# Science

## Teachers' Guide

(Implemented from 2018)

Grade 09

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

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**Content**

## Director General's Message

With the primary objective of realizing the National Educational Goals recommended by the National Education Commission, the then prevalent content based curriculum was modernized, and the first phase of the new competency based curriculum was introduced to the eight year curriculum cycle of the primary and secondary education in Sri Lanka in the year 2007.

The second phase of the curriculum cycle thus initiated was introduced to the education system in the year 2015 as a result of a curriculum rationalization process based on research findings and various proposals made by stake holders.

Within this rationalization process the concepts of vertical and horizontal integration have been employed in order to build up competencies of students, from foundation level to higher levels, and to avoid repetition of subject content in various subjects respectively and furthermore, to develop a curriculum that is implementable and student friendly.

The new Teachers' Guides have been introduced with the aim of providing the teachers with necessary guidance for planning lessons, engaging students effectively in the learning teaching process, and to make Teachers' Guides will help teachers to be more effective within the classroom. Further, the present Teachers' Guides have given the necessary freedom for the teachers to select quality inputs and activities in order to improve student competencies. Since the Teachers' Guides do not place greater emphasis on the subject content prescribed for the relevant grades, it is very much necessary to use these guides along with the text books compiled by the Educational Publications Department if, Guides are to be made more effective.

The primary objective of this rationalized new curriculum, the new Teachers' Guides, and the new prescribed texts is to transform the student population into a human resource replete with the skills and competencies required for the world of work, through embarking upon a pattern of education which is more student centered and activity based.

I wish to make use of this opportunity to thank and express my appreciation to the members of the Council and the Academic Affairs Board of the NIE the resource persons who contributed to the compiling of these Teachers' Guides and other parties for their dedication in this matter.

**Dr. (Mrs.) Jayanthi Gunasekara**
Director General
National Institute of Education





Maharagama

## 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**
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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 9

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.

### 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).*

### 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*

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**(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.

| School Term | No. | No | Competency Level | Periods | |
|---|---|---|---|---|---|
| | 1 | I | 1.1 Investigate the application of micro-organisms. | 12 | |
| | 2 | II | 1.2 Reviews eye and ear as sense organs. | 07 | |
| 1 | 3 | III | 2.1 Reviews the nature and properties of matter | 15 | 45 |
| | 4 | IV | 3.1 Identifies basic concepts related to force. | 05 | |
| | 5 | V | 3.2 Utilizes the pressure exerted by solids effectively in day to day life | 06 | |
| | 7 | I | 1.3 Discovers the structure-function relationships related to the human blood | 08 | |
| | 8 | II | 1.4 Rewiew the plant growth substances. | 06 | |
| | 9 | III | 1.5 Reviews the mechanical support and movements in organisms. | 07 | |
| 2 | 10 | IV | 1.6 Explores the importance of the evolutionary process in bio-diversity | 06 | 57 |
| | 11 | V | 2.2 Inquires into electrochemical processes. | 15 | |
| | 12 | VI | 3.5 Uses the concept of density in day to day tasks effectively. | 05 | |
| | 13 | VII | 4.4 Investigates on bio diversity | 05 | |
| | 14 | VIII | 4.5 Investigates on artificial environment and green concept | 05 | |
| | 15 | I | 3.3 Applies effectively the prin,,ciples of reflection and refraction of rays for day to day tasks . | 12 | |
| | 16 | II | 3.4 Uses simple machines effectively to facilitate day to day activities. | 12 | |
| | 17 | III | 4.1 Inquries into nanotechnology and its applications. | 10 | |
| 3 | 18 | IV | 4.2 Investigates into the prevention of accidents due to lightening. | 08 | 55 |
| | 19 | V | 4.3 Inquires into the scientific background of natural disasters. | 08 | |









| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| 1.0 Explores life and life processes in order to improve productivity of biological systems | 1.1 Investigate the application of micro-organisms. | • Micro-organism<br>  • Bacteria<br>  • Fungi<br>  • Protozoa<br>  • Algae<br>• Viruses<br>• Environments and substrate of<br>• micro-organisms<br>• Effect of micro-organisms<br>  • Favourable<br>  • Unfavourable | **Student should be able to :**<br>• group micro-organisms by observing characteristics as bacteria, fungi, protozoans and algae giving examples.<br>• identify viruses as a group in between the living and non-living.<br>• state that vireses multiply only inside living cells and are devoid of a cellular organization.<br>• state that unicellular and multicellular micro-organisms are found within the groups of micro-organsms.<br>• state that micro-organisms can live even under the extreme environmental conditions.<br>• name meat, fish,fruits, human skin, mouth, alimentary canal, reproductive organs and soil as the specific substrates in which micro-organisms grow.<br>• describe how various micro-organisms are used in activities carried out for economic gain and research(agriculture, medicine, industries)<br>• state that micro-organisms are employed in environmental conservation decomposition of oil spilled on oceanic waters, absorption of heavy metals, recycling of plastics.) | 12 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 1.2 Reviews eye and ear as sense organs. | • Eye<br>• Structure<br>• Functioning<br>• Visual defects, complaints and remedies<br>• Ear<br>• Structure<br>• Functioning<br>• Complaints in the ear | • state diseases, food spoilage and use of micro-organisms as chemical weapons as unfavorableeffects of micro-organisms.<br>• demonstrate an occasion wheremicro-organisms are used in the food production process.<br>• accept that micro-organisms can be used to facilitate day to day activities.<br>• accept the fact that no other organisms can exist without micro-organisms.<br><br>**Student should be able to :**<br>• describe the basic structure of the human eye with the help of models or diagrams.<br>• describe how an image is formed on the retina of the eye using diagrams.<br>• explain the importance of binocular vision and stereoscopic vision of the human through activities.<br>• state that long sightedness and short sightedness are defects of vision.<br>• explain how lenses are used to correct the defects of vision using diagrams. | 07 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • state that cataract and glaucoma are frequent complaints in the eye at present.<br>• accept that protective measures should be followed before preventing complaints in the eye.<br>• accept that protection of the eye as an important organ is momentous.<br>• describe the basic structure of the human ear using models or diagrams.<br>• state that the main functions of the ear are receiving auditory senses and maintaining balance of the body.<br>• name cochlea and semi-circular canals as the structures relevant to the major functions of the ear.<br>• state that causes leading to the complaints in the ear be prevented.<br>• becoming aware of the ranges which the ear can withstand, accepts that it is essential to protect as a sensory organ . | |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 1.3 Discloses the structure-function relationships related to the human blood | • Blood circulatory system<br>• Blood<br>  • Components<br>  • Function<br>  • Blood groups<br>  • Blood transfusion and agglutination<br>• Clotting of blood<br>• Structure of the heart<br>• Chambers of the heart, valves, walls, main arteries and veins, coronary artery.<br>• Structure of arteries, veins and capillaries | **Student should be able to;**<br>• state the components of blood and their functions.<br>• state transport and protection as the main functions of blood.<br>• state that there are four blood groups A, B, AB and O depending on the protein components contained in blood cells.<br>• classify the main blood groups further as positive and negative based on the Rhesus factor.<br>• state that blood transfusion is the transference of blood of one individual(the donor) to the body of another(the acceptor/ recipient).<br>• state that if incompatible blood types are mixed during transfision, agglutination occurs.<br>• illustrate the compatibility of blood groups in transfusion, by using a table<br>• prepare and presents a report on the qualifications of a blood donor.<br>• state that clotting of blood is an important protective event during bleeding. | 08 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • describe the structure of the human heart using diagrams or models.<br>• describe the rough structure of arteries, veins and capillaries in relation to their functions.<br>• accept that a person can claim a healthy life by maintaining the proper functioning of his/ her blood circulatory system. | |
| | 1.4 Reviews the plant growth sub-stances. circulatory system. | • Plant growth substances<br>• Auxins<br>• Cytokinins<br>• Gibberellins | **Student should be able to;**<br>• state that plants contain chemical substances which control their physiological functions.<br>• demonatrate through simple activities the effect of growth promoting substances on the growth of plants.<br>• explain the effects caused by various growth-promoting substances in plants.<br>• accept that artificial growth- substances can induce physiological effects<br>. | 06 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 1.5 Reviews the mechanical support and movements in organisms. | • Mechanical support<br>• Movement<br>  • Bone-muscle, joints<br>• Plant movements<br>  • Tropic<br>  • Nastic | **Student should be able to;**<br>• explain the movement and mechanical support of animals using bones – muscles and joints.<br>• explain support in plants.<br>• demaonatrate tropic and nastic movements of plants.<br>• appreciate the importance of in-situ conservation of plants as they are immovable unlike animals. | 07 |
| | 1.6 Explores the importance of the evolutionary process in bio-diversity | • Evolution of living organisms.<br>  • Origin of earth and life<br>  • Evolution<br>  • Evidence in support of evolution<br>  • Importance of evolution in bio-diversity | **Student should be able to;**<br>• state simply the notion about the origin of the planet Earth.<br>• state that life originated as a result of a bio-chemical process.<br>• state that evolution is the emergence of living beings at present from the simple organisms lived at the begining.<br>• describe the importance of fossils among other evidence which support evolution.<br>• demonstrate how a fossil is created using a simple activity.<br>• state that bio-diversity is a result of evolution.<br>• accept that the future of bio-diversity depends on the process of evolution. | 06 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| 2.0 Explores properties and interactions of matter with the aim of promoting quality of life. | 2.1 Reviews the nature and properties of matter | • Elements, compounds and mixtures<br>  • Elements<br>  • Atoms<br>  • Subatomic particles<br>  • Atomic number<br>  • Mass number<br>  • Compounds<br>  • Molecules<br>  • Mixtures<br>  • Homogeneous<br>  • Heterogeneous | **Student should be able to;**<br>• classify matter as pure substanes and non pure substances.<br>• state that non pure substances are mixtures.<br>• separate the components of a mixture through simple activities.<br>• identify mixtures ashomogeneous and heterogeneous by simple activities and classifies them.<br>• present examples for elements and compounds.<br>• compare the differences between elements and compounds.<br>• write symbols of a few elements.<br>• States that the building block of elements is the atom.<br>• state that atoms are composed of subatomic particles.<br>• state that electrons, protons and neutrons are the subatomic particles.<br>• state the relative masses of electrons, protons and neutrons.<br>• state the relative charges of electrons, protons and neutrons. | 15 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • identify the number of protons in the nucleus of an atom as the atomic number.<br>• illustrate using examples that atomic number is unique for a given element.<br>• state that in a neutral atom the number of protons is equal to the number of electrons.<br>• identify that mass number is the sum of the number of protons and the number of neutrons in the neucleus.<br>• state that compounds are formed by the combination of two or more elements.<br>• name the elements present in a few common compounds.<br>• indicate some commonly used compounds by their formulae.<br>• state that the properties of a compound are different from those of the constituent elements.<br>• present examples for different compounds formed by the same set of elements.<br>• state that molecule is the building unit of some compounds. | |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 2.2 Inquires into electrochemical processes. | • Electrolysis<br>  • Electrolyte<br>  • Positive electrode<br>  • Negative electrode<br>  • Acidulated water<br>  • Sodium chloride solution<br>• Electroplating<br>  • Electrolysis of copper sulphate solution.<br>  • Uses | • state that the molecules formed by the atoms of the same element are homoatomic molecules.<br>• state that the molecules formed by the atoms of different elements are heteroatomic molecules.<br>• present examples for homoatomic molecules and heteroatomic molecules.<br>• appreciate the orderly organization of matter from simple to complex in nature<br>**Student should be able to;**<br>• identify an electrolyte and an non-eletrolyte by simple activites.<br>• state that in order to conduct electricity, the electrolyte should contain mobile ions.<br>• electrolyse acidiulated water using inert (carbon) electrodes.<br>• identify and name the positive electrode, negative electrode and the electrolyte.<br>• identify by simple tests the products discharged at the respective electrodes during the electrolytic processes stated above. | 15 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • state that the splitting of a chemical substance into more simpler substances is called electrolysis.<br>• state that the constituent ions in some substances can be made mobile by melting (fusion) or dissolving in suitable solvents.<br>• demonstrate electroplating by electrolyzing a copper sulphate solution.<br>• state that the object to be electroplated should be made the negative electrode.<br>• state that a piece of metal that needs to be plated should be made the positive electrode.<br>• state that a solution containing ions of the metal that should be plated needs to be used as the electrolyte.<br>• name several instances where electroplating is used in day to day life.<br>• appreciate the application of electroplating usefully. | |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| 3.0 Utilizes various forms of energy, their interaction with matter and energy transform at by maintain in efficiency and effectiveness at an optimum level | 3.1 Identifies basic concepts related to force. | • Force<br>  • Magnitude<br>  • Point of application<br>  • Diagrammatic representation | **Student should be able to;**<br>• state that unite use to measure magnitude of force is newton (N).<br>• measure the magnitude of force correctly using the newton spring balance correctly.<br>• carry out simple activities to show that a force has a magnitude, direction and a point of application.<br>• state that force is a vector quantity.<br>• illustrate diagrammatically the magnitude, direction and the point of application of a force.<br>• accept that the point of application and direction of a force can be changed appropriately to make tasks easier in day to day life. | 05 |
| | 3.2 Utilizes the pressure exerted by solids effectively in day to day life. | • Pressure<br>• Factors affecting to pressure<br>• Unites of pressure | **Student should be able to;**<br>• explain the concept of pressure taking day to day experiences as examples.<br>• state that force and the area on which the force acts affect pressure. | 06 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • conduct appropriate activities to show that force affects the pressure exerted by a solid.<br>• conduct appropriate activites to show that the surface area on which the force acts affects pressure exerted by a solid.<br>• derive the relationship between the perpendicular force and the surface area on which the force acts for pressure.<br>• state that the unit of pressure is $N/m^2$ or $Nm^{-2}$.<br>• use pascal (Pa) as a unit of measuring pressure.<br>• solve simple problems using the relationship, Pressure = $\frac{perpendicular\ force}{The\ surface\ area\ on\ which\ the\ force\ acts}$<br>• accept that the factors affecting pressure can be appropriately changed in instances where the pressure exerted by the solid objects need to be increased or decreased. | |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 3.3 Applies effectively the prin,,ciples of reflection and refraction of rays for day to day tasks. | • Reflection of light<br>• Diffuse reflection<br>• Regular reflection<br>• Incident ray<br>• Refracted ray<br>• Normal to the point of incidence<br>• Angle of incidence<br>• Angle of reflection<br>• Laws of reflection<br>• Characteristics of the images formed by a plane mirror<br>• Ray diagrams | **Student should be able to;**<br>• carry out a simple activity to identify the incident ray, reflected ray, normal to the point of incidence, angle of incidence and angle of reflection.<br>• state laws of reflection of light.<br>• explain regular reflection using a parallel beam of light.<br>• explain diffuse reflection using a parallel beam of light.<br>• illustrate by a ray diagram how the image of a point object placed in front of a plane mirror is perceived by the eye.<br>• state that the number of images formed by an object placed between two inclined plane mirrors changes with the change in angle.<br>• create equipment using plane mirrors to make day today tasks easier.<br>• engage in simple activities to show that sound can be reflected.<br>• state that echo and reverberation are results of the reflection of sound. | 12 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | • Reflection of sound<br>  • Echo<br>  • Reverberation<br><br>• Refraction of light<br>  • Refraction at an interface<br>  • Refraction by a prism<br>  • Dispersion caused by a prism<br>  • Rainbow | • state applications of the reflection of sound.<br>• suggest methods to remove barriers for reflection of sound.<br>• carry out activities to demonstrate refraction of light.<br>• state that refraction is the change of the path of light when it enters from one transparent medium to another.<br>• provide examples for the effects caused by refraction of light.<br>• demonstrate the formation of a spectrum when light passes through a prism.<br>• state that sunlight is a mixture of seven colours.<br>• state that the rainbow is created by the dispersion of colours in sunlight. | |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 3.4 Uses simple machines effectively to facilitate day to day activities. | • Machines<br>• Simple machines<br>  • Effort<br>  • Load<br>  • Fulcrum<br>  • Effort arm, load arm<br>  • Mechanical advantage<br>  • Velocity ratio<br>  • Efficiency<br>• Levers<br>• Classes of levers<br>• Inclined plane<br>• Wheel and axel<br>• Pulleys | **Student should be able to;**<br>• explain a machine.<br>• present examples to indicate how work is facilitated by machines.<br>• state that lever, inclined plane, wheel and axle and pulleys are used as simple machines.<br>• introduce the load, effort and fulcrum of a lever by a simple activity.<br>• name the force applied on the lever as the effort, the force that is overcome by the effort as the load and the point/axis around which the effort and the load tend to rotate as the fulcrum.<br>• demonstrate through simple activities the instances where levers are used in relation to the placement of the fulcrum the effort and the load.<br>• indicate advantages in using levers belonging to different classes and examples met in day to day life for them.<br>• demonstrate through activities how levers can be used more profitably.<br>• present a simple activity to show that the inclined plane is a simple machine. | 12 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | | | • state the occasions where inclined planes are used in day to day life.<br>• show by an activity that the mechanical advantage of the inclined plane changes with the slope of the plane.<br>• show by an activity that wheel and axle is a simple machine.<br>• demaonstrate through a simple activity how wheel and axle can be used more profitably.<br>• give examples for the instances of using wheel and axle more profitably.<br>• explain through an activity that the immovable pulley is a simple machine.<br>• demonstrate the ways of coupling movable pulleys with immovable pulleys to facilitate work.<br>• present examples for the uses of pulley systems.<br>• demonstrate complex machines are created by the combination of a number of machines using an appropriate machine.<br>• appreciate the contribution of machines for the technological development entailing a comfortable life. | |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 3.5 Uses the concept of density in day to day tasks effectively. | • Density<br>• Density = mass/volume<br>• Hydrometer | **Student should be able to;**<br>• explain the relationship between the mass and volume of a liquid through an activity.<br>• introduce density as the mass per unit volume.<br>• plan activities to measure the densities of various substances.<br>• state that the unit of density is $gm^{-3}$.<br>• solve simple problems relating to density.<br>• indicate examples for the instances where the concept of density is used in the events of everyday life.<br>• create a simple hydrometer and uses it to compare the densities of various liquids.<br>• appreciate the use of the concept of density in determining the quality of various liquids and solutions. | 05 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| 4.0 Explores nature, properties and processes of earth and space by understanding natural phenomena for intelligent and sustainable utilization | 4.1 Inquries into nanotechnology and its applications. | • Nanotechnology<br>• Introduction of nanotechnology<br>• Nanometer<br>• Application of nanotechnology<br>• Future of nanotechnology. | **Student should be able to;**<br>• state that the size $10^{-9}$m is a nanometer.<br>• accept that the nanometer is a very small unit of measurement.<br>• state that nanotechnology is a process carried out using materials in the range of 1 -100 nm.<br>• present examples for nano scale natural phenomena/ processes.<br>• describe how lotus effect is brought about.<br>• describe the process happening in non – wettable clothes using the lotus effect.<br>• explain simply the adsorption process of activated carbon as another application of nanotechnology.<br>• give examples for other applications of nanotechnology.<br>• predict other possible conditions in nanotechnology in the future. | 10 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 4.2 Investigates into the prevention of accidents due to lightening. | • How lightening is caused<br>• Lightening accidents<br>  • Prevention<br>  • safety | **Student should be able to;**<br>• explain simply how clouds get electrically charged.<br>• state that lihtening occurs due to charges in the clouds get discharged in various ways.<br>• state that sudden expansion of air owing to the current generated by discharge causes thunder.<br>• state precautions that can be taken to prevent lightening accidents.<br>• describe how safety can be ensure when lightening strikes.<br>• accept that loss of lives and properties due to lightening which is a natural phenomenon can be prevented. | 08 |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 4.3 Inquires into the scientific back-ground of natural disasters. | • Natural disasters<br>• Whirl wind and stroms<br>• Earthquakes and earth tremors<br>• Tsunami<br>• Wild fires | **Student should be able to;**<br>• state that the reason for the greater tendency for some natural disasters is the increase in global warming.<br>• name a few factors affecting the increase in global warming.<br>• state that the depressions in the atmosphere is the cause for depressions whirl winds and stroms.<br>• forward a report on the losses of lives and property caused by whirl winds and storms in Sri Lanka during past 50 years.<br>• explain simply the geological factors leading to earthquakes and earth tremors.<br>• explain simply the causes leading to a tsunami states.<br>• state that the earthquakes and tsunami tend to occur along the tectonic plate margins of the Earth.<br>• present a report on the tsunami conditions emerged globally.<br>• explain simply the conditions leading to wild fires.<br>• present information about the wild fires erupted globally.<br>• Accepts that natural disasters cannot be prevented but the loss can be minimized by awareness and preparedness. | 08 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 4.4 Investigates on biodiversity | • Introduction to biodiversity<br>• Importance of biodiversity<br>• Threats to biodiversity<br>• Interactions in ecosystems<br>  • Living-living<br>  • Living –non living<br>  • Non living-non living<br>• Natural eco systems and built environment<br>• Eco systems in Sri Lanka<br>• Aquatic<br>  • Rivers<br>  • Estuaries/lagoons<br>  • Riverine<br>  • Inland waters<br>  • Ocean<br>  • Wetlands<br>• Terrestrial<br>  • Forests<br>  • Tropical rain forests<br>  • Montane forests<br>  • Dry mixed evergreen forests<br>  • Thorn bushes and scrublands<br>• Grasslands<br>  • Wet patana<br>  • Dry patana<br>  • Damana and thalawa<br>  • Villu | **Student should be able to;**<br>• conduct a simple activity to demonstrate the concept of biodiversity.<br>• state what is Bio diversity.<br>• describe the importance of Bio diversity<br>• explain threats to Bio diversity<br>• state the important features of eco systems<br>• give examples for natural and artificial ecosystems.<br>• list major eco systems in Sri Lanka<br>• state the importance and major characteristics of main eco- systems of Sri Lanka and map the locations of them.<br>• accept the importance of biodiversity for existence of our planet. | |

| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 4.5 Investigates on artificial environment and green concept | • Artificial environment<br>• Green concept<br>• Agriculture<br>  • Organic farming<br>  • Water management<br>  • Land management<br>  • Post harvesting technology<br>• Industrial processes<br>  • Usage of chemicals<br>  • Construction<br>  • Green transportation | **Student should be able to :**<br>• explain simply about artificial environment and green concept.<br>• describe the importance of using organic fertilizers over the inorganic fertilizers.<br>• prepare a report on the traditional agricultural methods that can be used to control pests.<br>• discuss the importance of correct water management in farming.<br>• describe the importance of maximum use of cultivated lands in farming related to reducing forest cover.<br>• state scientific basis of using mixed crop farming and agricultural land management.<br>• state the harmful effects of using chemicals in food production, food transportation, food storage and food preservation.<br>• state the importance of using post harvest technology in food security to minimize waste of foods.<br>• tabulate the chemicals used in industries and their harmful effects on environment.<br>• describe the importance of disposal of chemicals used in industries in a safe way. | 08 |





| Competency | Competency level | Contents | Outcomes | Time (Periods) |
|---|---|---|---|---|
| | 4.6 Identification of natural resource distribution and sustainable use of natural resources. | • Natural resources<br>  • Water<br>  • Minerals and rocks (gems)<br>  • Plants<br>  • Wood<br>• Sustainable use of natural resources<br>  • Importance<br>• Strategies | • state the importance of construction of environment friendly building in relation to power saving.<br>• appreciate the use of green transportation.<br><br>**Student should be able to;**<br>• explain briefly about natural resources.<br>• explain simply sustainable use of water. (using rain water harvesting)<br>• state available methods used to extract minerals from soil.<br>• explain characteristic features of gems.<br>• present unique characteristics of different types of gems.<br>• present a report about adverse effects caused to the environment and to the human due to gem mining industry.<br>• give examples of plants for various uses of them as natural resources.<br>• collect and present information of different types of wood in Sri Lanka and their specific uses.<br>• explain scientific basis of wood decomposition<br>• list out the methods used to prevent wood decomposition.<br>• accept the importance of sustainable use of natural resources. | 05 |

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

**Competency Level 1.1** : **Investigate the application of micro-organisms.**

**Number of periods** : 12

**Learning outcomes** :

**At the end of the lesson the student should be able to** :

- group micro-organisms by observing characteristics as bacteria, fungi, protozoans and algae giving examples.
- identify viruses as a group in between the living and non-living.
- state that viruses multiply only inside living cells and are devoid of a cellular organization.
- state that unicellular and multicellular micro-organisms are found within the groups of micro-organsms.
- state that micro-organisms can live even under the extreme environmental conditions.
- name meat, fish,fruits, human skin, mouth, alimentary canal, reproductive organs and soil as the specific substrates in which micro-organisms grow.
- observe microbial growth on selected substrates through teacher demonstration.
- describe how various micro-organisms are used in activities carried out for economic gain and research(agriculture, medicine, industries)
- state that micro-organisms are employed in environmental conservation (decomposition of oil spilled on oceanic waters, absorption of heavy metals, recycling of plastics.)
- state diseases, food spoilage and use of micro-organisms as bio chemical weapons as unfavorable effects of micro-organisms.
- demonstrate an occasion where micro-organisms are used in the food production process.
- accept that micro-organisms can be used to facilitate day to day activities.
- accept the fact that no other organisms can exist without micro-organisms.

**Instructions to plan the lesson:**

- Display pictures, specimens or video tapes of bacteria, fungi, protozoa, algae and viruses. Let the students observe the characteristics of each group and identity.
- Explain that viruses have living and non living characteristics.





- Get the students to observe instances in which the micro-organisms have had their involvement such as spoilt fruits and milk a mouldy piece of bread, compost, coconut water fermented with yeast, yoghurt, curd and vinegar.
- Let the students see pictures or video clips depicting diseases caused by micro-organisms and instances where micro-organisms are used in industrial applications and production of medicines.
- Direct the students to collect information about the events in which micro-organisms are used in day to day life and the group of micro-organism used in such instances.
- Explain through diagrams/ video clips how micro-organisms are used in production of food, production of drugs, agriculture and environmental conservation.
- Discuss with students about the unfavorable effects of micro-organisms such as causing of diseases, food spoilage and production of bio-chemical weapons.
- Get the students to demonstrate the production of a product using micro-organisms.

**Key words/Concepts**

- Micro-organisms
- Fungi
- Algae
- Extreme environmental conditions
- Recycling
- Bacteria
- Protozoa
- Viruses
- Substrate
- Bio-chemical weapons

**Quality inputs**

- Optical microscope
- Spoilt vegetables, fruits, milk
- Mouldy bread
- Compost
- Coconut water fermented by yeast
- Curd
- Vinegar

- Pictures or videos of micro-organisms
- Pictures or video clips of diseases caused by micro-organisms
- Pictures or video clips showing the activity of a virus
- Materials needed for the microbial product.

**Instructions for assessment and evaluation**

- Get the students groups to demonstrate production of a product using micro-organisms and evaluate using the following criteria.
  - Usage of correct methods.
  - Usage of methods for protection
  - Time management
  - Collaborative work
- Make a booklet or a power point presentation about favorable and unfavorable effects of micro-organisms.
- Evaluate the above using following criteria.
  * Adequacy of facts
  * Accuracy of facts
  * Finish





**Competency Level 1.2 : Investigates eye and ear as sense organs.**

**Number of periods : 07**

**Learning outcomes :**

At the end of the lesson the student should be able to:

- describe the basic structure of the human eye with the help of models or diagrams.
- describe how an image is formed on the retina of the eye using diagrams.
- explain the importance of binocular vision and stereoscopic vision of the human through activities.
- state that long sightedness and short sightedness are defects of vision.
- explain how lenses are used to correct the defects of vision.
- state that cataract and glucoma are currently common eye disorders.
- accept that protective measures should be followed to prevent disorders.
- accept that eye is an important organ which should be protected.
- describe the basic structure of the human ear using models or diagrams.
- state that the main functions of the ear are receiving auditory senses and maintaining the balance of the body.
- name cochlea and semi-circular canals as the structures relevant to the major functions of the ear.
- state that causes leading to the disorders of the ear can be prevented.
- becoming aware of the ranges which the ear can withstand, accept that it is essential to protect as a sensory organ.

