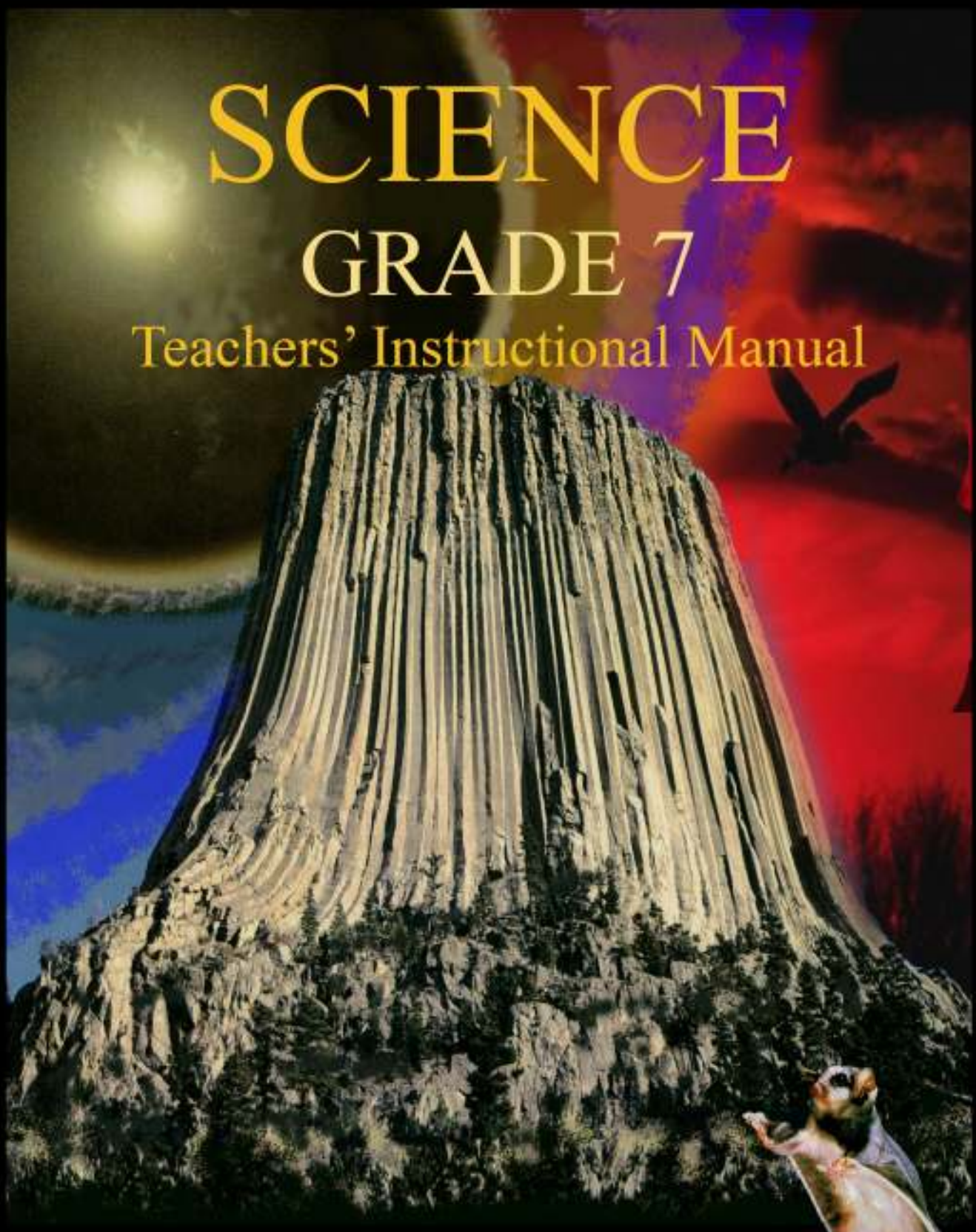
SCIENCE

GRADE 7

Teachers' Instructional Manual



Department of Science, Health and Physical Education
Faculty of Science and Technology
National Institute of Education

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Message of the Director General

The first curriculum revision for the new millennium is based on the elimination of the several problems obtaining in the present education system. The present curriculum reforms have been planned having identified the problems that youth face consequent to the weakening of their thinking abilities, social abilities as well as personal abilities and step by step exploration of factors leading to this situation, to overcome which, the necessary background was prepared.

