Grade 08

Science

Teacher's Guide

(Implemented from 2017

Department of Science
Faculty of Science & Technology
National Institute of Education
Sri Lanka
www. nie.lk

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Message from the Director General

Teaching and Learning

This Manual provides the teacher with the essentials required to implement the subject curriculum in their respective school. In implementing the curriculum, teachers must always bear in mind that their work will have paramount and far-reaching consequences for the child's *cognitive achievement* and *behavioural development*.

On the dimension of cognitive achievement, teachers must pay attention, *inter alia*, to the following where learning quality is higher:

- When the learner is aware of his/her life goals and the task is both relevant to goal achievement as well as abilities;
- When the learner is involved actively in the process of teaching/learning (student-centered process). Recall what Confucius said: *What they hear, they forget; What they see, they remember; & What they do, they learn.*
- When the learning environment is conducive, i.e. resourceful and challenging. Ensure access to study materials, equipment, labs, cases and experiences from multiple sources; and
- When the learner is given prompt feedback, both positive and constructive. In doing so, enable the learning to occur sequentially with higher levels of absorption, and integration with existing knowledge, skills and goals of the learner.

In education, expectation of the government is to enable all children in schools to reach the required levels of mastery of fundamentals of the subject matter, so that they experience the joy of achievement after facing examinations.

In the dimension of behavioural development of the child, the objective of education is to link cognitive achievement with the world of work. Therefore, curriculum delivery in the hand of teacher must foster the competencies that the learner requires to possess in dealing with the world outside the school. Some of the important, generic competencies are in these areas:

- Industrious work ethic – Positive attitudes, will to innovate, and persevere;
- Interpersonal relations - Teamwork, discipline, and effective communication;
- Moral values – A person with integrity possessing civic values such as respect for diversity

In conclusion, I wish to ask all principals, teachers and other staff in schools to look at the process of teaching and learning with attention to **4As** in management: **A**ttitude, **A**nalysis, **A**ction, & **A**ccountability. Start with the relevant and positive *attitudes* about the ends and means of what you do (your lesson, etc.); search, obtain and *analyse* information in order to organize

(session plans etc.); consider options and take prompt action efficiently (deliver); and monitor, assess and measure results to take *accountability* (ownership).

I take this opportunity to wish all the teachers involved the joy of teaching and learning. Please do not hesitate to write to the relevant Head of Department at NIE, with copy to me where desirable, on your experiences and observations of this Manual.

Prof. Gunapala Nanayakkara, **PhD (Carleton)**
Director General

Message from the Deputy Director General

Education from the past has been constantly changing and forging forward. In recent years, these changes have become quit 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 or taking appropriate and timely steps with regard to 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 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 provided substantial support in the classroom teaching- learning process at the same time. Furthermore the teacher will have a better control of the classroom with a constructive approach in selecting modern resource materials and following guide lines given in this book.

I trust that through the careful study of this Teachers Guide provided to you, you will act with commitment in the generation of a greatly 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 of you who contributed your knowledge and skills in making this document such a landmark in the field.

M.F.S.P.Jayawardhana
Deputy Director General
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Instructions to use the Teacher's Guide

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

This teachers' guide consists of a compilation of instructions given to the teachers to make use of in the classroom to achieve specific competency levels. Further, the specific competencies thus highlighted are included in the teachers' guide with time suggested for each of the competency levels.

Learning outcomes to be achieved at the end of each lesson are mentioned clearly in the teachers' 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. Further, 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 in order to ensure that students reach the learning outcomes.

The teachers' guide also includes the basic concepts and essential technical terms the students are expected to acquire gradually when the competency levels are developed. 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 the subject 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 thus necessary for the lesson planning strategies is mentioned here as quality input. If the teacher intends to introduce lesson planning strategies different from the suggested ones 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 the way to achieve feedback and at the same time to use remedial methods accordingly. At the end of each unit there are suggested evaluation and assessment procedures suitable 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 the 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.

INTRODUCTION

The main aim of the subject science is the personal development of the student through a scientific lifestyle, thereby paving the way to national development, thus building a unique, wondrous and prosperous Sri Lanka.

A series of objectives exclusive to the subject of Science has been established as a foundation for the progressive achievement of this admirable goal. To reach this target, the student must learn Science with zeal and enthusiasm. We proudly present you with the duly equipped Science Teacher's guide for Grade 8.

Sri Lanka has a claim to a significant level of literacy rate 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 revising of the syllabus, and improving, developing and updating it every eight years.

Therefore, the syllabus presented in 2017 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.

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 democratic life to promote the characteristics of respecting 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 well being and the concept of human values
5. Promoting positive feelings needed for a balanced personality with the qualities of creative skills, initiative, critical thinking and being responsible
6. Developing the human resources, needed for the progress of the well being of an individual, the nation as well as the economic growth of Sri Lanka,

   Through education,

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 is 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 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 : Listening, carefully speaking clearly, and 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, color, 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 private life

(ii.) Competencies relating to 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, fuel, matter, materials and their links with human living, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, waste 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 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 skilful and sustained attention, and be willing to persevere and attend to details that matter in a given situation.

Course objectives grade 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 undertake 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 the dynamic nature of science.

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time
1.0 Explores life and life processes in order to improve productivity of biological systems	**1.1** Explore the importance of microorganism	• Importance of microorganisms • Impacts of micro-organisms	**Students should be able to:** • conduct simple activities to show that there are living organisms which can't be seen with the naked eye • design and conduct group activities to investigate the effects of micro-organisms on food • explore instances where micro-organisms change the properties of some substances • collect and present information about importance of micro-organisms • state the importance of micro-organisms • accept that some of the micro-organisms are beneficial and some others are harmful	05

Competency	Competencylevel	Content	Outcomes	Time
	1.2 Examine the external features of animal groups	Classification of animals • Major groups of invertebrates • Major groups of vertebrates	**Students should be able to:** • state a few examples and collect some possible specimens for invertebrate groups (coelenterates, annelids, mollusks and arthropods) • state a few examples and collect some possible specimens for vertebrate groups (pisces/ fishes, amphibians, reptiles, aves/ birds and mammals) • classify given invertebrates into major groups using external features • classify given vertebrates into major groups using external features appreciate the diversity of invertebrates and vertebrates	06

Competency	Competencylevel	Content	Outcomes	Time

	1.3 Describe basic functions of plants	Basic functions of parts of the plant
		• Basic functions of plant leaves
		  • Other functions of plant leaves
		  • Diversity of plant leaves
		• Basic functions of the plant stem
		  • Other functions of the plant stem
		  • Diversity of the plant stem
		• Basic functions of plant roots
		  • Other functions of plant roots
		  • Diversity of plant roots
			Students should be able to:
			• explore and draw the major parts of a plant
			• describe the basic functions of major parts of a plant
			• explain the adaptations of plants that lead to diversity
			• investigate the environment with a view to relating the adaptations of major parts of plants to their specific functions
			• collect and draw plant specimens with the specific adaptations in leaves, stems or roots
			• prepare a collection of plant specimens and preserve them with relevant information
			• appreciate the diversity among different parts of a plant
			• accept that the exploration of environment should be carried out with minimum damage to the environment
				05

Competency	Competencylevel	Content	Outcomes	Time

	1.4 Explore the human excretory system	• Excretory organs and excretory products of humans
		  • Kidneys– Urine
		  • Lungs– Carbon dioxide
		  • Skin– Sweat
		• Parts of the urinary system
		• Kidney
		  • Structure
		  • Location
			Students should be able to:
			• state what excretion is
			• name excretory organs and excretory products of the human
			• draw and label the major parts of the human urinary system
			• describe the structure and location of the kidney
			• state the causes and prevention measures for kidney damage
			• accept the importance of maintaining a healthy life style for a proper functioning of the excretory system
				03