**Instructions to plan the lesson:**

- Introduce the parts of the eye using a diagram or a model.
- Explain how an image of an object is formed on the retina of the eye by using a pin hole camera.
- Instruct students to lable a diagram of the human eye.
- Instruct to show that convex lenses converge light and concave lenses diverge light.
- State that the lens in the human eye is a convex lens.
- Using a ray diagram show how an image is formed on the retina of the human eye.
- Discuss the characteristics of the image formed on the retina (compare with the results obtained by the pin hole camera).
- Discuss reasons for the defects of vision.
- Explain how lenses can be used to correct the visual defects of a defective eye.

- Let the students draw ray diagrams to show the formation of images in a defective eye and to indicate image formation after wearing lenses.
- Explain the binocular vision of the human through a simple activity.
- Explain the importance of the stereoscopic vision of the human through a simple activity.
- State cataract and glaucoma as the most frequent disorders in the eye at present.
- Conduct a discussion about cataract and glucoma.
- Emphasize that precautions should be taken to prevent disorders in the eye

(Follow medical advice when wearing spectacles and sun glasses.)

- Conduct a discussion to affirm that eye is important as a sense organ.
- Describe the structure of the ear using a model or a labeled diagram of the ear.
- Tie a sheet balloon to the mouth of a thistle funnel. Make an arrangement to see the vibration of the membrane when a vibrated tuning fork is brought closer to the open end of the thistle funnel.
- Based on the above activity, describe how the tympanic membrane vibrates.
- Explain that the main function of the ear is receiving the auditory sensations of hearing and cochlea contributes to it.
- Lead a discussion on the disorders of the ear (deafness, impaired hearing, and hardening of ossicles).
- State information about the range of sound waves which the human ear can tolerate.
- Conduct a discussion to stress the need of protecting the ear (reframing from loud sounds, bathing in deep waters, inserting foreign objects into the ear).
- Direct the students to prepare 10 short question on eye and the ear.

**Key words/ Concepts**

- Retina
- Long sightedness
- Short sightedness
- Binocular vision
- Stereoscopic vision
- Tympanic membrane
- Cochlea





**Instructions for assessment and evaluation**

- Conduct a quiz between two groups of students.
  - Accuracy of questions
  - Objectivity of questions
  - Accuracy of answers
  - Presentation skills
  - Working with team spirit
  - abiding by rules

**Competency 1.3 : Discovers the structure-function relationships related to the human circulatery system**

**Number of periods : 09**

**Learning outcomes :**

At the end of the lesson student should be able to;

- state transport and protection as the main functions of blood.
- state the components of blood and their functions.
- state that there are four blood groups A, B, AB and O depending on the protein components contained in blood cells.
- classify the main blood groups further as positive and negative, based on the Rhesus factor.
- state that blood transfusion is the transference of blood of one individual(the donor) to the body of another(the acceptor/recipient).
- state that if incompatible blood types are mixed during transfusion, agglutination occurs.
- illustrate the compatibility of blood groups in transfusion by using a table.
- present a report on the qualifications of a blood donor.
- state that clotting of blood is an important protective measure during bleeding.
- describe the structure of the human heart using diagrams or models.
- describe the rough structure of arteries, veins and capillaries in relation to their functions.
- accept that a person can claim a healthy life by maintaining the proper functioning of his/her blood circulatory system.

**Instructions to plan the lesson :**

- Introduce the parts of heart using a model/ diagram of the human heart.
- Get the students to construct a model that shows the functioning of heart.
- Demonstrate how blood circulates in arteries and veins using a model of the heart.
- Explain the part played by arteries and vein in blood circulation.
- List the main differences between arteries and veins.
- Explain the structure and function of blood capillaries.
- Conduct a discussion about the substances transported by blood
- Initiate a discussion with what students know about blood and introduce the main components of blood.
- Explain the functions of the components of blood.
- Explain how blood platelets contribute for the protective functions of blood.
- State that blood is classified into four groups according to proteins it contains and these are further divided as positive and negative according to the Rhesus factor.





- Introduce blood transfusion and present a table showing the blood groups that are compatible in blood transfusion.
- Discuss the instances where blood transfusion needs to be done.
- Prepare a list of qualifications a donor should have for blood transfusion.
- Prepare a report on good health habits that should be followed to maintain the blood circulatory system properly.

**Key words/ Concept**

- Blood groups
- Blood transfusion
- Donor
- Rhesus factor
- Agglutination

**Instructions for assessments and evaluation**

- Instruct students to construct a model of the human heart.Use suitable criteria for evaluation.
- Direct the students to prepare a report on the facts to which attention is drawn during an examination of a blood sample and the qualification of a donor for blood transfusion. Evaluate it on following criteria.
  - Use of correct information
  - Reporting information correctly

**Competency level 1.4 : Investigates the plant growth substances.**

**Number of periods : 04**

**Learning outcomes**

At the end of the lesson student should be able to;

- state that plants contain chemical substances which control their physiological functions.
- demonstrate through simple activities the effect of growth promoting substances on the growth of plants.
- explain the effects caused by various plant growth-promoting substances in plants.
- accept that artificial growth substances can induce physiological effects.

**Instructions to plan the lesson :**

- Take two similar potted plants and remove the apex of them. Let students observe how the two plants grow (Do this activity about two weeks before starting the teaching learning process related to the relevant competency level).
- Explain through examples that the reason for the difference in growth of the two plants is the effect of growth substances produced in the apex of the plants.
- Instruct students to plan an activity to show that plants shoots show positive phototropic movements ( This activity too has to be arranged about a week before the lesson).
- Based on the observations of the activity conducted to show the positive phototropism of shoots, initiate a discussion to highlight that it is affected by plant growth promoting substances produced in the apex.
- Let the students observe the ends of a petiole of a leaf fallen naturally after its life span and a growing leaf plucked from a tree. Do the same for fruits. Explain that growth substances have their influence on physiological processes such as falling of dead leaves and ripening of fruits.
- On the basis of the above observations explain that physiological processes in plants occur under the influence of the growth promoting substances produced in the plant.
- Elaborate that growth promoting substances are organic substances which are produced by higher plants and control some physiological processes in the plant.
- Explain the sites of plants in which plant growth substances are produced, their types and effects.





- Introduce that many plant growth substances have been produced artificially, and are used in agriculture. Let the students tabulate the uses of artificial plant growth substances.
- Engage students in activities such as inducing fast growth of roots in plant cuttings using artificial growth regulators. From them let the students have an experience about the use of artificial growth substances.
- Discuss that, in crop cultivation the yield can be increased by using artificial growth substances.Further, plant growth substances can be used as weedicides.
- Organize a feild visit to a plant nursary using plant growth substances.

**Key words/ Concepts**

- Growth substances
- Cytokinin
- IAA
- Auxins
- IBA
- Gibberelins

**Quality inputs**

- Artificial growth substances purchased from the market
- Leaflets/ videos showing the effects of growth substances

**Instructions for assessments and evaluation**

- Direct the students to induce root growth in plant cuttings using plant growth substances.
  - Engaging in activities according to instructions
  - Reporting observation correctly

**Competency level 1.5 : Investigates the mechanical support and movements in organisms.**

**Number of periods : 07**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain the movement and support of animals using bones – muscles and joints.
- name appendages used by animals for locomotion.
- explain support in plants
- demonstrate tropic and nastic movements of plants.
- appreciate the importance of in-situ conservation of plants as they are immovable unlike animals.

**Instructions to plan the lesson :**

- Let the students observe the methods of locomotion of snail, earthworm, prawn, a snake, frog, a bird a fish and man. Use specimens/ video clips with animation for this.
- Let the students tabulate the appendages or parts used for movement and their parts.
- By observing the living specimens (e. g. earthworm, prawn, frog etc.) make students understand that those animals have internal tissues or structures to maintain the shape of the body and for locomotion.
- Tabulate the appendages or parts that help locomotion of the animals given as examples.
- Referring to the table explain how rigidity and stability of the body of a living organism is brought about by mechanical support.
- Demonstrate using a set up of apparatus the need of a skeleton for the movements executed by muscles. e. g. Bending and straightening arm at the elbow joint.
- Get the students to collect examples about the movements taking place in plants.
- Explain that a plant is mechanically supported due to water present in the stem and deposition of various substances.
- Explain nastic and tropic movements in plants using examples (blooming of lowers and sleeping movement in mimosa plants).
- Let the students observe tropic and nastic movements by simple experiments.
- Explain in-situ conversation with examples.
- Taking examples from the environment, explain the importance of in situ convesation of plants.
- Give examples to show the importance of in-situ conservation of plants.





**Key words/ Concepts**

- Nastic movements
- Tropic movements
- In-situ conservation

**Quality inputs**

- Living specimens/diagrams or videos of snail, earthworm, prawn, snake, toad, bird and fish.
- Models showing the movements of bones and muscles.
- A vessel containing soil, mustard seeds, germinated green gram seeds a plank of wood, pins, cotton wool, perforated black cone (to demonstrate phototropic and geotropic movements)

**Instructions for assessments and evaluation**

- Assign groups of students to set up apparatus to demonstrate the movements of plants and animals and evaluate them using following criteria.
  - Creativity
  - Accuracy
  - Cooperation within the groups
  - Explaining the working of the set up correctly.

