

3.10 Demonstrates transference of heat and its effects

Duration: 10 periods

Learning outcomes:

Students will be able to;

- State that there are different types of thermometers based on the liquid (thermometric substance) used and the scale
- Express the units of temperature in terms of Celsius and Fahrenheit
- Express the terms ‘boiling point’ and ‘melting point’ of water
- Use a Celsius thermometer correctly to measure temperature of air, water and soil
- Use a clinical thermometer correctly to measure body temperature
- State that the human body temperature is constant (37 °C) and a clinical thermometer could be used to diagnose feverish conditions
- Conduct simple activities to demonstrate different methods of transference of heat
- Explain conduction, convection and radiation as methods of transference of heat
- Describe land breeze and sea breeze
- Accept that proper handling of instruments and taking measurements accurately is important in day-to-day life

Instructions for lesson planning:

- Conduct a group activity to recall the content learned in grade 6 on ‘Thermal energy and its effects’.
- Stress the difference between temperature and heat through a brief discussion.
- Introduce temperature as a measure of hotness or coldness of an object.
- Let students experience the principle of a liquid thermometer through a simple activity.

(e.g. Engage students in observing the level of water rising in a narrow transparent tube fixed to a bottle through a stopper when the bottle is filled with water and is heated with a candle flame or any other flame)

- Guide student groups to develop a simple thermometer using a narrow transparent tube with a scale (e.g. empty tube of a ball point pen) fitted to an air tight test tube filled with coloured water.
- Explain the principle of mercury-glass thermometer using a suitable diagram.
- Express the terms 'boiling point' and 'melting point' of water as fixed points by conducting a discussion.
- State briefly how a mercury-glass thermometer is calibrated with respect to the lower and higher fixed points.
- Introduce Celsius and Fahrenheit scales mentioning their fixed points. Introduce the notations also.
- Build the concept of thermometric properties of the substance used in thermometers (Boiling at a higher temperature, freezing at a lower temperature, clearly observable when included in a transparent narrow tube).
- Engage students in a simple activity to use laboratory thermometers correctly paying attention to the protection of the equipment also (use both Celsius and Fahrenheit scales).
- Guide students in measuring body temperature using a clinical thermometer.
- Differentiate between the clinical thermometer and the normal mercury-glass thermometer in the laboratory.
- Conduct a discussion on types of thermometers (e.g. mercury-glass, alcohol-glass, clinical) briefly highlighting their various uses.
- Guide the students to experience heat transference by conduction, convection and radiation using simple activities (e.g. hold a metal tea spoon inserting one end to a candle flame, keep hand above the candle flame about 15 cm, keep the hand sideways to the candle flame about 1 cm).
- Introduce terms, 'conduction', 'convection' and 'radiation'.
- Assign student groups to collect information on other examples of each method of transference of heat in day-to-day life.
- Ask them to present their findings and conduct a discussion and correct them if necessary.
- Discuss simply, sea breeze and land breeze.

Key words and concepts

Temperature, heat, thermometric substance, thermometer, upper fixed point, lower fixed point, transference of heat, conduction, convection, radiation.

Assessment and evaluation

- Assess students while they are doing activities based on the following criteria.
 - Handling the equipment safely and protectively
 - Recording observations scientifically
 - Following the teacher's instructions
- Conduct tests individually to assess correct use of thermometer using the following criteria.
 - Proper handling
 - Correct way of taking readings
 - Accuracy
 - Reading scale correctly

Quality inputs

A bottle, a narrow transparent tube, an empty tube of a ball point pen, stoppers, test tube mercury-glass thermometers (in Celsius and Fahrenheit scales), alcohol-glass thermometers (in Celsius and Fahrenheit scales), clinical thermometers, a candle, metal strips, metal spoons

Competency: 3.0.

Utilizes various forms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level

Competency level

- 3.11. Conducts simple experiments to demonstrate distance, displacement and force by understanding the relevant concepts.

Duration: 08 periods

Learning outcomes:

Students will be able to;

- Give examples of distance and displacement
- Differentiate between the concepts of distance and displacement
- State units of distance and displacement
- Conduct simple activities to differentiate between the concepts of distance and displacement
- Design simple activities to demonstrate force as a push or a pull
- Describe force as a push or a pull giving examples
- State that force could be expressed in terms of a magnitude and direction
- State the SI unit of force as 'newton'
- Accept the importance of force in day-to-day life

Instructions for lesson planning:

- Conduct a discussion emphasizing the need of two physical quantities ‘distance’ and ‘displacement’, giving real life examples.
- Use a simple demonstration to explain the difference between ‘distance’ and ‘displacement’.
- State the international unit of distance and displacement as metre (m).
- Construct a simple device to measure the distance of a curved line (for finding the distance between two cities on a map).
- Ask students to list suitable real life experiences as pushes and pulls.
- Guide students to perform a simple activity emphasizing the fact that a push or a pull can be identified as a force (e.g. to move a block of wood on the table along a given line about 50 cm using a piece of string / rigid rod).
- Introduce force as a physical quantity which has a magnitude as well as a direction by relating the above observations.
- State ‘newton’ as the international unit for measuring force.
- Introduce the newton balance to students and let them measure the applied force, weight.
- Assign students to collect information with diagrams, photographs where forces are applied in day-to-day life and compile them into a small booklet.