	1.5 Explore the human nervous system	• Human nervous system • Nervous coordination • Major parts of the central nervous system • Peripheral nervous system	**Students should be able to:** • discuss what nervous coordination is • identify the major parts of the human central nervous system • state how central nervous system is protected • state what peripheral nervous system is • design a simple activity to demonstrate the nature of the nerve impulse	03

Competency	Competencylevel	Content	Outcomes	Time
			• accept the importance of taking necessary protective measures in day to day activities since the nervous system is very fragile	
	1.6 Examine the structural and functional relationship of the human skin	• Basic structure of the human skin • Basic functions of the skin	**Students should be able to:** • explain major functions of the human skin • draw an outline diagram of the human skin and label the major parts • collect information on some treatment done on the skin and their effects • accept the importance of maintaining healthy skin • accept the need for avoidance of unnecessary treatments on the skin	02

	1.7 Investigates some plant processes that ensure the survival of plants and protection of the environment	• Mechanisms involved in the transport of materials in plants
		  • Osmosis
		  • Diffusion
		• Some processes involved in plants
		• Transportation
			Students should be able to:
			• conduct simple activities to demonstrate diffusion and osmosis
			• describe diffusion and osmosis as major modes of transportation in plants
			• conduct simple activities to show the transportation of water
				08

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time
		• Transport of water • Transport of minerals • Transport of food • Transpiration • Process • Adaptations of plants to reduce transpiration • Importance of transpiration • Guttation • Photosynthesis • Raw materials • Products • Importance • Life cycle of an organism • Plant • Animal • Different types of life cycles • Life cycles with metamorphism	• state appropriate examples for transport of soluble minerals and food substances by plants through their transport system • accept the importance of material transportation for the survival of plants • design and conduct suitable activities to show transpiration in plants • investigate and report the adaptations of plants for minimizing transpiration with suitable examples • accept the importance of transpiration • distinguish between guttation and transpiration • conduct simple experiments to show the main product and by-product of photosynthesis • illustrate photosynthesis using a word equation. • collect and compile a report on global importance of photosynthesis • accept the importance of photosynthesis for the survival of the living world	

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time
	1.8 Observe and understand the life cycle of an organism	• Life cycles without metamorphism • Economical value of life cycles	**Students should be able to:** • diagrammatically illustrate that every living being has a life span which is completed with a life cycle • illustrate and compare life cycles of the human and the butterfly • describe the term metamorphism • give examples for life cycles with metamorphism (frog) and life cycles without metamorphism • differentiate complete and incomplete metamorphism • give examples for complete and incomplete metamorphism • illustrate life cycle of a flowering plant diagrammatically • collect available specimens of the stages of life cycles and display them in a suitable manner • identify the stages of life cycles of pests with the view to controlling them successfull. • accept that the stages of life cycles can be need to control pests effectively • accept the importance of protecting the sensitive stages of life cycles to conserve biodiversity	08

Competency	Competencylevel	Content	Outcomes	Time
	1.9 Use the knowledge of food preservation as well as processing techniques in purchasing the food item	• Preserved food • Processed food	**Students should be able to:** • describe what food preservation is • explain the necessity of food preservation • give example for preserved and non preserved foods • give example for processed foods • list out various traditional and modern technological methods of food preservation • explain the principles behind food preservation • preserve available food items • list out the benefits and drawbacks of processed foods and preserved foods • accept the importance of analyzing the information printed on processed food packs before purchasing	06

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time

2.0. Investigates matter, properties of matter and their interaction to enhance the quality of life	2.1 Investigates the discontinuous nature of matter	• Particle /discontinuous nature of matter
		• Physical properties of matter in relation to particle nature (qualitatively)
		  • Shape
		  • Volume
		  • Compressibility
		  • Density
		• Differences in arrangement and the type of movements of particles in the three states of matter
			Students should be able to:
			• conduct simple activities to show the particulate/ discontinuous nature of solids, liquids and gases
			• list out examples in support of the discontinuous nature of matter
			• illustrate diagrammatically the arrangement of particles in the three states of matter
			• state that the matter is composed of very small particles
			• explain shape and volume as two physical properties of solids, liquids and gases
			• explain the terms density and compressibility and introduce them as another two physical properties of matter
			• compare and contrast solids, liquids and gases with respect to the given physical properties
			• accept the importance of discontinuous nature of matter in day to day life
			• appreciate the method of logical speculation used by scientists to understand the nature of matter
				08

Competency	Competencylevel	Content	Outcomes	Time
	2.2 Investigates how the physical properties of matter should be utilized in day to day life	Physical properties of matter • Lustre • Colour • Texture • Hardness • Elasticity • Odour • Brittleness • Density • Expansivity • Conductivity (thermal and electrical) • Malleability • Ductility • Sonority Pure substances • Elements • Metals and Nonmetals • Compounds	**Students should be able to:-** • classify the given substances as pure and impure substance • state that the substance which has a constant composition is a pure substance • state that the pure substance that can't be divide further is an element • state that the pure substance consists two or more elements is a compound • conduct simple activities to explore physical properties of substance • describe that different types of substances have different physical properties • conducts simple activities to observe density, melting point and boiling point • design and conduct simple activity to show electrical conductivity of given substances • describe that pure substances have constant values for physical properties such as density, melting point and boiling point • state that the pure substance that can't be divide further is an element • state that the pure substance consists two or more elements is a compound	10

Competency	Competencylevel	Content	Outcomes	Time

	2.3 Explore the effect of changes in matter occuring in the environment	• Changes in matter
		• Physical changes associated with change of state
		  • Fusion/ Melting
		  • Vapourisation
		  • Sublimation
		  • Condensation
		  • Freezing
		• Chemical changes
		  • Evidences for a chemical reaction
		  • Reactants and products
		  • Open and closed systems
		  • Law of conservation of mass
			• classify the given pure substance to elements and compounds
			• classify of given elements as metal or nonmetals based on their physical properties
			• accept that physical properties of the substances use full in day to day activities
			
			Students should be able to :
			• conduct simple activities to demonstrate the changes of matter
			• state that matter can be changed by transferring energy
			• catogarise the given changes depending on the fact composition of substance that remains changed or unchanged
			• state that a physical change is a one where the composition of a substance remains unchanged
			• a chemical change always involves formation of new substances with different composition
			• design and conduct simple activities to demonstrate the physical changes associated with change of state
				20

Competency	Competencylevel	Content	Outcomes	Time
		• Common examples of chemical changes ▪ Combustion ▪ Tarnishing of metals • Corrosion • Rusting of iron • Prevention of rusting of iron ▪ Neutralisation	• Fusion/ Melting • Vapourisation • Sublimation • Condensation • Freezing • give evidence for the occurrence of chemical changes by simple activities • Changes in colour • Liberation of a gas • Evolution of absorption of heat • Precipitation • identify the reactants and products of a given chemical change • describe an open system and a closed system using simple activities • state the law of conservation of mass using the results of the activities performed • describe combustion as a chemical reaction between a combustible substance and a supporter of combustion • describe fire triangle and requirement of reaching the ignition point for breaking out a fire	

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time
			• design and carry out experiments to demonstrate that carbon dioxide and water are produced during combustion • distinguish complete and incomplete combustion • name the zones of the flames of a candle and the Bunsen burner • state that tarnishing of metals and rusting of iron are chemical changes • conduct simple experiments to demonstrate the requirements for rusting of iron • state methods that can be used to prevent rusting of iron • take precautions to retard rusting of iron objects used in day today life • accept that rusting of iron is an enormous economical damage and taking preventive measures is very important • state that acids are neutralized by bases and vise versa • demonstrate neutralization reactions using a suitable indicator • give examples for the adoption of neutralization principles in day to day life • classify the changes occurring in day to day life as physical changes and chemical changes	