**Competency level 1.6 : Explores the importance of the evolutionary process in bio-diversity**

**Number of periods : 06**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- state simply the notion about the origin of the planet Earth.
- state that life originated as a result of a bio-chemical process.
- state that evolution is the emergence of living beings at present from the simple organisms lived at the begining.
- describe the importance of fossils among other evidence which support evolution.
- demonstrate how a fossil is created using a simple activity.
- state that bio-diversity is a result of evolution.
- investigate the major stages of human evolution and the supporting evidence from SriLanka

**Instructions to plan the lesson :**

- Conduct a discussion about the origin of Earth.
- State that it is believed that the earth had its origin about five billion years ago.
- State that it is believed, living beings had their origin the earth, about four billion years ago .
- Introduce the theory of creation and explain the reason for its rejection.
- State that the presently accepted theory is that in the early earth, first unicelluar organisms were born. Those being subjected to change over a long period of time, the present diversity emerged.
- Explain that the origin of life occurred in the ocean first giving rise to simple unicellular organisms. With the passage of a long period of time multicellular organisms emerged from the unicellular organisms and specialization of tissues, organs and systems in multicellular oranisms produced the present forms of living beings.
- State this systematic progress from initial simple organisms to present diversity of life as evalution.
- Initiate a brainstorning on the bio-diversity prevailing on the earth today occured.
- Say that a fossil is a living organism or a part of a living organism preserved in some way or the marks or foot prints left by them.
- Direct the students to create a fossil by using kaolin or another type of clay on a plant leaf/oyster shell.
- Display pictures to show different types of fossils.
- State that dragon fly, coelocanth, nautilus and lung fish are examples for living fossils.





- State that the report of fossils about most of the organisms is incomeplete. Say that fossil evidences are like a story book with torn pages. Nevertheless the evalution horse is portrayed by fossils.
- Stage that te future bio-diversity is decided as a result of evolution.

**Key words/ Concepts**

- Special theory of creation
- Theory of spontaneous generation
- Evolution
- Fossils

**Quality inputs**

- Clay
- Diagrams of fossils
- Fossil diagrams showing the evalution of horse

**Instructions for assessments and evaluation**

- Assign as a group activity to prepare an article for a wall paper on one of the following topics origin of life, origin of universe, fossils and bio-diversity. Evaluate them on following criteria.
  - Adequacy of facts
  - Accuracy of facts
  - Finish
  - Attractinvness
  - Solution of sources

**Competency level 2.0 : Explores properties and interactions of matter with the aim of promoting quality of life.**

**Competency level 2.1 : Reviews the nature and properties of matter**

**Number of periods : 15**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- classify matter as pure substanes and non pure substances.
- state that non pure substances are mixtures.
- separate the components of a mixture through simple activities.
- Identify mixtures ashomogeneous and heterogeneous by simple activities and classifies them.
- present examples for elements and compounds.
- compare the differences between elements and compounds.
- write symbols of a few elements.
- state that the building block of elements is the atom.
- state that atoms are composed of subatomic particles.
- state that electrons, protons and neutrons are the subatomic particles.
- state the relative masses of electrons, protons and neutrons.
- state the relative charges of electrons, protons and neutrons.
- identify the number of protons in the nucleus of an atom as the atomic number.
- illustrate using examples that atomic number is unique for a given element.
- state that in a neutral atom the number of protons is equal to the number of electrons.
- identify that mass number is the sum of the number of protons and the number of neutrons in the neucleus.
- state that compounds are formed by the combination of two or more elements.
- name the elements present in a few common compounds.
- indicate some commonly used compounds by their formulae.
- state that the properties of a compound are different from those of the constituent elements.
- present examples for different compounds formed by the same set of elements.
- state that molecule is the building unit of some compounds.
- state that the molecules formed by the atoms of the same element are homoatomic molecules.
- state that the molecules formed by the atoms of different elements are heteroatomic molecules.
- present examples for homoatomic molecules and heteroatomic molecules. Appreciates the orderly organization of matter from simple to complex in nature





**Instruction to plan the lesson :**

- Initiate a discussion about the ways of classifying substances in the environment.
- Let the students classify substances as pure and non pure according to the components they contain.
- Name the non pure substances identified by students the mixtures.
- Give the mixtures prepared by mixting pairs of substances to students and left them separate the components.
- Based on the above activity, conduct a discussion about the characteristics of a mixture.

  e.g.
  - suger and sand
  - iron and sulphur
  - wheat flour and water
  - salt and water
  - rice and sand
  - chaft and pieces of rock
- Give students a mixture of chalk power and water and a salt mixture of salt and water. Get the students to identify the differences between them by observation.
- Direct the students to distinguish the homogeneous and hetergeneous mixtures met in everyday life.
- Explain with examples that elements and componds are considered pure substances.
- Explain that atom is the building unit of an element and electrons, protons and neutrons are its subatomic partides.
- Get the students to make models of the atom using suitable materials and describe the location of the subatomic particles in it.
- Define atomic number and mass number.
- Let students tabulate the number of protons, electrons and neutrons in elements of given atomic number and mass number.
- Build up a discussion to emphasize the relative charge and relative mass of subatomic particles.
- Explain that an atom is neutral because its number of protons is equal to the number of electrons.
- State that a molecule is formed by the combination of two or more atoms.
- Using examples explain that homoatomic molecules are formed by the same kind of atoms.
- Some elements exist in nature as homoatomic molecules.

  e.g. $H_2$, $O_2$, $N_2$, $Cl_2$

- Using examples explain that the molecules formed by the combination of sevaral elements are called heteroatomic molecules
  e. g. $CH_4$, $NH_3$, $CO_2$, $H_2O$
- Inustrate with examples that there are different compounds formed by the same set of elements
  eg. glucose and sucrose.

**Key words/ Concept**

- Homogeneous mixtures
- Components
- Subatomic partides
- Neutrons
- Atomic number
- Molecule
- Heteroatomic molecules
- Heterogeneous mixtures
- Atom
- Proton
- Electron
- Mass number
- Homoatomic molecules

**Quality input**

- Models/ diagrams of show the structure of the atom.
- Elements and compounds avilable in the laboratory some compounds used at home.
- Iron filings, chalk, sand, chaff, pieces of rock
- Solt powder
- Beakers or suitable containers.

**Instructions for assessments and evaluation**

- When engaged in the construction of atomic modles using various materials, evaluate the stdents using following criteria.
- Use of suitable materials
- Creativity
- Accuracy
- Clealiness in the work station





**Competency level 2.2 : Inquires into electrochemical processes.**

**Number of periods : 15**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- identify an electrolyte and a non-eletrolyte by simple activites.
- state that in order to conduct electricity, the electrolyte should contain mobile ions.
- electrolyse acidiulated water using inert (carbon) electrodes.
- identify and name the positive electrode, negative electrode and the electrolyte.
- identify by simple tests the products discharged at the respective electrodes during the electrolytic processes stated above.
- state that the splitting of a chemical substance into more simpler substances is called electrolysis.
- state that the constituent ions in some substances can be made mobile by melting (fusion) or dissolving in suitable solvents.
- demonstrate electroplating by electrolyzing a copper sulphate solution.
- state that the object to be electroplated should be made the negative electrode.
- state that a piece of metal that needs to be plated should be made the positive electrode.
- state that a solution containing ions of the metal that should be plated needs to be used as the electrolyte.
- name several instances where electroplating is used in day to day life.
- appreciate the application of electroplating usefully.

**Instruction to plan the lesson :**

- Help students plan activities to identity which of the following liquids/
- solutions conduct elecricity.( kerosene, salt solution, acidulated water, copper sulphate solution)
- Give instructions to tabulate the observations obtained in each activity.
- Hence explain that the liquids/ solutions which conduct electricity are electrolytes and which do not conduct electricity are non electrolytes.
- Introduce as electrodes the conductors through which the eletric current enters the electrolyte and leaves the electrolyte.
- Explain that the electrode connected to the positive terminal of the direct current supply is the positive electrode and the electrode connected to the negative terminal is the negative electrode.
- Let the students use inert electrodes or the electrodes that do not react with electrolyte in electrolysis.

- Through observations, explain that a chemical reaction occurs near the electrodes during electrolysis.
- Explain that electrolysis is the separation of the components of a liquid/ solution by an electric current.
- Get the students to collect the gases liberated when acidulated water is electrolysed.
- State that when acidulated water is elecrolysed oxygen gas is liberated at the positive electrode and hydrogen gas is liberated at the negative electrode.
- Let the students electrolyse an aqueous solution of copper sulphate using carbon electrodes and note what is observed at the electrodes.
- Direct the students to use a key/ nail as the negative electrode, a clean copper plate as the positive electrode and an aqueous solution of copper sulphate as the electrolyte and electroplate copper on the key/nail.
- Explain what is electroplating.
- Explain that, during electrolysis the metal that should be plated should be used as the possitive electrode.
- State that during electrolysis an aqueous solution of a salt of the metal that should be plated needs to be used.
- Conduct a discussion on the conditions which should be maintained to carry out electroplating optimally.
- Direct the students to collect information about the applications of elecroplating.