Compared to the other countries in the Asian region, our country took the lead in education in earlier years. But most countries in this region have superceded Sri Lanka in education today. Some factors that influenced this deterioration are the action taken by educational institutions to continue to take action to confirm the known, learn that which had been decided on earlier, and reconstruct that which was, in the same form itself.

All these matters have been taken into consideration and the officers of the National Institute of Education have endeavoured to prepare the new curriculum on the basis of a distinct philosophy. The primary objective here is to change that which is known, explore that which is new and develop that which is necessary for tomorrow and build up a generation of students who can display their readiness for a successful future. But there is no need to reiterate, the need for a visible change in the teacher's role for the realization of this objective. In place of the obvious transactional teacher role presenting in our classrooms so far, the Sri Lankan school teacher will have to understand and conform to a student-centered, competency based and activity focused transformational role.

It is our firm belief that this Teacher Instruction Manual will serve you as an aid to become an effective teacher through the provision of numerous instructions that will help you adapt to the new situation. Through the study of these instructions you will be provided the opportunity of making your daily teaching as well as the evaluation task easy. There is no doubt that instructions for student exploration and other quality inputs will help facilitate the teacher's task. Similarly, the Teacher Instruction Manual will help convey to school principals valuable information they can use in time-tabling, sharing of limited resources and internal supervision.

My sincere thanks go to Dr. Mrs. I. L. Ginige, Assistant Director General (Curriculum Development) Science & Technology Faculty of National Institute of Education for her direct involvement in the preparation of this Teacher Instruction Manual that will serve an immense purpose in the task performed at school level by the section above and also teacher educationist involved in beginning or continuous teacher educational matters, in-service advisors as well as officers at various levels, involved in external supervision plus monitoring programmes.

Professor J. W. Wickramasinghe
Director General
National Institute of Education

Preface

The first curriculum reform for the millennium implemented with the aim of preparing a powerful basis for a new Sri Lanka anticipates a visible transformation of the teacher's role. The three main sections below are included in the Teacher Instruction Manual prepared with the objective of providing the teacher with the necessary support in this regard.

- Detailed Syllabus
- Activity Continuum that helps in the implementation of the syllabus
- Instruments for the extension of the learning teaching process.

Teachers have been provided the opportunity of understanding several basic matters that have been taken into consideration in the preparation of the curriculum for the detailed syllabus extending beyond subject topics and sub-topics. Competency levels that correspond to subject competency have been included in this section that commences with an introduction to the factors and subject aims that formed the basis of the new syllabus. One special features of this section is that, while the knowledge-base determined under competency level each student needs to develop has been introduced as the subject content the multiple learning and teaching methods employed in transmitting this section to the student has also been taken into consideration in determining the time frame with respect to each competency level.

The final part of the detailed syllabus presented under the heading "School Policy and Programs" needs to be studied very carefully and understood by every instructional leader. This section provides school managers a range of valuable instructions to assist them in the allocation for teaching, subject-teaching assigning functions to teachers, implementing co-curricular activities as well as supervision of the teacher's task. The second section of the Teacher Instruction Manual has been prepared with the objective of providing teachers with clear understanding of the proposed learning- teaching methodology. This section commences with the introduction of the methods of planning activities under competency-based education as well as the change in the teacher's role. Although the activity continuum necessary for the implementation of the curriculum has been introduced next, the implementation of the proposed activity in the very same manner is not expected of teachers. The teacher should endeavor to make use of his / her creative, as well as critical thinking abilities and adapt these activities in a manner that suits ones class, best. Although instructions have been provided on the constitution of groups in keeping with the facets of the problems subject to exploration, the teacher is expected to take an intelligent decision on the number of groups based on number of students in the class.