Science-Grade-8 **Syllabus**

Competency	Competencylevel	Content	Outcomes	Time
3 .0. Utilizes variousforms of energy, their interaction with matter and energy transformations by maintaining efficiency and effectiveness at an optimum level	3.1. Develop awareness on generation of sound. 3.2. Construct simple instruments to generate sound and make necessary changes to produce required sound	Generation of sound Generation of sound by the vibration of: • Strings and rods • Diaphragms • Air columns	**Students should be able to:** • identify three types of sources of sound by playing simple sound generating instruments • give examples for the instruments that produce sound by vibrating strings or rods, diaphragms and air columns • explain that all natural and artificial sounds are generated by vibration of strings or rods, diaphragms and air columns • conduct a simple activity to show all vibrations don't produce sound that can be heard by human • identify variation of sound according to the change in length of a prong of tuning forks • construct simple musical instruments of each type (vibration of air columns, strings and rods and diaphragms) which can be adjusted to change the sound	06

Competency	Competencylevel	Content	Outcomes	Time
			• compile a short literature review starting from traditional musical instruments and including some modern instruments highlighting the method of sound production • explain the difference between noise and musical sounds • appreciate the use of music to improve quality of life	
	3.3 Gains experiences on productive uses of magnets	• Magnets • Permanent magnets • Magnetic poles • Field patterns of bar magnets • Applications of permanent magnets • Earth magnetism and compass	**Students should be able to :** • conduct a simple activity to identify the substances as magnetic and non magnetic • use different methods to demonstrate the magnetic field around a bar magnet • describe that the region around a magnet where it has a magnetic effect as the magnetic field • identify north and south poles of magnets • explain what earth magnetism is • explain compass as the equipment which can be used to find the direction of magnetic fields	08

Competency	Competencylevel	Content	Outcomes	Time
			• use the compass appropriately to find earth's magnetic north • state that there is a difference between magnetic north and geographical north • conduct simple activities to make permanent magnets by stroking and electrical methods • explain that permanent magnets are made of materials which retain magnetic properties for a long time • state that steel is suitable to make permanent magnets and soft iron is suitable for temporary magnets • use and keep magnets in a proper manner • give examples for applications of permanent magnets	

Competency	Competencylevel	Content	Outcomes	Time
	3.4: Develop awareness of basic quantities related to current electricity and measure those quantities using relevant instruments	• Quantities related to current electricity and measuring those quantities • Voltage • Electric current • Resistance	**Students should be able to:** • explain electric potential with suitable examples • explain voltage as a potential difference • state the unit of voltage as 'volt '(V) • measure the voltage between two given points in a circuit using a voltmeter correctly • describe that flow of current is from higher potential to the lower potential • state that the direction of current is from the positive terminal to the negative terminal • state the unit of electric current as the 'ampere' (A) • measure the value of current passing a given point of a circuit using an ammeter correctly • explain resistance as a property which opposes the passage of an electric current through a conductor • explain the unit of resistance as 'ohm (Ω) • accept of the importance of measuring electrical quantities correctly	06

Competency	Competencylevel	Content	Outcomes	Time

	3.5 Uses simple electrical appliances productivity in day to day activities	• Connection of cells and bulbs
		  • Series
		  • Parallel
		• Simple electrical circuit
		  • Torch
		  • Light decorations
		• Safety and economic uses of electrical appliances at home environment
		  • Current controlling components
		  • Switches
		  • Fixed resistors
		  • Variable resistors
		  • Rheostat
		  • LDR
			Students should be able to:
			• construct simple electrical circuits in series and in parallel using the given circuit diagrams
			• explain the observations on the circuits in series and in parallel
			• draw the circuit diagram of a torch
			• state that a bulb lights up only when the circuit is completed
			• build suitable light decoration circuits according to given situations
			• use circuit assembling tools effectively
			• use current controlling components to control the current in a circuit appropriately
			• list out safety measures to be taken when using electrical appliances in the home
			• collect information on the electrical appliances used at home and select more effective and efficient appliances
				08

Competency	Competencylevel	Content	Outcomes	Time

	3.6 Use the effects of electricity efficiently in day to day life	• Effects of electricity
		  • Heating effect
		  • Lighting effect
		  • Magnetic effect
		  • Chemical effect
			Students should be able to:
			• conduct simple activities to show the thermal effect, the lighting effect, the magnetic effect and the chemical effect of electricity
			• investigate applications of the thermal effect of electricity in day to day life
			• construct simple appliances to show the lighting effect of electricity using LED
			• construct a simple electromagnet and demonstrate the methods of changing its strength
			• construct simple working models using the magnetic effect of electricity
			• demonstrate the application of the chemical effect of electricity in day to day life
			• construct innovative products using the effects of electricity
			• explain that electricity can be transformed into various types of energy
			• accept that the effects of electricity can be used productively in day to day life
				08

Competency	Competencylevel	Content	Outcomes	Time
4.0. Explores nature, properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization	4.1 Inquire in to information on the solar planetary system, space and space exploration. 4.2. Develop skills to demonstrate the solar planetary system and some important phenomena related to it.	Sun, Earth and moon Rotation and revolution of the Earth – Seasons Phases of moon – Eclipses – lunar eclipse – solar eclipse Solar planetary system Constellations – constellations in the zodiac – other constellations Space exploration Artificial satellites	**Student should be able to:** • construct various models to demonstrate the rotation and revolution of the Earth and the moon • use models to describe the occurrence of seasons • illustrate phases of moon diagrammatically • use models to demonstrate lunar and solar eclipses • describe occurrence of lunar and solar eclipses using ray diagrams • construct various models to illustrate the solar planetary system • identify major constellations and name important stars belongings to some constellations • identify planets and stars by observing the night sky • state that selected twelve constellations in the path of the apparent motion of earth is termed the zodiac	20

Competency	Competencylevel	Content	Outcomes	Time
	4.3. Investigates the scientific basis of climatic changes related to natural disasters.	Scientific basis of • Drought • Flood • Landslide • Lightning	• present information related to space exploration and artificial satellites using attractive ways • accept the importance of artificial satellites in communication systems • accept that all space exploration activities should be aimed at the wellbeing of humankind **Students should be able to;** • describe the causes for natural disasters (i.e. drought, flood, landslide and lightning) • use various models to demonstrate the scientific basis of natural disasters mentioned above • accept the importance of taking precautions to minimize damages caused by natural disasters • appreciate the importance of communication to minimize damages caused by natural disasters	08

Science
Grade 8

Syllabus
(Implemented from 2017)

Department of Science
Faculty of Science and Technology
National Institute of Education
Sri Lanka
www.nie.lk

School Term	No	No	Competency level	Time (periods)	
1	1	i		05	40
	2	ii	1.2 Examines the external features of animal groups	06	
	3	iii	1.3 Describes the basic functions of plants	05	
	4	iv	2.1 Investigates the discontinuous nature of matter	08	
	5	v	2.2Investigates how the physical properties of matter should be utilized in day to day life	10	
	6	vi	3.1 Develops awareness of the generation of sound & 3.2 Constructs simple instruments to generate sound and makes the necessary changes to produce the required sound	06	
2	7	i	3.3 Gains experiences on productive uses of magnet	08	58
	8	ii	3.4 Develops awareness of basic quantities related to current electricity and measures those quantities using relevant instruments	06	
	9	iii	2.3 Explores the effect of change in matter on the environment	20	
	10	iv	1.4 Explores the human excretory system	03	
	11	v	1.5 Explores the human nervous system	03	
	12	vi	1.6 Examine the structural and functional relationship of the human skin	02	
	13	vii	3.5 Uses productivity of simple electrical appliances in day to day activities	08	
	14	viii	3.6 Uses the effects of electricity efficiently in day today life	08	
3	15	i	1.7Investigates some plant processes that ensure the survival of plants and protection of the environment	08	50
	16	ii	1.8 Observe and understand the life cycle of an organism	08	
	17	iii	1.9 Use the knowledge of food preservation as well as processing techniques in purchasing t food items	06	
	18	iv	4.1 Inquire into information on the solar planetary system, space and space exploration 4.2 Develop skills to demonstrate the solar planetary system and some important phenomena related to it	20	
	19	v	4.3Investigates the scientific basis for climatic changes related to natural disasters.	08	