**Key words/ Concepts**

- Electrolytes
- Electrolysis
- Negative electrode
- Acidulated water
- Non electrolytes
- Positiue electrode
- Discharge of ions
- Electroplating

**Quality inputs**

- Carbon roads
- Copper sulphate
- Kerosene
- Dry cells
- 1.5v LEDs
- Voltameters
- Salt
- Dilute sulphuric acid
- Cell holders
- Connecting wire

**Instructions for assessments and evaluation**

- Assess the students while engaged in the electrolysis activity using the following criteria
  - Arranging the circuit corectly
  - Reporting the observations correctly
  - Achieving the descred results
  - Keeping the work station clean





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

**Competency level 3.1 : Identifies basic concepts related to force.**

**Number of periods : 05**

**Learning outcomes :**

At the end of the lesson student should be able to;

- state that unite use to measure magnitude of force is newton (N).
- measure the magnitude of force correctly using the newton spring balance correctly.
- carry out simple activities to show that a force has a magnitude, direction and a point of application.
- state that force is a vector quantity.
- illustrate diagrammatically the magnitude, direction and the point of application of a force.
- accept that the point of application and direction of a force can be changed appropriately to make tasks easier in day to day life.

**Instruction to plan the lesson :**

- Using Newton spring balance correctly, demonstrate to students how to obtain readings correctly.
- Let students measure the weight of several objects using Newton spring balance.
- Direct students to engage in simple activities to show that a force has a magnitude, direction and a point of application.
- Explain through simple activities such as pulling and pushing a table that point of application and direction of a force should be appropriately use to facilitate day to day work.

**Key words/ Concepts:**

- Vector quantity
- Point of application

**Qulity inputs:**

- Newton spring balance

**Instructions for assessments and evaluation**

- Using given data evaluate the ability of representing force diagrammatically under the following criteria.
  - Accuracy of the diagram drawn
  - Recording force with correct units
- Evaluate the ability of describing the magnitude and direction of a force using a chart of forces given.

**Competency level 3.2 : Utilizes the pressure exerted by solids effectively in day to day life.**

**Number of periods : 06**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain the concept of pressure taking day to day experiences as examples.
- state that force and the area on which the force acts affect pressure.
- conduct appropriate activities to show that force affects the pressure exerted by a solid.
- conduct appropriate activites to show that the surface area on which the force acts affects pressure exerted by a solid.
- derive the relationship between the perpendicular force and the surface area on which the force acts for pressure.
- state that the unit of pressure is $N/m^2$ or $Nm^{-2}$.
- use pascal (Pa) as a unit of measuring pressure.
- solve simple problems using the relationship,

$$\text{Pressure} = \frac{\text{perpendicular force}}{\text{The surface area on which the force acts}}$$

- accept that the factors affecting pressure can be appropriately changed in instances where the pressure exerted by the solid objects need to be increased or decreased.

**Instruction to plan the lesson :**

- Using day to day examples explain that solid objects exert a pressure on the surfaces on which they are kept.
- Engage students in suitable activities and show through a discussion that force affects pressure.
- Involve students in activities to discover that the pressure exerted by the same force is different when act it on surfaces of different area using a regular object with surfaces of different areas.
- Conduct a discussion to highlight that pressure is the force exerted on unit area.
- Present the relationship pressure (P) = $\frac{\text{Force (F)}}{\text{Area (A)}}$
- Recall that standard unit of force is newton (N) and the standard unit of area is square metre. Explain that the standard unit of pressure is newton per square metre ( $Nm^{-2}$).





- Introduce newton per square metre as the pascal (Pa)
- Get students to solve simple problem using the relationship P = F/A.
- Discuss with students instances in day to day life where pressure is increased or decreased as required by changing force (F) and area (A).

**Key words/ Concepts:**

- Pressure
- Pascal

**Quality inputs:**

- Various regular solids
- sets of weights
- Piceces of sponge

**Instructions for assessments and evaluation**

- Assess the students while they are engaged in activities on the basic of following criteria.
  - Active participation in group work
  - Recording observations
  - Actively participating in the discussion
- Give students simple problems on pressure as exercises and evaluate them

**Competency level 3.3 : Applies effectively the principles of reflection and refraction of rays for day to day tasks.**

**Number of periods : 12**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- carry out a simple activity to identify the incident ray, reflected ray, normal to the point of incidence, angle of incidence and angle of reflection.
- state laws of reflection of light.
- explain regular reflection using a parallel beam of light.
- explain diffuse reflection using a parallel beam of light.
- illustrate by a ray diagram how the image of a point object placed in front of a plane mirror is perceived by the eye.
- state that the number of images formed by an object placed between two inclined plane mirrors changes with the change in angle.
- create equipment using plane mirrors to make day today tasks easier.
- engage in simple activities to show that sound can be reflected.
- state that echo and reverberation are results of the reflection of sound.
- state applications of the reflection of sound.
- suggest methods to remove barriers for reflection of sound.
- carry out activities to demonstrate refraction of light.
- state that refraction is the change of the path of light when it enters from one transparent medium to another.
- provide examples for the effects caused by refraction of light.
- demonstrate the formation of a spectrum when light passes through a prism.
- state that sunlight is a mixture of seven colours.
- state that the rainbow is created by the dispersion of colours in sunlight.

**Instruction to plan the lesson :**

- Introduce quantities related to reflection through a simple activity using a plane mirror, a wooden panel, a while paper, holders, sunlight and a torch
- Introduce laws of reflection using quantities related to reflection.
- Explain regular reflection and diffuse reflection using suitable activities and ray diagrams.
- Direct students to make equipment such as the periscope and kaleidoscope and test them.
- Let students observe the image of a letter kept in front of a plane mirror placed vertically close to it and explain the characterristics of the image (Location, size, nature, lateral invertion).
- Demonstrate refraction of light using a glass block, a vessel of water, a torch and a narrow beam of light.





- Explain refraction of light using those observations.
- Explain that apparent depth is an effect of refraction of light.
- Demonstrate the formation of a spectrum when white light passes through a prism.
- Illustrate by diagrams how sunlight is subject to two refractions and an internal reflection resulting in dispersion and creating a rainbow.
- Direct the students to depict by ray diagrams how the image of a point object placed in front of a plane mirror is formed.
- Demonstrate reflection of sound using a source of sound such as a mechanical clock that emits a very soft sound.
- Lead a discussion to explain echo and reverberation in the light of experiences.
- Introduce instances in which reflection of sound is used by way of examples.
- Discuss using examples and in the light of experience in day to day life the methods used to remove obstructions caused by reflection of sound ( in cinemas, Lecture theatres etc.)

**Key words/ Concepts:**

- Reflection, regular reflection, diffuse reflection, incident ray, refracted ray, normal, angle of incidence, angle of reflection, laterral inversion, periscope, kallidoscope
- Refraction of light, dispersion, spectrum, rainbow, incident ray, refracted ray
- Echo, reverberation

**Quality inputs:**

- Plane mirrors, stands, a small laser torch, rubber bands
- A glass block, a vessel of water soap, an electric torch, a glass prism ($60^0$, $60^0$, $60^0$ ), a piece of cardboard
- A mechanical table clock, two pieces of PVC pipes (length about 30 cm, diameter 2.5 cm), a smooth piece of metal, stand

**Instructions for assessments and evaluation**

- Examine knowledge by a written test.
- Assess students using following criteria.
  - Correct observation
  - Active participation for discussions
- Assess the students while engaged in the activities using following criteria.
  - Mainpulating equipment correctly
  - Drawing ray diagrams correctly
  - Functioning of the products
- Assess the students using following criteria.
  - Active participation for discussions
  - Presenting daily life experrience creatively

**Competency level 3.4 : Uses simple machines effectively to facilitate day to day activities.**

**Number of periods : 12**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain a machine.
- present examples to indicate how work is facilitated by machines.
- state that lever, inclined plane, wheel and axle and pulleys are used as simple machines.
- introduce the load, effort and fulcrum of a lever by a simple activity.
- name the force applied on the lever as the effort, the force that is overcome by the effort as the load and the point/axis around which the effort and the load tend to rotate as the fulcrum.
- demonstrate through simple activities the instances where levers are used in relation to the placement of the fulcrum the effort and the load.
- indicate advantages in using levers belonging to different classes and examples met in day to day life for them.
- demonstrate through activities how levers can be used more profitably.
- present a simple activity to show that the inclined plane is a simple machine.
- state the occasions where inclined planes are used in day to day life.
- show by an activity that the mechanical advantage of the inclined plane changes with the slope of the plane.
- show by an activity that wheel and axle is a simple machine.
- demaonstrate through a simple activity how wheel and axle can be used more profitably.
- give examples for the instances of using wheel and axle more profitably.
- explain through an activity that the immovable pulley is a simple machine.
- demonstrate the ways of coupling movable pulleys with immovable pulleys to facilitate work.
- present examples for the uses of pulley systems.
- demonstrate complex machines are created by the combination of a number of machines using an appropriate machine.
- appreciate the contribution of mashines for the technological development entailing a comfortable life.

**Instruction to plan the lesson :**

- Introduce machines as equipment used to facilitate work.
- Taking an equipment such as the bicycle as an example, discuss the devices used in them to facilitate work.
- Introduce levers, inclined plane, wheel and axle and pully as simple machines.
- Let students observe several simple machines belonging to the class of levers.