Key words and concepts

Distance, displacement, force, ‘newton’

Assessment and evaluation

- Assess students while they are engaged in activities based on the following criteria.
 - Following the teacher’s instructions
 - Arranging the set up correctly
 - Interpretation of the observations
- Assess student’s performance in preparing a small booklet using the following criteria
 - Relevance of information
 - Diversity of events
 - Attractiveness
 - Format of the booklet

Quality inputs

Threaded iron bar, nuts, wheels, metre ruler, wooden blocks, newton balances, strings, small rigid rods (pencil with an eraser attached to it)

Competency: 4.0

Explores nature properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization.

Competency levels

4.1 Constructs and uses models to demonstrate the structure of the earth.

Learning outcomes

Students will be able to:

- Describe core, mantel and crust of the earth.
- Demonstrate the structure of the earth's interior using suitable activities.
- Make models to illustrate the structure of the earth.
- Explain modes of movement of plates.
- Conduct simple activities to demonstrate plate tectonics.
- Accept that the earth's crust is dynamic.

Duration: 08 periods

Instructions for lesson planning

- Demonstrate the structure of earth using various aids (diagrams, eggs, avocado, videos etc.).
- Assist student groups to construct models of the earth using materials such as clay, pulp, paper wood, styrofoam etc.).
- Guide students to use prepared models, and other materials to explain plate tectonics
- Conduct a literature survey to explore the developmental history of the earth's structure and prepare a comprehensive report.

Key words and concepts

Earth, plates, plates tectonic

Assessment and evaluation

- Assess student's performance in preparing the survey report on the developmental history of the Earth using the following criteria.
 - Adequacy of information
 - Presentation format
 - Attractiveness
 - References

- Assess students performance in the construction of models and explanation using the following criteria
 - Representing correct concepts
 - Proportion
 - Finishing
 - Explanation of the model

Quality inputs

Pulp, paper, sawdust, clay, paint, paint brushes, eggs, avocado, scissors

Competency: 4.0

Explores nature properties and processes of earth and space by understanding natural phenomena and sustainable utilization

Competency levels

4.2. Show knowledge of the atmosphere.

Duration: 08 periods

Learning outcomes:

Students will be able to;

- State the composition of the air in the troposphere (lower atmosphere)
- Illustrate layers of the atmosphere and their properties using diagrams
- Describe the variation of pressure and temperature qualitatively across the layers of the atmosphere
- Realize the importance of atmosphere for the existence of life on earth

Instruction for lesson planning

- Assign student groups to prepare a presentation on the compositions of the air in the atmosphere, and ask them to present it in the class.
- Conduct a discussion to summarize the information presented above.
- Use diagrams/ videos/ animations/ graphics to explain different layers of the atmosphere.
- Assign students to record the temperatures of several cities located at various altitudes on a particular week and ask them to present their recordings graphically.
- Conduct a discussion to make students aware that, pressure and temperature change with respective altitudes within the lower atmosphere.
- Assign groups to list the consequences on earth, if the atmosphere disappears. Allow them to present their predictions.

- Guide students to construct a concept map to summarize the content of the lesson

Key words and concepts:

Atmosphere, troposphere, stratosphere, mesosphere, thermosphere, exosphere, altitude

Assessment and evaluation

- Assess the concept map using following criteria
 - Use of sub concepts to cover the central concepts
 - Using appropriate link words
 - Using cross links
 - Clarity and accuracy

Quality inputs

Bristol boards, marker pens, demy papers, diagrams, videos, animations, graph

Competency: 4.0

Explores nature properties and processes of earth and space by understanding natural phenomena and sustainable utilization

Competency levels 4.3 Conducts simple activities to investigate structure and components of soil

Time 10 periods

Learning outcomes:

Students will be able to:

- Name soil types.
- Compare and contrast different soil types.
- State the composition of soil.
- Describe constituents of soil and their functions.
- Make a model of a soil profile.
- Conduct simple activities to show the presence of air, water, organisms and decaying matter in soil.
- Conduct simple activities to observe constituents of different types of soil.
- Conduct simple activities to illustrate soil erosion.
- Collect articles and pictures regarding soil composition and erosion.