Competency 1.0 : **Explores life and life processes in order to understand the process of productivity of biological systems**

Competency level 1.1 : **Explore the importance of microorganism.**

Time **:** 05 periods

Outcome :

Students should be able to:

- conduct simple activities to show that there are living organisms which can't be seen with the naked eye
- design and conduct group activities to investigate the effects of micro-organisms on food
- explore instances where micro-organisms change the properties of some substances
- collect and present information about importance of micro-organisms
- state the importance of micro-organisms
- accept that some of the micro-organisms are beneficial and some others are harmful

Instructions for lesson planning:

- Plan and conduct simple experiments to show the impact of micro-organisms on selected food substance (Sugar solution/ Toddy)
- Demonstrate and assist student groups to explore the importance of micro-organisms, followed by a discussion
- Observe and record instances where micro-organisms change the properties of materials
- Guide students to list out instances where micro-organisms are harmful and beneficial
- Instruct the students to submit a booklet on importance of micro-organisms

Key concepts:

Importance of micro organisms, Spoilage of food, Control of microbial activity, Microbial-degradation, Applications of microbes, Infectious diseases

Quality inputs:

Video clips/ reading materials, sugar solution/toddy, milk, microscope, slides, cover slips, antibiotics, pH papers, essential glassware, Bristol board, marker pens

Assessment and evaluation:

Assess the student performances on experiments conducted to show the impact of micro-organisms on selected food substance using the following criteria

- Proper planning
- Handling equipment
- Manipulating variables
- Recording observations

Assess the booklet on the 'importance of micro-organisms' using the following criteria;

- Accuracy of information
- Relevance of information
- Sufficiency of Information
- Quality of the booklet

Competency level 1.2:- Examines the external features of animal groups

Time **:** 06 periods

Outcome:

Students should be able to:

- state a few examples and collect some possible specimens for invertebrate groups (coelenterates, annelids, mollusks and arthropods)
- state a few examples and collect some possible specimens for vertebrate groups (pisces / fishes, amphibians, reptiles, aves/ birds and mammals)
- classify given invertebrates into major groups using external features
- classify given vertebrates into major groups using external features
- appreciate the diversity of invertebrates and vertebrates

Instructions for lesson planning:

- Assist students to explore the unique external features of animals given in the form of specimens/pictures/diagrams/ video clips
- Ask students to classify the above animals as invertebrates and vertebrates.
- Based on unique external features, guide students to classify the invertebrates into groups such as coelenterates, annelids, arthropods and mollusks
- Based on unique external features, guide students to classify the vertebrates into groups such as Pisces/ fish, amphibians, reptiles, Aves/ Birds and mammals
- Ask student groups to explore their environment, collect information for a group presentation on vertebrates and invertebrates

Key concepts:

Invertebrates, coelenterates, annelids, mollusks, arthropods, vertebrates, pisces, amphibians, reptiles, aves, mammals

Quality inputs:

Video clips/ reading materials/ specimens/ pictures/ diagrams

Assessment and evaluation:

Assess the group presentation using the following criteria;

- Time management
- Relevance
- Accuracy of information
- Team work
- Usage of appropriate tools

Competency level 1.3 : Describes the basic functions of plants

Time: 05 periods

Outcome:-

Students should be able to:

- explore and draw the major parts of a plant
- describe the basic functions of major parts of a plant
- explain the adaptations of plants that lead to diversity
- investigate the environment with a view to relating the adaptations of major parts of plants to their specific functions
- collect and draw plant specimens with the specific adaptations in leaves, stems or roots
- prepare a collection of plant specimens and preserve them with relevant information
- appreciate the diversity among different parts of plants
- accept that the exploration of the environment should be carried out with minimum damage to the environment

Instructions for lesson planning:

- Instruct the students to bring samples/pictures of different parts of plants to class
- Assist students to identify the major parts of plants as root, stem, leaves, flowers, fruits and seeds and state their basic functions
- Conduct a field visit to observe the following and guide them to relate adaptations of plant parts to their functions
- Diversity of leaves
- Diversity of stems
- Diversity of roots
- Guide students to collect information on the following
  - main function of plant leaves is photosynthesis .In addition , leaves help in minimizing transpiration, storage of food and propagation
  - main functions of stems are bearing fruits ,flowers and transporting of food, water and minerals
  - some plants have stems adapted for photosynthesis, climbing, propagation and storage giving examples
  - basic functions of roots as absorption of water and minerals, attaching the plant to the soil
  - different types of roots as tuberous, stilt, prop, climbing , aerial and respiratory

- let students present their information creatively
- Instruct the students to collect samples and draw specific adaptations in leaves, stems and roots
- Collect and preserve a collection of plant specimens

Key words and concepts:

Photosynthetic stems, climbing stems, propagative stems, underground stems, tuberous roots, stilt roots, prop roots, climbing roots, aerial root respiratory roots

Quality inputs :

Field note book, knife, specimen jar, hand lens, forceps, scissors

Assessment and evaluation

Based on the following criteria evaluate the collection of specimens

- Using a diverse range of specimens
- Correct Information
- Creativity
- Suitable method of preservation

Competency level 1.4 : Explores the human excretory system

Time: 03 periods

Outcome:

Students should be able to:

- state what excretion is
- state excretory organs and excretory products of the humans
- draw and label the major parts of the human urinary system
- describe the structure and location of the kidney
- state the causes and preventive measures for kidney damage
- accept the importance of maintaining a healthy life style for a proper functioning of the excretory system

Instructions for lesson planning:

- Guide students to distinguish between excretion and defecation
- Assist students to explore different types of excretory products of humans
- Use models/ charts/ diagrams to show the parts of the urinary system and location as well as the structure of the human kidney
- Collect and present information on kidney diseases and kidney disorders in Srilanka
- Organize group discussions on the importance of maintaining a healthy life style for the proper functioning of the excretory system

Key Concepts :

Excretion, excretory products, Urinary system, Kidney

Quality inputs

Models, Charts, diagrams of the excretory system, colour pens, demy papers

Assessment and Evaluation

Assess student groups while they involve in group discussion, using the following criteria

- Active participation
- Accuracy of information
- Relevance of information
- Team work

Competency level 1.5 : Explores the human nervous system

Time: 03 periods

Outcome:

Students should be able to:

- discuss what nervous coordination is
- identify the major parts of the human central nervous system
- state how the central nervous system is protected
- state what the peripheral nervous system is
- design a simple activity to demonstrate the nature of the nerve impulse
- accept the importance of taking necessary protective measures in day to day activities since the nervous system is very fragile

Instructions for lesson planning:

- Explain what nervous co-ordination is
- Make students learn that the nervous system is composed of the Central nervous system and Peripheral nervous system
- Make students learn that central nervous system is composed of the brain and the spinal cord
- Make students learn the parts of the Central Nervous System using diagrams / video clips / charts /models
- Ask students to find out protective measures of the central nervous system
- Discuss what the peripheral nervous system is
- Make students learn what the peripheral nervous system consists of
- Conduct a simple activity to show the nature of nerve impulses (time taken to convey through the human body)
- Ask the students to make a small booklet on the topic "the importance of taking protective measures for the nervous system in day to day life

Key Concepts:-

Nervous system, nervous co-ordination, central nervous system, peripheral nervous system**.** Brain, spinal cord**, impulse**.