Time has been allocated for activities to ensure achievement of the relevant competency levels. Therefore, teachers may have to exceed the 40-minute period. While each activity has been provided adequate time for the actualization of each competency level, the teacher is expected to make use of single or double periods in the time table and breakdown these activities, as suitable in implementing them.

For the success of the procedure it is essential that every time an activity commenced the previous day is carried over to the following day, that a brief summary of the part of the activity completed the previous day is presented to the class. Similarly, this decision will provide the school community with the opportunity of involving students in effective learning where teachers obtain leave of absence.

The final item in this section is a list of quality inputs necessary for the maintenance of the quality of subject learning and teaching, when taken as a whole. As such, the teacher has a choice of ordering out the necessary learning-teaching materials in time and having them on hard.

Included in the third part of the teacher Instruction Manual under the title
" Assessment and evaluation" are a number of important hints to ensure that the expected results of the exercise are realized.

This section has been so structured as to introduce matters related to the assessment and evaluation that should take place under each activity, extension of the learning and teaching that takes place based on activity groups and the nature of the questions that might be expected in general examinations. It must be pointed out that the primary responsibility of the teachers is to Identify instances where assessment and evaluation can be implemented in the course of each activity and to carry out this task successfully on the basis of common criteria. The set of instruments prepared with a range of activities as the objective for the purpose of extending learning and teaching provide students with the opportunity of involvement in continuous learning outside the recommended classroom sessions. While it is the task of the teacher to regularly examine the learning students receive, based on these instruments, and encourage them, arriving at a correct decision regarding the final results of the activities and communicating that decision to the relevant parties is expected of the teacher. It is essential that a visible change takes place in general examinations for the success of the learning-teaching process. The National Institute of Education, with the assistance of the Sri-Lanka Department of Examinations, has introduced several prototype questions for educational levels that terminate with these examinations. Since this change in examination question papers has been suggested in order to direct students to learn through practice and experience, instead of resorting to mechanical approaches like memorizing or answering model question papers, the education of school students and parents about this change should commence at the beginning itself.

All teachers should realize that various activities can be developed for the achievement of any particular competency level. Accordingly, they should be prepared for more successful teaching through the use of better approaches, exploration, as well as instruments for the extension of learning and teaching.

The present Teacher Instruction Manual will give teachers right throughout the country the courage to effect a visible change in the teacher's role and prevent their becoming inactive in the presence of new approaches. Similarly, we expect to award certificates and provide numerous development opportunities to teachers who go beyond the activities to involve themselves in the innovation of novel creations. What teachers have to do order in to become eligible to the awards is to improve these activities, using their creative thinking, and present them. Learning-teaching plans prepared in this manner outside the basic activity plan, should be forwarded to Assistant Director General (Curriculum Development), Science and Technology faculty, National Institute of Education, Sri Lanka. Selection of those entitled to awards will be made subsequent to the study of these activities by the relevant subject committees.

We have endeavoured in this manner, to bring learning-teaching assessment and evaluation on to the same platform through new methodologies. According to this, teachers will be provided substantial latitude to meaningfully handle the learning-teaching process, school-based assessment, as well as assignment of home-work. It is our firm conviction that the school system of Sri Lanka will, make maximum use of this aid and depart from orthodox learning-teaching approaches to enhance the thinking abilities, social abilities as well as the individual abilities of the sons and daughters of the county.

Dr. Indira Lilamani Ginige
Assistant Director General (Curriculum Development),
Faculty of Science and Technology ,
National Institute of Education,
Sri Lanka.