Instruction for lesson planning

- Direct student groups to find out whether sand, silt, or clay is made of larger particles using water, plastic bottles, and soil.
- Assist student groups to separate particles of soil in different sizes using appropriate sieves and direct them to name these particles according to their sizes.
- Get students groups to mix these particles in different ratios to prepare samples of major soil types.
- Get students create models of a soil profile on a cardboard using gum, and soil samples from different horizons.
- Assign students to explore, record and present various functions of constituents of soil.
- Conduct simple activities in student groups to show the presence of air, water, organisms and decaying matter in soil.
- Conduct simple activities to demonstrate air, water, organism and decaying matter in soil varies with different sites of the area.
- Assist student groups to explore facts about soil erosion and demonstrate their knowledge using models prepared by themselves.
- Assign student to collect articles and pictures regarding soil composition and erosion and let them present their collection on a wall paper.

Key words and concepts

Soil, sand, silt, clay, sandy soil, loamy soil, soil profile, composition of soil, decaying matter, soil organism, soil air, soil water, soil erosion .

Assessment and evaluation

- Assess students models of the soil profile using the following criteria
 - Quantity of information
 - Accuracy
 - Correct scaling
 - Neatness
 - Self construction
- Assess students performance when they are demonstrating their knowledge on soil erosion using the following criteria
 - Accuracy of facts
 - Appropriateness of the model
 - Presentation skills
 - Logical presentation
 - Time management

Quality inputs

Sieves in different pore sizes, water, plastic bottles, soil, cardboard, gum, magnifying glasses, forceps

Competency: 4.0.

Explores nature, properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization

Competency Levels:

4.4 Exhibits knowledge of the importance of minerals and rocks as natural resources

Learning outcomes:

Students will be able to;

- State characteristics of rocks and minerals
- Differentiate between rocks and minerals
- Explain mechanisms of weathering of rocks
- Illustrate rock cycle with diagrams/photographs
- Explain rock cycle
- Collect different types of minerals and prepare a mineral box
- Realize the importance of rocks and minerals as natural resources
- Accept that rocks and minerals are limited and should be used sustainably

Duration: 05 periods

Instructions for lesson planning

- Guide student groups to observe and record the nature and properties of given samples of rocks and minerals.
- Conduct a whole class discussion to categorize samples as rocks and minerals, highlighting their unique characteristics.
- Carry out a discussion to categorize rocks as igneous, sedimentary and metamorphic using samples/diagrams/photographs/ videos etc..
- Assign student groups to prepare a collection of rocks and minerals with a brief description of each sample.
- Use models / diagrams / any other aids to explain that the earth's surface is made up of rocks, minerals and soil.
- Guide student groups to find evidences to prove weathering of rocks and conduct a discussion to reveal the involvement of physical, chemical and biological factors on weathering of rocks .
- Clarify to the students that weathering of rocks leads to the formation of soil.
- Use appropriate resources to introduce the process of rock cycle and guide student groups to present the rock cycle using a suitable mode of presentation.

Key words and concepts

Minerals, rock, weathering of rocks, igneous rock, sedimentary rock, metamorphic rock, rock cycle

Assessment and evaluation:

- Assess students' collection of samples of rock and minerals using the following criteria
 - Number and variety of samples
 - Accuracy of the information provided
 - Mode of presentation
 - References used
- Assess student presentation on rock cycle based on the following criteria
 - Accuracy of information provided
 - Amount of information
 - Creativity
 - Explanation
 - Attractiveness

Quality inputs:

Samples of rocks and minerals, hand lenses, trays, hammer, spade, dissecting needle, scalpel, sack, materials and instruments needed for presentations

Competency:

4.0. Explores nature, properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization

Competency levels:

4.5 Takes necessary action to use sources of energy sustainably

Learning outcomes:

Students will be able to;

- Describe the terms 'renewable sources of energy' and 'non-renewable sources of energy'
- Give examples for renewable and non-renewable sources of energy
- Conduct simple activities to strengthen the concepts of renewable and non-renewable sources of energy
- Accepts the importance of sustainable use of sources of energy

Duration: 05 periods

Instructions for lesson planning

- Guide student groups to construct simple working models to demonstrate the use of various sources of energy.
- Instruct the students to list the sources of energy which they use in their day to day life
- Guide the students to identify properties of renewable and non-renewable sources of energy and tabulate them.
- Conduct a discussion based on the sources of energy already discussed and categorizes them as renewable and non-renewable energy.
- Guide the student groups to explore and prepare a report on techniques of using renewable sources of energy in day to day life instead of non-renewable energy.
- Organize a debate on the topic “renewable sources vs. non-renewable sources”. After the debate carry out a discussion to highlight the advantages of renewable sources of energy.