Quality input:-

Models, Charts, diagrams

Assessment and Evaluation:-

Evaluate the booklet using the following criteria

- Accuracy and relevance of facts
- Neatness
- On time submission

Competency level 1.6 : Examine the structural and functional relationship of the human skin

Time **:** 02 periods

Outcome:

Students should be able to:

- Explain the major functions of the human skin
- draw an outline diagram of the human skin and label the major parts
- collect information on some treatment done on the skin and their effects
- accept the importance of maintaining a healthy skin
- accept the need for avoidance of unnecessary treatments on the skin

Instructions for t lesson planning:

- Guide students to identify the human skin as the largest organ of the body
- Show them an unlabelled chart/ model/diagram of a cross section of a human skin and ask them to identify the parts
- Ask them to draw and label them
- Conduct a classroom discussion to highlight the basic functions of the skin.
- Guide students to collect information on the 'Importance of maintaining a healthy skin' and let them present.

Key words / Concepts:-

Dermis, epidermis, hypodermis, sweat glands, sebaceous glands, hair follicles

Quality input:-

Chart, models, diagrams

Assessment and Evaluation:-

- Conduct a quiz on the skin and assess student performance using suitable criteria.

- Accuracy and relevance of facts
- Neatness
- On time submission

Competency level 1.7 : Investigates some plant processes that ensure the survival of plants and protection of the environment

Time : 08 periods

Outcome:

Students should be able to:

- conduct simple activities to demonstrate diffusion and osmosis
- describe diffusion and osmosis as major modes of transportation in plants
- conduct simple activities to show the transportation of water
- state appropriate examples for transport of soluble minerals and food substances by plants through their transport system
- accept the importance of material transportation for the survival of plants
- design and conduct suitable activities to show the transpiration in plants
- investigate and report the adaptations of plants for minimizing transpiration with suitable examples
- accept the importance of transpiration
- distinguish between guttation and transpiration
- conduct simple experiments to show the main product and by-product of photosynthesis
- illustrate photosynthesis using a word equation
- compile a report on the global importance of photosynthesis
- accept the importance of photosynthesis for the survival of the living world

Instructions for lesson planning:

- Guide students to design and conduct the following activities to demonstrate diffusion and osmosis
  - Diffusion-$KMnO_4$ dissolving in water
  - Osmosis-Egg membrane and salt water experiment
- Illustrate diffusion and osmosis through appropriate diagrams
- Explain diffusion and osmosis as major modes of transportation in plants
- Conduct the following simple activities /any other suitable activity to show the transport of water, mineral and food
  - Water-oozing of sap from a cut stem
  - Mineral transport-Flow of $KMnO_4$ dissolved in water through a plant
- Guide the students to construct simple instruments to show transpiration and conduct simple activities to demonstrate the process of transpiration
- Explain the process of transpiration
- Make the students compile and record observations on how plants are adapted for minimizing transpiration

- Guide students to observe guttation and discuss the difference between guttation and transpiration
- Guide students to design and carry out suitable experiments to show, that plants manufacture food (starch) in the presence of solar energy.
- Assist students to develop an appropriate experimental set up to show that oxygen emitted as a byproduct of photosynthesis.
- Explain the photosynthetic process using word equation
- Facilitate students to compile a report on the global importance of photosynthesis

Key concepts :

Photosynthesis, transport, osmosis, diffusion, mass flow, transpiration, guttation

Quality inputs:

$KMnO_4$, beakers, salt, knife, egg membrane, potted plants, test tubes, saline tube

Assessment and Evaluation:-

Evaluate the simple instruments to show the transpiration base on the following criteria

- Designing the instrument
- Time management
- Proper functioning of the instrument
- Conducting the experiment

Competency level 1.8 : Observe and understand the life cycle of an organism

Time: 08 periods

Outcome:

Students should be able to:

- diagrammatically illustrate that every living being has a life span which is completed within a life cycle
- illustrate and compare life cycles of the human and the butterfly
- describe the term metamorphosis
- give examples for life cycles with metamorphosis (frog) and the life cycles without metamorphosis
- differentiate complete and incomplete metamorphosis
- give examples for complete and incomplete metamorphosis
- illustrate the life cycle of a flowering plant diagrammatically
- collect available specimens of the stages of life cycles and display them in a suitable manner
- identify the stages of life cycles of pests with a view to controlling them successfully
- accept the stages of life cycles can be need to control pests effectively
- accept the importance of protecting the sensitive stages in life cycles to conserve biodiversity

Instructions for lesson planning:

- Guide the students to observe and draw the life cycles of human and butterfly and explain to the students that every organism has a life cycle with in their life span
- Conduct a discussion to show the differences between the life cycles of a human and a butterfly
- Conduct a discussion highlighting that the offspring of some of the animals looks like the adult from birth while some have different morphological forms at birth unlike adult
- Describe what metamorphosis is using the life cycles of a human and a butterfly
- Using life cycles drawn by students differentiate the complete and incomplete metamorphosis

- Ask student groups to illustrate the life cycle of a flowering plant diagrammatically and collect specimens of different stages of its life cycle
- Conduct a discussion on the stages of the life cycles of pests. Ask students to identify the different life stages of pests which are harmful to plants and man
- Conduct a discussion highlighting that controlling of pests can be achieved by controlling different phase of the life cycle

Key concepts :

Metamorphosis, complete metamorphosis, incomplete metamorphosis, pests, lifecycle, life span, larva, pupa, nymph, offspring, morphological forms.

Quality inputs

Demy, pastels, diagrams showing the life cycles of animals and plants.

Assessment and evaluation

Assess student drawings on life cycles using the following criteria,

- Accuracy
- Neatness
- Identification of different stages life cycles and their stages

Competency level 1.9 : Use the knowledge of food preservation as well as processing techniques in purchasing t food items

Time **:** 06 periods

Outcome:

Students should be able to:

- describe what food preservation is
- explain the necessity of food preservation
- give example for preserved and non preserved foods
- give example for processed foods
- list out various traditional and modern technological methods of food preservation
- explain the principles behind food preservation
- preserve available food items
- list out the benefits and drawbacks of processed foods and preserved foods
- accept the importance of analyzing the information printed on processed food packs before purchasing

Instructions for lesson planning:

- Get students to observe different homemade preserved food items and make notes on texture, colour, weight, smell and let them compare with fresh food items

  Ask students to bring labels of preserved food items available in the market and let them collect and organize their information as follows

No	Name of the Preserved Food	Preserved Methodology	Presence of Additives	Date of Manufacture	Expiry Date
1.					
2.					

- Guide students to compare the above tabulated processed food items along with fresh food substances
- Assign student groups to collect various traditional methods for food preservation and ask them to present the using appropriate methodology
- Assist students to explore and list various modern technological methods used for food preservation. If possible arrange a field trip to a nearby Food Processing Industry

- Conduct a simple activity to introduce microbial decomposition and self decomposition of food as causative phenomena for food spoilage and allow students to explore various possible principles behind food preservation
- Assist students to tabulate the benefits and drawbacks of food processing and food preservation
- Plan a debate among student groups on the benefits and drawbacks of processed food. Assist them with suitable supportive materials such as peer reviewed journals, books, newspapers etc
- Assign student to preserve any food items available at home and share the method with the class

Key concepts :

Preserved food, Processed food, Preservatives, food spoilage

Quality inputs :

Bristol board, marker pens, labels of various processed food

Assessment and evaluation

- During the debate assess the students based on the following.
- Presenting Skills
- Use of appropriate evidence
- Reliability of evidences used
- Assess student performances in their presentations (speeches, posters etc.) based on
- Variety of information
- Accuracy of information
- Logical presentation

Competency: 2.0 Investigates matter, properties of matter and their interaction with each other on the quality of life

Competency level 2.1 : Investigates the discontinuous nature of matter

Time : 8 periods

Outcomes:

Students should be able to:

- conduct simple activities to show the particle/ discontinuous nature of solids, liquids and gases
- list out examples in support of the discontinuous nature of matter
- illustrate diagrammatically the arrangement of particles in the three states of matter
- state that matter is composed of very small particles
- explain shape and volume as two physical properties of solids, liquids and gases
- explain the terms density and compressibility and introduce them as another two physical properties of matter
- compare and contrast solids, liquids and gases with respect to the given physical properties
- accept the importance of the discontinuous nature of matter in day to day life
- appreciate the method of logical speculation used by scientists to understand the nature of matter

Instructions for lesson planning:

- Recall that matter exists in three states, namely solid, liquid and gas.
- Guide the students to conduct simple activities with a view to giving them an understanding of the discontinuous nature of solids, liquids and gases
  Ex: solids (by using chalk and coloured ink)
  liquids (by using water and potassium permanganate)
  gases (by using air and a coloured gas)
- Help to prepare a chart on common evidence for discontinuous nature of solids, liquids and gases
- Explain in terms of the behavior of particles the physical properties of matter such as shape, volume, density, compressibility
- Induce students to demonstrate the arrangement of particles in solids, liquids and gases using suitable activities.
- Conduct a discussion to compare and contrast the physical properties of the three states of matter with relevance to day to day life.
- Appreciate the logical speculation used by scientists to understand the nature of matter.