CONTRIBUTION

Direction: Prof. J W Wickremasinghe - Director General

Guidance: Dr. I. L. Ginige
Assistant Director General
Faculty of Science and Technology
National Institute of Education

Supervision : Mr. C M R Anthony
Director
Department of Science, Health & Physical Education

Instructional leadership, Co-ordination and Editing :

Mr. C M R Anthony	-	Director
Mr. G H Gauthamadasa	-	Chief Project Officer
Mr. W A D Rathnasuriya	-	Chief Project Officer
Mr. W A Sumathipala	-	Project Officer
Ms. J Athamlebbe	-	Project Officer
Mr. A D A de Silva	-	Project Officer
Mr. L K Waduge	-	Project Officer
Mr. P Malavipathirana	-	Project Officer
Ms. Nadee Ama Jayasekera	-	Project Officer
Ms. H M Mapagunaratne	-	Asst. Project Officer

Translation & Computer page setting	:	Miss. I. Warushavithana, Lecturer, Teachers Training College, Galle.
Art	:	Ms. U L N Fernando Teacher Service, Sirimavo Bandaranayake V. Colombo.07.
Cover page and pictures	:	Master. Soraj Dhananjaya Kolonne, Grade 11, Thurstan College, Colombo.
Verses	:	Ms. Hasika Dilhani Jayasekara. Grade 11, Sirimavo Bandaranayake V. Colombo 07.

Contents

Descriptive Syllabus

Introduction

Basis for School Science Curriculum Reform

Previous curriculum reform, aimed at teaching Science at secondary level through the subjects, Environmental Studies for grade 6 and Science & Technology for grades 7-11, faced following drawbacks.

- Lack of adequate opportunities for the students to acquire internationally accepted Science process skills.
- Omission of some essential basic scientific concepts in the course which hindered systematic development of scientific concepts.
- Fewer opportunities provided for students to engage in a learning- teaching process which enables proper comprehension of scientific concepts.

Furthermore, the following factors that prevailed in the school Science curriculum have also contributed to the decline in the quality of Science.

- Environment related activities subject at primary level has not contributed to comprehension of basic scientific concepts as expected.
- Deviation of the learning-teaching process from practical situations towards transmission of knowledge through text books.
- Examination oriented learning-teaching process resulting in students being diverted from exploration based learning towards mechanical learning.

Basically, the prime objective of the new curriculum reform is to alleviate these shortcomings and to minimize the curriculum gap between G.C.E. (O/L) and G.C.E. (A/L) as well. In order to achieve this objective, measures should be taken to avoid the separation of theoretical aspects from practical activities in Science.

Present curriculum reform is expected to introduce a new approach to provide opportunity to amalgamate theoretical aspects and practical activities.

New methodology is unique as the science curriculum has been developed according to the following distinctive features:

- Competency based
- Activity oriented
- Student centered

Science subject is introduced as a **common Science curriculum** for grades 6-9, and as a **subject curriculum** for grades 10-13. However, in the science curriculum for grades 10-11 the three main subjects of Physics, Chemistry and Biology are presented as three modules with equal weight for the G.C.E. (O/L) examination.

Science syllabi for grades 6-9 has been developed as a spiral curriculum based on the broad themes given below.

- Observing the environment
- Organisms and life processes
- Matter, their properties and interactions
- Earth and space
- Energy, force and work

The new curriculum reform consists of a set of competencies and competency levels , a continuum of activities together with a set of activities which provide opportunities to extend the learning-teaching process beyond the classroom environment.

Course Objectives for Grade 6 - 11 Science

On completion of this course, the student will be able to;

- 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 a back ground of limitations and dynamic nature of science.