- Introduce the force that is exerted on the lever as the effort, the force that is overcome by the effort as the load and the point around which the effort and the load tend to rotate as the fulcrum.
- Introduce threee classes of levers according to the positioning of the effort, load and fulcram.
- Guide students to list instances in which each type of levers is used. In the light of them discuss the advantage of the use of each type of levers.
- Introduce effort arm and load arm.
- Introduce the terms mechanical advantage, velocity ratio and efficiency relating to a lever and involve students in a few calculations.
- Present an activity to introduce inclined planl as a machine.
- Discuss instances where the inclineds plane is used in day to day life.
- Demonstrate by way of a simple activity that the mechanical advantage of the inclined plane change with its slope.
- Introduce wheel and axle as a simple machine.
- Discuss instances where wheel and axle is used in day to day life.
- Introduce pulley as a simple machine.
- Discuss instances where pulley is used in everyday life and illustrate them with diagrams.
- Using a suitable machine demonstrate that complex machines are formed by the combination of many simple machines.
- Direct student to work out simple calculations relating to machines.

**Key words/ Concepts:**

- Machine, simple machine, laver, inclined planl, pyney, wheel and axle, effort, load, fulcrum, mechanical advantage, velocity ratio, efficiency, immovable pulley, effort arm, load arm

**Quality inputs:**

- Pair of scissots, hammer, pulley, box of weights, twine, scale pans, inclined plane

**Instructions for assessments and evaluation:**

- While engaged in activities, assessthe students according to following criteria.
  - Participation for observation
  - Accuracy of observation
  - Recording observations
  - Presentation skills
- Evaluate the students by written tests.

**Competency level 3.5 : Uses the concept of density in day to day tasks effectively.**

**Number of periods : 05**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain the relationship between the mass and volume of a liquid through an activity.
- introduce density as the mass per unit volume.
- plan activities to measure the densities of various substances.
- state that the unit of density is $gm^{-3}$.
- solve simple problems relating to density.
- indicate examples for the instances where the concept of density is used in the events of everyday life.
- create a simple hydrometer and uses it to compare the densities of various liquids.
- appreciate the use of the concept of density in determining the quality of various liquids and solutions.

**Instruction to plan the lesson :**

- Direct students to measure the mass of different volumes of water and compare the mass to volume ratio in eac case.
- State that density = $\frac{\text{mass (give the formula P= m/v)}}{\text{volume}}$
- State that the SI unit of density is kg $m^{-3}$.
- Direct the students to measure the mass of equal volumes of different liquids and cmpare their densities.
- Let students solve simple problems on density.
- State that hydrorneter can be used to measure the density of a liquid.
- Discuss about the hydrometers used to measure the density of various solutions.
- Get the students to make a simple hydrometer and compare the density of various liquids/ solutions.
- State that density can be used to indicate the quality of various liquids and solutions.

**Key words/ Concepts:**

- Density, hydrometer

**Quality inputs:**

- Coconut oil, kevosene, measuring cylinder, beakers, balance, different hydrometers





**Instructions for assessments and evaluation:**

- Asses students during practical activities using following criteria.
  - Obtaining correct measurements
  - Recording
  - Numerical calculations
- In group activities evaluvate cooperation and cleanliness.
- Evaluvate students by written tests.
- Assess the students while engaged in the electrolysis activity using the following criteria
  - Arranging the circuit corectly
  - Reporting the observations correctly
  - Achieving the descred results
  - Keeping the work station clean

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

**Competency level 4.1 : Inquries into nanotechnology and its applications.**

**Number of periods : 07**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- state that the size $10^{-9}$m is a nanometer.
- accept that the nanometer is a very small unit of measurement.
- state that nanotechnology is a process carried out using materials in the range of 1 -100 nm.
- present examples for nano scale natural phenomena/ processes.
- describe how lotus effect is brought about.
- describe the process happening in non – wettable clothes using the lotus effect.
- explain simply the adsorption process of activated carbon as another application of nanotechnology.
- give examples for other applications of nanotechnology.
- predict other possible conditions in nanotechnology in the future.

**Instructions to plan the lesson :**

- Let the students wet a lotus leaf and various other leaves in the environment and observe the nature of retention of water on them. Get them to nature of retention of water on them. Get them to report their obserations.
- Introduce that the phenomenon of non retention of water on a lotus leaf is called the lotus effect and it is a natural phenomenon related to the nano scale.
- State that the prefix nano designates $10^{-9}$
- Explain that a nano metre is one biellionth of a metre and give example for the particles of the nano scale
- Explain simply giving examples that nano technology is
  - the study of entities belonging to the range of 1 nanometre to 100 nanometres (nano particles)
  - the involvement of nano particles in the fields of research and development
  - the production process implemented through them.





- Conduct a discussion to explain about the non wettable cloths, self-cleaning glasses and self-cleaning paints inverted by applying the principles of lotus effect which is a natural phonomenon in the nano scale. (use video and diagrams for this)
- Explain simply the structure of nano porous activated carbon.
- Explain through a discussion the process of adsorption of nano prous activated carbon in water purification.
- Predict about the environmental and health problems that we encounter in the future due to the use of nano technology.

**Key words/ Concepts**

- Nanometer, Lotus effect, nano porous activated carbon

**Quality inputs**

- Diagrams and video showing the application of nano technology and natural phenomena

**Instructions for assessments and evaluation**

- Direct the students to prepare a report in groups about the natural phenomena and new discoveries in the field of nano technology after researching into them.
- Get them to present the information collected in groups.
- Evaluate the students on following criteria:
  - Quality of the information collected
  - Variety of the sources of information
  - Method of presentation and time management

**Competency 4.2 : Investigates into the prevention of accidents due to lightening.**

**Number of periods : 10**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain simply how clouds get electrically charged.
- state that the lightening occurs due to charges in the clouds get discharged in various ways.
- state that instantaneous high current is caused due to the high potential defference between the clouds and the Earth.
- state that sudden expansion of air owing to the current generated by discharge causes thunder.
- state precautions that can be taken to prevent lightening accidents.
- describe how safety can be ensure when lightening strikes.
- accept that loss of lives and properties due to lightening which is a natural phenomenon can be prevented.

**Instruction to plan the lesson :**

- Direct the students to survey the periods in which lightening occurs generally in Sri Lanka. Display the information gathered by students and lead a discussion on the following events.
  ( Only a simple understanding is expected here).
- How clouds get electrically charged (using of and diagrams)
- Discharge of electrical charges in various ways and eruption of thunder during such discharges (video clips and photographs can be used to show different types of discharges)
- Emission of light and sound during an electric discharge (displayed by the discharge of a electrostatic charges generated by rubbing materials through the buld of a neon tester).
- Danger of lightening (using library video and newspaper reports)
- Let the students collect and present information from various sources about the loss of lives and property due to lightening and devices employed to minimize the potential damages that would be caused by lightening (It is suitable to give this as an assigment about two weeks before starting the lesson).
- Lead a discussion summarizing the information presented by students. Present library videos and newspaper reports. During the discussion introduce precautions taken to minimize accidents caused by thunderbolts.
- Discuss with students about the safty measures that can be taken aginst the accidents caused by lightning.





**Key words/ Concepts**

- Camulus rain clouds, electrical charges, discharge of charges, lightning, hightening conductor

**Quality inputs**

- Neon tester, materials that should be stroked to generate electric charges, videos, pictures, photographs, newspaper reports

**Instructions for assessments and evaluation**

- Evaluate the students by a short written test.
- Assess the information, reports and assignments collected and presented by students based on following criteria.
  - Relavance of information
  - Accuracy of information
  - Adequacy of the information collected

**Competency 4.3 : Inquires into the scientific background of natural disasters.**

**Number of periods : 10**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- state that the reason for the greater tendency for some natural disasters.
- name a few factors affecting the increase in global warming.
- state that the depressions in the atmosphere is the cause for whirl winds and stroms.
- forward a report on the losses of lines and property caused by whirl winds and storms in Sri Lanka during past 50 years.
- explain simply the geological factors leading to earthquakes and earth tremors.
- explain simply the causes leading to a tsunami states.
- state that the earthquakes and tsunami tend to occur along the tectonic plate margins of the Earth.
- present a report on the tsunami conditions emerged globally.
- explain simply the conditions leading to wild fires.
- present information about the wild fires erupted globally.
- accept that natural disasters cannot be prevented but the loss can be minimized by awareness and preparedness.

**Instructions to plan the lesson :**

- In grade 7 students have studied how the lower larger of the earth's crust is formed from tectonic plates. Recall again how the tectonic plates are arrenged through and acivity. For the activity use a boild egg with cracks on its shell or any other suitable model.
- By using a suitable activity explain about the drift of tectonic plates. Conduct a discussion drawing students' attention to the changes it would cause on the earth's surface.(A suitable activity: pour water to a tray or a basin and cover the water surface with prieces of polystyrene sheets. Then stir water. Let students observe the behaviour of the bounderies of the sheets and the movements of water at the boundaries.)
  Conduct a discussion to disclose the following phenomena and facts and reasons for them.
  - Earthquakes and tremors
  - Break out of tsunami
  - Identification of areas where the incidence of earthquakes, earth tremors and tsunami is high





- Other possible reasons causing tsunami (Animations showing the origin of the above can be obtained from the internet. Let students view such selected programmes)
- About two weeks before starting this lesson give following assignments to students.

**Assigment 1**

Garner information about the earthquakes occurred globally during the past 10 years.