Quality Inputs:

Diagrams, charts, models, video clips

Key Concepts:

Physical properties, compressibility, discontinuous nature, density

Assessment and Evaluation:

Assess the activities and presentations carried out by students using the following criteria:

- Conformity with the speculated nature
- Relevance of the activity
- Cooperation within the group
- Logical presentation of facts
- Evaluate the students using a short question paper.

Competency level 2.2 : Investigates how the physical properties of matter should be utilized in day to day life

Time **:** 10 periods

Outcomes:

Students should be able to:

- classify the given substances as pure and impure substance
- state that the substance which has a constant composition is a pure substance
- state that the pure substance that can't be divided further is an element
- state that the pure substance with consists of two or more elements is a compound
- conduct simple activities to explore physical properties of substance
- describe that different types of substances have different physical properties
- conduct simple activities to observe density, melting point and boiling point
- design and conduct simple activities to show electrical conductivity of given substances
- describe that pure substances have constant values for physical properties such as density, melting point and boiling point
- classify the given pure substance to elements and compounds
- classify the given elements as metal or nonmetals based on their physical properties
- understand the physical properties of substances usefull in day to day activities

Instructions for lesson planning:

- Guide the students to classify the given substances as pure and impure
- Explain that the substance which has a constant composition is a pure substance
- Explain that the pure substance which can't be divided further is an element
- Explain that the pure substance which can be divided in to two or more elements is a compound
- Guide the students to classify the given substance as elements and compounds
- Explain the following physical properties of matter. Give appropriate examples for the physical properties with the aid of pictures/images
- Lustre
- Colour
- Texture
- Hardness
- Elasticity
- Odour
- Brittleness

- Density
- Expansivity
- Conductivity (thermal and electrical)
- Malleability
- Ductility
- Sonority

- Provide some substances and ask student to identify their specific physical properties and tabulate the observations on the following table

Substance	State	Colour	Odour	Texture	Brittleness	Density	Expansion	Thermal Conduct	Electrical Conduct

- Conduct a discussion based on the above results and show how different substances possess different physical properties
- Conduct simple activities to explain how physical properties can be used to identify pure substance
- Explain that different types of substances have different physical properties
- Guide to conduct simple activities to observe density, melting point and boiling point
- Guide to design and conduct simple activities to show the electrical conductivity of given substances
- Explain that pure substances have constant values for physical properties such as density, melting point and boiling point
- Explain what metals and non metals are by using their common physical properties
- Guide the students to identify the metals and non metals in the given samples
- Conduct simple activities to distinguish metals and non metals by using their physical properties and ask the students to tabulate the observations on
- lustre, colour, texture, hardness, elasticity brittleness, odour, density, thermal expansivity, thermal and electrical conductivity, malleability, ductility and sonority.

Key words and concepts:-

Physical properties, metals, non-metals, melting point, boiling point, conductivity, expansivity, sonority, ductility, malleability and density

Quality inputs:-

Commonly available metals, non metals and compounds (Cu, Zn, Mg, Al, Fe, Pb, graphite, coal, sulphur, NaCl, H_2O, $CaCO_3$, $CuSO_4$)
wire, electric cells, LED

Assessment and evaluation:

- Assess the students using the following criteria:
- Use of appropriate methods
- Skills of handling equipment
- Presentation of results
- Correct categorisation

Competency level 2.3 : Explores the effect of change in matter on the environment

Time : 20 periods

Outcome:

Students should be able to:

- conduct simple activities to demonstrate the changes in matter
- observe and state that matter can be changed by transferring energy
- categories the given changes as the composition of substances remaining changed or unchanged
- observe and state that a physical change is where the composition of a substances remains unchanged
- whereas a chemical change always involves formation of new substances with different composition
- design and conduct simple activities to demonstrate the physical changes associated with change of state
  - Fusion/ Melting
  - Vapourisation
  - Sublimation
  - Condensation
  - Freezing
- give evidence for the occurrence of chemical changes by simple activities
  - Changes in colour
  - Liberation of a gas
  - Evolution of absorption of heat
  - Precipitation
- identify the reactants and products of a given chemical change
- identify and describe the open system and closed system using simple activities
- state the law of conservation of mass using the results of the activities done
- describe combustion as a chemical reaction between a combustible substance and a supporter of combustion
- describe fire triangle and requirement of reaching the ignition point for the breaking out of a fire
- design and carry out experiments to demonstrate that carbon dioxide and water are produced during combustion
- distinguish complete and incomplete combustion
- name the zones of the flames of a candle and the Bunsen burner
- state that tarnishing of metals and rusting of iron are chemical changes
- conduct simple experiments to demonstrate the requirements for rusting of iron
- state methods that can be used to prevent rusting of iron

- take precautions to retard rusting of iron objects used in day today life
- accept that rusting of iron is an enormous economic damage and that taking prevention measures is very important
- state that acids are neutralized by bases and vice versa
- demonstrate neutralization reactions using a suitable indicator
- give examples for the adoption of neutralization principles in day to day life
- classify the changes occurring in day to day life as physical changes and chemical changes

Instructions for lesson planning:

- Conduct simple experiments with students to show physical changes and chemical changes.
  E.g. tear a piece of paper and burn allowed to another similar piece of paper
  Dissolve sodium chloride in water and evaporate
  Heat potassium permanganate crystals
  Mix aqueous solutions of lead nitrate and sodium chloride
  Add a zinc granule to an aqueous solution of copper sulphate
- Conduct a discussion to differentiate chemical changes and physical changes and tabulate the reactions carried out
- Conduct simple activities, describe physical changes such as fusion/ melting, vapourisation, sublimation, condensation and freezing
- Build the concept of chemical change through reactions mentioned above and day to day experiences (i.e. ripening of fruits, decaying of organic matter, tarnishing of metals
- Make the students identify the evidence for the occurrence of chemical reaction using the observations in the above activities
- Conduct a discussion to identify the reactants and products of a chemical reaction
- Direct the students to identify a closed system and an open system through simple activities
- Build up the concept of law of conservation of mass by suitable experiments
- Guide the students to identify the requirements for combustion and its products using simple activities and to build the fire triangle
- Conduct a discussion to distinguish complete and incomplete combustion by observing the flame of a candle and a Bunsen burner
- Direct students to identify the zones of the flame of a candle and the Bunsen burner.
- Conduct a discussion to explain tarnishing of metals and rusting of iron
- Conduct simple activities to show the need of oxygen/ air and water/ moisture for rusting of iron

- List the methods that can be used to prevent the rusting of iron
- Introduce acid-base neutralisation as a chemical change
- Discuss applications of acid-base neutralization in day to day life

Key Concepts:-

Physical change**,** chemical change, fusion, melting, vapourisation, sublimation, condensation, freezing, combustion, tarnishing, corrosion, rusting, neutralization, open system, closed system, reactants, products, supporter combustion, Law of conservation of mass