GRADE 7 SCIENCE SYLLABUS

Competency & competency level	Content	Time minutes
1.0 Explores the dynamic nature of the environment. 1.1 Investigates the interactions between organisms.	• Mutual interactions that ensure the existence of organisms. • Interactions based on food • Plant-plant • Plant-animal • Animal-animal • Food chains and food webs • Interactions based on protection • Caring for the young • Camouflage • Protective behaviour and strategies	120
1.2 Investigates the interactions between organisms and abiotic environment.	• Interactions between organisms and the abiotic environment that ensure the existence of organisms. • Interactions based on habitat • related to plants • related to animals • Interactions based on the need for substances and energy • soil,water and air • light and heat • Interactions based on the change in environmental factors • hibernation • migration	120
1.3 Investigates the mutual interactions between organisms and abiotic environment with time.	• Environmental succession • Establishment of organisms in a barren environment with time • Establishment of organisms in a cleared environment with time • Establishment of organisms in the surroundings of a reservoir with time	120
1.4 Investigates the interactions in abiotic environment.	• Interactions in the abiotic environment • Weathering of rocks • Decomposition of organic matter • Soil erosion	120

Competency & competency level	Content	Time minutes

2.0 Focusses attention on the environment quantitavely.
2.1 Uses the measurements of volume to describe the materials and objects in the environment.
	• Concept of volume and units
	  • Volume of a liquid
	  • Volume of a regular object
	  • Volume of an irregular object
		120

2.2 Uses the measurements of density to describe the materials and objects in the environment appropriately.	• Concept of density and units • Changes in mass of equal volumes • Density in terms of mass and volume	120
2.3 Uses the measurements of speed to describe the phenomena in the environment appropriately.	• Concept of speed and units • Speed in terms of distance and time • Measuring speed	120
2.4 Uses the concept of rate to describe the phenomena in the environment appropriately.	• Concept of rate • Measuring rate	120

3.0 Investigates the organizational patterns in the bodies of organisms.
3.1 Investigates the patterns in the organization of animal body to perform life functions.
	• General plan of organization in the animal body
	  • Head, thorax, abdomen and appendages
	• Various systems which constitute the human body, their basic parts and major functions.
	  • Respiratory
	  • Digestive
	  • Excretory
	  • Blood circulatory
	  • Nervous
	  • Reproductive
	• Tissues and cells
		120

Competency & competency level	Content	Time minutes

3.2 Investigates the patterns in the organization of plant body to perform life functions.	• General plan of organization of the plant body
	  • Shoot system
	  • Stem, leaves, flowers and fruits
	  • Root system
	  • Roots
	• Tissues and cells
		120

4.0 Makes inquiry to identify the nature of earth and space.
4.1 Investigates on the components of lithosphere.
	• Major strata of the earth's interior
	  • Crust
	  • Mantle
	  • Core
	• Lithosphere, the uppermost stratum of the crust containing rocks and minerals.
	  • Rocks
	  • Minerals
	  • Soil
	• Uses of rocks, minerals and soil
		120

4.2 Utilizes soil while conserving its quality effectively.	• Diversity of soil according to its constitution and properties
	  • Clayey soil
	  • Sandy soil
	  • Loam soil
	• Soil erosion
	  • Occurence
	  • Effects
	• Soil conservation
		120

4.3 Investigates on the solar system.	• Celestial bodies belonging to the solar system and their charateristics.
	  • Sun
	  • Planets and moons
	  • Dwarf planets
	  • Small objects in the solar system
		120

Competency & competency level	Content	Time minutes

4.4 Investigates on the space explorations.	• Space travel
	  • Space crafts
	  • Challenges faced in space travel
	  • Ways of overcoming challenges
	• Historical development of space exploration
		120

5.0 Inquires on the properties, uses and interactions of matter.
5.1 Classifies matter using various criteria.
	• Physical states
	  • Solids, liquids and gases
	• Constitution
	  • Mixtures (homogenous and heterogenous)
	  • Compounds and elements
	  • Rocks
	• Metals and non-metals
		120

5.2 Inquires on the interactions of various substances with water, acids and bases.	• Interactions with water
	  • Dissolving
	  • Hydration
	  • Chemical reactions
	• Interactions with acids
	• Interactions with bases
		120

5.3 Uses the concept of specific gravity in day to day pursuits.	• Relative density
	• Phenomena related to Relative density
	  • Floating, floating by sinking and sinking
	  • Upthrust
		120