- year/ date of the earthquake
- Area/ country in which the earthquake occurred
- Death toll in the earthquake
- Loss of property in the earthquake

**Assignment 2**

Garner information about the tsunami occurred globally during the past 20 years.

- Year/ date of the tsunami
- Area/ country in which the tsunami occurred
- Death toll in the tsunami
- Loss of property in the tsunami

- About three weeks before starting the lesson, instruct the students to prepare a report on loss of lines and property caused by whirl winds and storms during the past half century in Sri Lanka. Give guidance for it.
- Evaluating the reports prepared by the students explain reasons forcreation of whirl winds and storms.
- Conduct a discussion presenting facts about the wild fires broke out globally and locally in recent past and reasons for their occurrence.
- Emphasize that the reason for the increase of natural disasters in recent times is the rise in globle warming.
- Quota causes for the increase in global warming and discuss about the measures we can take to minimize that situation.
- Use newspaper reports and videos effectively in this regard.
- Explain with examples that natural disasters cannot be prevented.
- Taking each of the above disasters as an example, discuss ways of minimizing them.

**Key words/ Concepts**

- Natural disasters, global warming, depression, whirl wind, storm, earth tremors,tectonic plates, earthquake, tsunami, wild fire, disaster management

**Quality inputs**

- An egg, pieces of polystyrene sheets, videos, internet, news paper reports, photographs, information hand books

**Instructions for assessments and evaluation**

- Evaluate the students by a short written test.
- Based on following criteria, assess the students assignments and reports.
- Adequacy of information.
- Relevance of information.
- Accuracy of information.
- Organisation and presentation of information.
- Sources used.





**Competency 4.4 : Investigates on bio diversity**

**Number of periods : 07**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- conduct simple activity to demonstrate the concept of biodiversity.
- state what is Bio diversity.
- describe the importance of Bio diversity.
- explain threats to Bio diversity.
- state the important features of eco systems.
- give examples for natural and artificial ecosystems.
- list major eco systems in Sri Lanka
- state the importance and major characteristics of main eco systems of Sri Lanka and map the locations of them.
- accept the importance of biodiversity for existence of our planet.

**Instructions to plan the lesson :**

- Get the students to draw a set of pictures separately of plants, animals and other components (soil, water) belonging to a selected plot of land in the school garden exactly as they are placed there.
- Provide three pictures which show separately the main parts of an ecosystem to students.
- Let them observe the picture that emerges when those pictures are kept over lapping.
- Through this discuss that depending on the various factors in the environment, there is a broad variation in an ecosystem.
- Explain that the assembly of plants, animals and micro-organisms including genetic material and ecosystems is called biodiversity.
- Discuss how the presence of a small number of species and the presence of a large number of species affect the stability of an ecosystem.
- Conduct a discussion on the threats for biodiversity in Sri Lanka.
- Illustrate with examples the natural ecosystems in Sri Lanka.
- Provide a map of Sri Lanka with district boundaries and guide to mark on it the various ecosystems that exist in the area in which the students live.
- Discuss about the main ecosystems in Sri Lanka giving examples.
- Mark on a map the main ecosystems in Srilanka and instruct students to observe and mark the relevent locations in their maps.
- Explain this with videos and photographs.
- Instruct to make a booklet containing the pictures/ photographs of various ecosystems in Sri Lanka and their characteristics.

**Key words/ Concepts**

- Biodiversity
- Ecosystems
- Natural ecosystems
- Created ecosystems

**Quality inputs**

- Several pictures showing the various parts of an environment, photographs of various ecosystems, atlases of Sri Lanka, video tapes

**Instructions for assessments and evaluation**

- Based on following criteria, evaluate the booklet prepared on various ecosystems in Sri Lanka.
  - Inclusion of all the information
  - Adequacy of facts
  - Accuracy of facts
  - Finish





**Competency 4.5 : Investigates on artificial environment and green concept**

**Number of periods : 08**

**Learning outcomes :**

At the end of the lesson student should be able to;

- explain simply about artificial environment and green concept.
- describe the importance of using organic fertilizers over the inorganic fertilizers .
- prepare a report on the traditional agricultural methods that can be used to control pests.
- discuss the importance of correct water management in farming.
- describe the importance of maximum use of cultivated lands in farming related to reducing forest cover.
- state scientific basis of using mixed crop farming and agricultural land management.
- state the harmful effects of using chemicals in food production, food transportation, food storage and food preservation.
- state the importance of using post harvest technology in food security to minimize waste of foods.
- tabulate the chemicals use in industries and their harmful effects on environment.
- describe the importance of disposal of chemicals used in industries in a safe way.
- state the importance of construction of environment friendly building in related to power saving.
- appriciate the use of green transportation.

**Instruction to plan the lesson :**

- Explain about urban, industrial and agricultural environments and explain what is artificial environment (Use pictures, videos etc. for this).
- Involve students in an activity using diagrams to hightlight favourable and unfavourable features in the artificial environment.
- Lead a discussion on how to minimize of demerits of artificial environment while highlighting the green concept.
- Discuss how green concept can be adopted when costructing buildings.
- Show a picture/ photograph of an environment in disarray to students and get them to make a picture/ model to show how it can be converted to an environment in order using green concept.
- Discuss the importance of the use of organic fertilizers and explain how organic fertilizers such as compost can be made at home.

- Assign to groups of students the preparation of a report on traditional methods used to control pests.
- Conduct a discussion to surface the methods of water management to cultivate crops and its importance ( collection of rain water, drip irrigation, control of water).
- Discuss how land is managed for maximum effectiveness.
  - Mixed crop cultivation
  - Crop rotation
  - Growing pest - resistant crop types
  - Cultivating high yielding crops and crops resistant to unfavourable weather conditions
- Discuss how deforestation can be reduced and available lands are managed.
- Explain steps that can be taken to ensure food security for supplying food with proper untritive value (food production, transportation, storage, preservation, minimizing wastage, post harvest technology).
- Explain scientifically the disadvantages in the use of chemical substances for food preservation and traditional methods used to preserve food.
- Explain with examples that by using post harvest technology property, wastage of food can be prevented and food can be preserved.
- Discuss with students about some chemicals used in industry, how they cause environmental pollution and methods of disposing such chemicals with minimum impact on environment. Tabulate relevant facts.(environment - friendliness, saving energy, importance storing water)
- Direct the students to find and report about the methods that can be ued to minimize pollution in transport. Confirm the concept of green transportaion. e. g. walking short distances, use of bicycles,use ofhybrid vehicles and electrical vehicles

**Key words/ Concepts**

- green concept, organic fertilizers, pest control, water management, transportation of food, food preservation, food security, post harvest technology, green transportation

**Quality inputs**

- Handouts newspaper articles, booklets and videos relevant to the concept presented here





**Instructions for assessments and evaluation**

- Assess the reports prepared by students on the control of pets under the following criteria.
  - Variety of the methods of pest control
  - Appropriateness and practicality of the methods
  - Orderliness and sequence of facts in the report
  - Finish
- Assess the model created using the green concept under the following criteria.
  - Creativity
  - Conformity to the scale
  - Use of suitable materials
  - Conformity to the green concept.

**Competency 4.6 : Identification of natural resources distribution and sustainable use of natural resources.**

**Number of periods : 05**

**Learning outcomes :**

**At the end of the lesson student should be able to;**

- explain simply about natural resources.
- explain simply sustainable use of water. (using rain water harvesting)
- state available methods used to extract minerals from soil.
- explain characteristic features of gems.
- present unique characteristics of different types of gems.
- present a report about adverse effects caused to the environment and to the human due to gem mining industry.
- give examples of plants for various uses of them as natural resources.
- collect and presents information of different types of wood in Sri Lanka and their specific uses.
- explain scientific basis of wood decomposition
- list out the methods used to prevent wood decomposition.
- conduct simple activities to estimate the amount of wood of a live tree trunk.
- accept the importance of sustainable use of natural resources.

**Instructions to plan the lesson :**

- Let the students survey and list the natural materials used in the production of various things available in the classroom.
- Introduce the materials produced by natural phenomena without the influence of human activities as natural resources.
- Introduce water, minerals, rocks, mineral oil and plants as ntural resources.
- Discuss the methods used to conserve water by humans in the past and at present.
- Discuss while demonstrating how minerals are separated from rocks by methods such as sitting and floating.
- Explain to students the characteristic properties of gems such as hardness, resistance to change, colour and high refractive index.
- Discuss unfavonrable environmental and social effects of the gem industry using pictures or videos.
- Direct students to collect information about the instances where plants are used in day to day life. (timber, food, medicine, fuel and various other products).
- Let students observe several instances in which wood is subjected to decay.





- Ask students to collect informatin about the causes for decay of wood and measures that can be taken to prevent the decay of wood.
- Pictures/ videos showing unfavourable effects of minring industry.
- Decayed peices of wood.

**Key words/ cocepts**

- Minerals, rocks, extraction, sustainable use, characteristic features

**Quality inputs**

- A sample of soil
- A sifting basket
- Pictures/ videos showing water pollution
- Pictures/ videos showing unfavourable effects of mining industry
- Decayed pieces of wood

**Instructions for assessments and evaluation**

- Direct groups of students to mark on a map of Sri Lanka the areas in which various natural resources such as mineral sands, gems, rocks etc. are found in abundance
- Assess on the following criteria
  - Use of correct information
  - Marking correctly
  - Working as a group
  - Time management
- Get students to implement practically some methods that are used to preserve wood as an assignment