Quality input:-

Copper sulphate, zinc granules, potassium permanganate, moth balls, lead nitrate, sodium chloride, iodine crystals, candle, candle, calcium hydroxide, iron nails, indicators, hydrochloric acid, and sodium hydroxide

Assessment and Evaluation:-

- Assess the students while doing the activities using the following criteria.
- Use of appropriate methods
- Skills at handling equipment
- Presentation of results
- Active participation in team work

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

Competency level: **3.1** Develops awareness of the generation of sound
3.2 Constructs simple instruments to generate sound and makes the necessary changes to produce the required sound

Time : 06 periods

Outcome:

Students should be able to:

- identify three types of sources of sound by playing simple sound generating instruments
- give examples for the instruments that produce sound by vibrating strings or rods, diaphragms and air columns
- explain that all natural and artificial sounds are generated by the vibration of strings or rods, diaphragms and air columns
- conduct a simple activity to show all vibrations don't produce sound that can be heard by a humans
- identify variation of sound according to the change in length of a prong of tuning forks
- construct simple musical instruments for each type (vibration of air columns, strings and rods and diaphragms) which can be adjusted to change the sound
- compile a short literature review starting from traditional musical instruments and including some modern instruments highlighting the method of sound production
- explain the difference between noise and musical sounds
- appreciate the use of music to improve the quality of life

Instructions for Lesson planning:

- Conduct a simple activity using various sound generating instruments to identify three types of sound sources
- Show some photographs of musical instruments

- Emphasize three types of sound sources used in different musical instruments and apparatus

  E.g.:- strings – violin / rods – xylophone, mouth organ
  Diaphragms – Drum, speakers in electrical instruments
  Air columns – flute, whistle

- Discuss the traditional and modern musical instruments.
- Use various types of musical instruments or simple electronic devices (siren, multi-vibrator etc.) to produce sound.
- Group students and direct them to make simple musical instruments or any other sound sources which can be adjusted to change the sound.
- Guide students to collect information on usage of music and sounds to upgrade the quality of life.

Key concepts:-

Vibrations, Strings or rods, air columns, diaphragms, musical instruments.

Quality inputs:-

- Tuning fork, some musical instruments.
- Pictures of musical instruments.
- Apparatus needed to make simple musical instruments.
  (Empty cans, wires, nylon strings, bamboo, balloons, etc.)

Assessment and evaluation:-

Assess group by group, while they are doing the activities based on the following criteria

- . Innovativeness
- Handling equipment safely and correctly
- Following the teacher's instructions

Competency level 3.3 : Gains experiences on productive uses of magnet

Time **:** 08 periods

Outcome:

Students should be able to:

- Conduct simple activities to identify the substances as magnetic and non magnetic
- Use different methods to demonstrate the magnetic field around a bar magnet
- Briefly explain that the region around a magnet where it has a magnetic effect is called its magnetic field
- Identify the North and South poles of magnets
- Explain what earth magnetism is
- Explain the compass as an equipment which can be used to find the direction of magnetic fields
- Use the compass appropriately to find earth's magnetic North
- State that there's a difference between the magnetic North and geographical North.
- Conduct simple activities to make permanent magnets by stroking and electrical methods
- Explain that permanent magnets are made out of materials which retain magnetic properties for a long time
- State that steel is suitable to make permanent magnets and soft iron is suitable for temporary magnets
- Use and keep magnets in a proper manner
- Give examples for applications of permanent magnets

Instructions for lesson planning:

- Recall the previous knowledge(Grade 6) about magnets and highlight that magnetism occurs as a property of the material
- Guide students to conduct on suitable activity using a bar magnet to identify the magnetic field pattern and magnetic poles
- Explain that freely rotatable magnets always directed to the North-South direction due to the Earth is magnetic field
- Explain that there is a small difference between the geographical North and the magnetic North
- Introduce compass and guide students to find the magnetic North using it.
- Explain the permanant and temporary magnets are by using simple activities
- Guide students to prepare a magnetic compass and allow them to identify the magnetic North and the direction of a magnetic field by doing simple activities

- Conduct a disscussion highlighting the applications of magnets
- Explain to the students that permanent magnets should be handled carefully to minimize the loss of its magnetic properties.(Time, Temperature, Adverse fields, sudden vibrations by falling)

Key Concepts:

- Magnetic and non magnetic materials
- Permanent magnets
- Magnetic effect / magnetic field
- Earth magnetism
- Compass

Quality Inputs:

Permanent magnet, Magnetic and non magnetic materials, Compass, Nails, Copper wire, Battery

Assessment and evaluation:

- Assess students while they are engaged in the activities using the criteria such as;
  - Whether they are handling magnets , magnetic and non magnetic materials and compass is safely
  - Recording observations
  - Conclusions
  - Listening to the teacher instructions
  - Creativeness of the apparatus they made.(e.g. Compass , making permanent magnets by electrical method.)

Competency level 3.4: **Develops awareness of basic quantities related to current electricity and measures those quantities using relevant instruments**

Time : 06 periods

Outcome:

Students should be able to:

- Explain the electric potential with suitable examples
- explain voltage as a potential difference
- state the unit of voltage as 'volt '(V)
- measure the voltage between two given points in a circuit using a voltmeter correctly
- describe that flow of current is from higher potential to the lower potential
- state that the direction of current is from the positive terminal to the negative terminal
- state the unit of electric current as the 'ampere' (A)
- measure the value of current passing a given point of a circuit using an ammeter correctly
- explain resistance as a property which opposes the passage of an electric current through a conductor
- explain the unit of resistance as ' ohm ' (Ω)
- accept the importance of measuring electrical quantities correctly

Instructions for lesson planning:

- Introduce the term 'electrical potential'by using different types of batteries
- Ask students how water flows in tube. It flows from higher potential to lower potential
- Current also flows like water and it flows from the higher potential to the lower potential
- Explain that in an electrical source (DC) the terminal with higher potential is known as positive [(+)ve] potential with lower potential is known as negative [(-)ve] terminal
- Introduce the term voltage as a potential difference between (+)ve terminal and
- (-)ve terminal and the unit of voltage as' volt' (V), the value measured from voltmeter connected correctly in parallel to the terminal.
- Introduce the unit of electric current as 'ampere' (A), value measured from ammeter connected correctly in series with the circuit.

- Ask the student to connect simple electric circuit completely with a switch , bulb and a battery guide them to connect volte meter in parallel to the battery with correct polarity and to measure the value of voltage.
- Ask the student to disconnect the volte meter and insert an ammeter in series with the circuit with correct polarity and to measure the value of current.
- Introduce the term ' resistance ' as internal property of a conductor which always oppose the passage of an electric current through the conductor and the unit of resistance as 'ohm' (Ω)
- Conduct two minute speech competition in the classroom under the team of importance of measuring electrical quantities correctly in day to day life.