5.4 Inquires on the changes in properties of substances subjected to heat.	• Combustion
	  • Conditions necessary for combustion
	  • Products of combustion
	  • Fuels
	  • Manipulating combustion effectively
	• Thermal decomposition
	  • Decomposition temperature
	  • Applications of thermal decomposition
	  • Manipulating thermal decomposition effectively
	• Thermal degradation
	  • Incidence of thermal degradation
	  • Control of thermal degradation
		120

Competency & competency level	Content	Time minutes

5.5 Uses thermal properties of substances effectively.	• Thermal properties and their uses
	  • Heat transfer
	  • Conducters and insulators
	  • Expansion
	• Solids, liquids and gases
	  • Change of state
	  • Melting point/freezing point
	  • Boiling point
	  • Sublimation
		120

5.6 Explores the nature and effects of static electricity.	• Electrostatic charges
	• Generating static electricity
	  • Positive and negative charges
	  • Identifying positive and negative charges
	• Lightning
		120

5.7 Selects appropriate materials to manipulate the electric current according to the situation.	• Conduction of electricity
	  • Conductors
	  • Insulators
	  • Semi-conductors
	  • Superconductors
	• Electrical resistance
		120

5.8 Develops simple electric circuits	• Sources of electricity
	  • Dynamo
	  • Cell
	• Electric current
	• Potential difference
	• Simple electric circuit accessories
	  • Ammeter
	  • Voltmeter
	  • Switch
	• Electric appliances
	  • Bulb
	  • Motor
		120

5.9 Conducts experiments to identify the chemical nature of substances that are in day to day use.	• Domestically used chemicals
	  • Acidic substances
	  • Basic substances
	  • Neutral substances
	• Indicators used for identification of substances
		120

Competency & competency level	Content	Time minutes

6.0 Uses the concepts, principles and theories related to energy, work and force effectively.
6.1 Effectively manipulates force at appropriate instances.
	• Force as a vector
	  • Magnitude
	  • Direction
	• Units of force
	• Ways of representing forces
	• Factors to be considered when exerting force
	  • Magnitude of the force
	  • Direction of the force
	  • *Point of action of force*
		120

6.2 Investigates on various forces and their applications.	• Contact forces and their applications
	  • Impulsive force
	  • Friction force
	  • Tension
	  • Thrust
	• Distant forces and their applications
	  • Gravitational force
	  • Magnetic force
	  • Electro-static force
		120

6.3 Investigates on types of motions and their applications.	• Movements of an object when a force is exerted
	• Types of motion
	  • Rectilinear motion
	  • Circular motion
	  • Rotational motion
	  • Oscillation/vibration
	  • Calculations related to rectilinear motion
	  • Speed
		120

6.4 Uses machines to do work at ease.	• Making work easy
	  • Simple machines
	  • Levers
	  • Inclined planes
	  • Pulleys
	  • Wheel and axle
	  • Machines
		120

Competency & competency level	Content	Time minutes

6.5 Generates energy by various sources.	• Sun as the primary source of energy
	• Naturally stored energy
	  • Food
	  • Fuel
	  • Wind, oceanic waves and flow of water
	• Artificially stored energy
	  • Electro-chemical cells
	  • Changing the position of an object
	  • Changing the form of an object
	  • Solar cells
		120

6.6 Uses strategies for transmission of mechanical energy according to the circumstances.	• Need for transmission
	• Means of transmission
	  • Belts (endless)
	  • Chains (endless)
	  • Cog-wheels
	  • Shaft
	  • Fluid/hydraulic
	  • Air/pneumatic
		120

6.7 Employs strategies to use energy effectively.	• Utilization of energy and its economical usage
	  • Domestic
	  • Institutional and indusrial
	  • Transport and public places
	• Problems encountered in utilization
	• Alternate energies
	  • Solar energy
	  • Alcohol
		120