Key words and concepts

Renewable sources of energy, non-renewable sources of energy, sustainable use of energy

Assessment and evaluation:

- Assess the debate using the following criteria
 - Variety of facts
 - Use of appropriate examples
 - Relevance of facts
 - Scientific and logical reasoning
 - Debating skills

Quality inputs:

Materials needed to construct models (e.g. cardboard, hammers, glue, scissor, rubber bands, small motor, wheels, cog wheels etc...), diagrams, photographs, videos, animations

Prototype Assessment Tools for School Based Assessment

Grade 7 – Science Tool 1

1. **Evaluation state** : Term 1
2. **Competency level covered:** 1.3, 1.4
3. **Content covered** : Content under competency levels 1.3 and 1.4
4. **Nature of the tool** : Wall paper
5. **Objectives of the tool** :
 - Guiding the students to refer different sources to get information related to the subject content.
 - Guiding the students to communicate effectively using the information collected.
 - Presenting the information relevantly to the communication method.
 - Presenting the evidences to confirm the accuracy of the collected information.
6. **Instruction to implement the tool :**
 - Explain the contents under 1.3 and 1.4 briefly in the classroom.
 - Guide them to collect information from websites and other resources.
 - Discuss how they can present the information correctly through a wall paper.
 - Group the student into four groups. Assign four groups to prepare wall papers on vertebrates and invertebrates
 - Give opportunity to present their wall paper to others.
7. **Evaluation / assessment criteria**

Criteria		Name of the student								
		A	B	C	D	E	F	G	H	I
1.	Collecting and categorizing the correct information.									
2.	Working according to the given instructions.									
3.	Communicating the ideas effectively.									
4.	Working as a group.									
5.	Presenting the wall paper creatively.									

Indicate proficiency levels as A, B, C, D

- A - Very good
- B - Good
- C - Ordinary
- D - Should be developed

Tool 2

1. **Evaluation state** : Term 2
2. **Competency level covered** : 4.1
3. **Content covered** : Developmental history of earth
4. **Nature of the tool** : Literature survey
5. **Objectives of the tool:**
 - Exploring the history of earth
 - Conduct a literature survey
 - Communicate information scientifically.
6. **Instruction to implement the tool** :
 - Select the instances from grade 7 content to explain the construction of historical background of earth.
 - Lead a discussion on the followings
 - How to conduct a literature survey
 - Sources for information
 - Collection of information
 - Reporting and presenting
 - It is appropriate to do small activities to explain their ideas.
 - Prepare the time frame for the activity.
 - Assign each student to survey information on developmental history of earth
 - Guide the students to get information from elders, newspapers, magazines, books and web sites.
 - Assist them whenever necessary.
 - Make sure about the accuracy of the information.
 - Help students to fill gaps and reduce unnecessary contents

7. **Evaluation / assessment criteria**

Criteria	Name of the student								
	A	B	C	D	E	F	G	H	I
1. Paying attention on the content limits.									
2. Selection of correct and appropriate information.									
3. Communicating the ideas effectively.									
4. Compiling the information in an order.									
5. Format of the presentation.									

Indicate proficiency levels as A, B, C, and D

- A - Very good
- B - Good
- C - Ordinary
- D - Should be developed

Tool 3

1. **Evaluation state** : Term 3
2. **Competency level covered** : 4.3
3. **Content covered** :
 - Soil erosion
 - Ways of soil erosion
 - Effects of soil conservation
4. **Nature of the tool** : Practical activity

5. Objectives of the tool :

- Investigating the factors affecting the soil erosion.
- Preparing sample experimental set ups.
- Explaining complex phenomena using simple instrumental set ups.

6. Instruction to implement the tool :

- Inform the students to bring necessary materials for the practical activity in advance.
- Discuss about soil erosion and factors affecting the soil erosion using teacher's Guide and text book.
- Divide the students into five groups.
- Instruct the student groups to construct the instrument to carry out the study on the factors affecting the soil erosion.
- Assist them to carryout experiments
- Ask the students to report their findings. Give a sample to write the report.

7. Evaluation / assessment criteria

	Criteria	Name of the student								
		A	B	C	D	E	F	G	H	I
1.	Selection of materials									
2.	Construction of experimental setup correctly									
3.	Following instructions									
4.	Controlling variables									
5.	Reporting of the practical work									

Indicate proficiency levels as A, B, C, and D

- A - Very good
- B - Good
- C - Ordinary
- D - Should be developed