Key concepts:-

Electricity, current, potential, voltage, resistance, units, circuit, conductors

Quality inputs:-

Battery, bulb, switch, connecting wire, ammeter, voltmeter, resistors, conductors

Assessment and evaluation:-

- Test knowledge by written questions.
- Assess the electric circuits developed by students based on their working, ability to measure the values and neatness.
- Evaluate presentation skills at the speech competition

Competency level 3.5 : Uses productivity of simple electrical appliances in day to day activities

Time **:** 08 periods

Outcome:

Students should be able to:

- construct simple electrical circuits in series and in parallel using the given circuit diagrams
- explain the observations on the circuits in series and in parallel
- draw the circuit diagram of a torch
- state that a bulb lights up only when the circuit is completed
- build suitable light decoration circuits according to given situations
- use circuit assembling tools effectively
- use current controlling components to control the current in a circuit appropriately
- list out safety measures to be taken when using electrical appliances in the home
- collect information on the electrical appliances used at home and select more effective and efficient appliances

Instructions for lesson planning:

- Give circuit diagrams and ask students to connect cells and bulbs in series and parallel circuits according to given instructions
- Supply torch with filament bulb to students and ask them to observe the internal circuit and direct them to draw the circuit diagram
- Discuss with the students the conditions that should be fulfilled in a circuit to light up the bulb
- Discuss how to use the circuit assembling tools such as the soldering iron
- Give simple bulb/LED decoration circuits and guide the students to build the circuits
- Supply students with a few different simple circuits including current controlling components and guide them to connect the circuits and to operate current controlling components in a suitable way
- Conduct a whole class discussion highlighting the reasons for the current controlling action of each component
- Guide students to collect information about safety measures and specifications about the appliances used in the home environment and conduct a discussion

Key oncepts:-

Electricity, current, resistance, circuit variable resistance, rheostat and LDR

Quality inputs:-

Battery**, Bulb**, switch, soldering iron, soldering lead, connecting wire, ammeter, resistors, rheostat and LDR

Assessment and evaluation:-

- Test knowledge by written questions.
- Assess the electric circuits developed by students based on their working ability to measure the values and neatness.
- Evaluate presentation skills at the speech competition

Competency level 3.6 : Uses the effects of electricity efficiently in day today life

Time : 08 periods

Outcome:

Students should be able to:

- conduct simple activities to show the thermal effect, the lighting effect, the magnetic effect and the chemical effect of electricity
- investigate applications of the thermal effect of electricity in day to day life
- construct simple appliances to show the lighting effect of electricity using LED
- construct a simple electromagnet and demonstrate the methods of changing its strength
- construct simple working models using the magnetic effect of electricity
- demonstrate the application of the chemical effect of electricity in day to day life
- construct innovative products using the effects of electricity
- explain that electricity can be transformed into various types of energy
- accept that the effects of electricity can be used productively in day to day life

Instructions for lesson planning:

- Conduct a simple activity to demonstrate the heating effect of electricity
- Prepare a list of uses of the heating effect of electricity in day to day life through discussion
- Conduct a simple activity to demonstrate the lighting effect of electricity
- Guide students to make light decorations using LED s
- Conduct a simple activity to demonstrate the magnetic effect of electricity
- Guide students to make an electro magnet and investigate the factors which affect its strength
- Guide students to make an electrical bell and a buzzer
- Conduct a simple activity to demonstrate the chemical effect of electricity
- Explain that the chemical effect used in electroplating, in the production of chemicals, in extraction of metals etc
- Conduct a discussion to explain that electrical energy can be transformed into other forms of energy

Key Concepts:-

Heating effect, magnetic effect, electro magnet, LED

Quality input:-

Dry cells, insulated Copper wires, Nichrome wire, LED, connecting wire

Assessment and Evaluation:-

Assess students using the following criteria

- Active participation in discussion
- Working condition of electric bell , buzzer
- Collecting examples for electrical energy transformation

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

Competency level 4.1 : **Inquire into information on the solar planetary system, space and space exploration**

4.2 : **Develop skills to demonstrate the solar planetary system and some important phenomena related to it**

Time **:** 20 periods

Outcome:

Student should be able to:

- construct various models to demonstrate the rotation and revolution of the Earth and the Moon
- use models to describe the occurrence of seasons
- illustrate phases of moon diagrammatically
- use models to demonstrate lunar and solar eclipses
- describe occurrence of lunar and solar eclipses using ray diagrams
- construct various models to illustrate the solar planetary system
- identify major constellations and name important stars belongings to some constellations
- identify planets and stars by observing the night sky
- state that selected twelve constellations in the path of the apparent motion of earth is termed the zodiac
- present information related to space exploration and artificial satellites using attractive ways
- accept the importance of artificial satellites in communication systems
- accept that all space exploration activities should be aimed at the wellbeing of humankind

Instructions for lesson planning:

- Define rotation and revolution
- State that the axis of the rotation of the Earth is not perpendicular to the plane of the revolution. State that the axis of rotation is pointed towards the star Polaris
- Guide students to prepare models to represent the Sun, the Earth and the Moon, their rotations and revolutions considering the above facts
- Use the model of the Earth to explain the occurrence of seasons using a light source for the Sun

- Students to draw diagrams to illustrate the seasons
- Instruct to observe the Moon and draw the phases during a period of several months
  Note: Give instructions for this activity at the beginning of the lesson
- Use a diagram to explain the reason for the phases of Moon
- Instruct students to explain the phenomenon of phases using their models
- Plan a practical to show lunar and solar eclipses in a dark room
  (E.g. Use two balls to represent the Earth and Moon. Use a light source to represent Sun)
- Guide students to draw ray diagrams considering the observations to describe the occurrence of the lunar and solar eclipses
- Demonstrate the solar system models available in the lab
- Guide students to construct a model of a solar planetary system using the material available focusing on the following facts
  - Distances between the planets
  - Relative sizes of the planets
  - Colours and appearance of the planets
  - Paths of the planets
- Use a simple model to explain the reason for the revolution of the planets
  (i. e. circular motion of a stone tagged by a length of thread)
- Show the diagrams of the major constellations and name the important stars belonging to them
  (i.e. the twelve constellations in the zodiac , Orion , Canis major ,Southern cross, Ursa major ,Ursa minor and Pleides)
- Define the term "zodiac"
- Explain how to distinguish the stars from the planets
- Guide to prepare a simple instrument to measure the horizontal and vertical angles between celestial bodies
  (i. e. Use straws and protractors for the model)
- Ask the students to observe the night sky, identify constellations and planets and record their relative positions using the instrument made
  Conduct a discussion to summaries the observations
- Show a video on space exploration (Download from internet)
- Briefly explain the events in the video
- Ask the students to create a timeline chart including the important events of space exploration
- State that space exploration activities have inspired innovators been a cause for technological advances
  (i. e. Astronomers focus on preparing clean environments to prevent dust particles that obscure the images taken from telescopes. The techniques developed by Astronomy are used in the hospitals and pharmaceutical labs as cleanliness is an important aspect in the medical field)

- Discuss the science behind launching a rocket using a suitable model (i.e. A balloon)
- Ask the students to make their own space craft in groups and arrange a space craft launching session
- State that artificial satellites are human built objects orbiting the Earth or another planet moving in the same way the moon orbits the Earth
- State about the prediction made by Arthur C. Clarke on geostationary satellites for communication

Key concepts

Rotation, revolution, seasons, lunar eclipses, solar eclipses, solar planetary system, constellations, zodiac, space exploration, artificial satellites

Quality inputs

A suitable apparatus to show the motion of planets of the solar system

Assessment and evaluation

- Assess the students in the following activities using suitable criteria:
  - Making the solar planetary system
  - Preparation of a night observation report
  - Making the time-line chart of a space exploration
  - Launching the space craft models

Competency level 4.3 : Investigates the scientific basis for climatic changes related to natural disasters**.**

Time : 08 periods

Outcome:

Students should be able to:

- describe the causes for natural disasters (i.e. drought, flood, landslide and lightning)
- use various models to demonstrate the scientific basis of natural disasters mentioned above
- accept the importance of taking precautions to minimize the damages caused by natural disasters
- appreciate the importance of communication to minimize the damages caused by natural disasters

Instructions for lesson planning:-

- Show video clips/ pictures of natural disasters to the class
- Describe scientifically what a natural disasters is
- Explore reasons for natural disasters
  - human activities
  - natural reasons
- Conduct group activities to explore the scientific basis of the following natural disasters using models ,diagrams ,paper cutting, pictures ,video clips etc
  - droughts
  - floods
  - landslides
  - Lightning
- Conduct group activities followed by discussion to make the students aware of
  - mitigation
  - preparedness
  - adaptation

regarding natural disasters

Key concepts:-

Drought, floods, landslide, lightning, mitigation, preparedness, adaptation

Quality inputs:-

Video clips, models, paper cuttings, posters

Assessment and evaluation:-

- Assess student's 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 others' safety
  - Time management