7.0 Discovers the values of marvels in the environment. 7.1 Discovers the information on marvels in the world of plants.	• Plants that exhibit mysterious characters	120
7.2 Discovers the information on marvels in the world of animals.	• Animals that exhibit mysterious characters	120

Competency & competency level	Content	Time minutes
7.3 Discovers the information on marvels of earth and space.	• Information related to water • Information related to land • Information related to space	120
7.4 Discovers the information related to marvels of human creations.	• Excellent creations and inventions • Scientists who contributed for new inventions	120

8.0 Exhibits the preparedness in management of natural disasters and associated risks.
8.1 Contributes to minimize the risks associated with floods.
	• Scientific factors based on the occurence of floods
	  • Short term
	  • Long term
	• Scientific approach for the management of risks associated with floods.
	  • Before the disaster
	  • Weather forecasts, previous experiences and observations.
	  • During the disaster
	  • Predicting the circumstances that can occur on available data and information.
	• Scientific measures that can be taken to minimize the damages to life and property.
	  • After the disaster
	  • Sanitary measures
	  • Effective management of newly emerged environmental conditions.
		120

Competency & competency level	Content	Time minutes
8.2 Contributes to minimize the risks associated with landslides.	• Scientific factors based on the occurence of landslides • Short term • Long term • Scientific approach for the management of risks associated with landslides. • Before the disaster • Weather forecasts, previous experiences and observations. • During the disaster • Predicting the circumstances that can occur on available data and information. • Scientific measures that can be taken to minimize the damages to life and property. • After the disaster • Sanitary measures • Effective management of newly emerged environmental conditions.	120
NB:- Number of periods per week - 05 Number of periods per year(approximately) - 150 (100 hours) Number of activities - 36 Suggested time in hours allocated for activities - 72 Plan the programs for extended learning by using the extra time accordingly.		

Teaching - Learning Process

School Policies and Programmes

- According to the proposed curriculum reform five periods have been allocated to teach Science for the grades 6-9 and six periods for grades 10 and 11.
- The learning-teaching process has been designed on an activity based approach.
- The expected learning-teaching methodology will be in accordance with the transformation role of the teacher. Activities designed on 5-E model have been provided through the Teacher Instruction Manual in order to implement the transformation role at classroom evel.
- The prescribed time to conduct one activity at class room level will be more than one period. Therefore, it is emphasized that the Sectional heads and school management to should take in to account the importance of allocating two adjacent periods for the successful implementation of activities at classroom level.
- It is a crucial factor that there should be excellent planning at grade level for the successful implementation of activities. It is wise to organize the activities with the participation of all the teachers who teach science in parallel classes of a particular grade level.
- Principals/Sectional Heads are expected to provide instructional leadership to the teachers on developing plans to identify and obtain the necessary quality inputs and utilizing them before the commencement of each term.
- Some activities in particular need specific experimental setups and printed materials. It is therefore advisable to prepare and maintain a reserve of these materials with the participation of teachers in the parallel classes of a particular grade level to maintain learn ing-teaching process efficiently.
- According to the new approach, students are not engaged in separate theory and practical sessions . It is expected to establish concepts, principles and theories through hands on practical experiences by way of proposed activities.
- Laboratory equipment as well as improvised and adapted setups are needed to carryout proposed activities. School management is responsible in providing such services and assistance within the school and from outside resources.
- As a measure of recognition of the articles that students prepare during the course of proposed activities, it is recommended to organize term end or year end exhibitions. This will encourage the students on further inventions.
- With a view to extend learning beyond the activities done at classroom level and to highlight the students' special abilities, it is expected to involve students in co-curricular activities such as debates, wall newspapers, magazines, school science societies, science days, science exhibitions etc.

Introduction

In deciding upon the learning teaching methodology relevant to the course, attention has been paid to the planning of learning-teaching activities so as to facilitate building up of student competencies based on exploration. In preparing for competency-based education, in this manner, an obvious change in the role of the teacher is expected.

The transmission role practiced in our classroom from way back and the more recently introduced transaction role is evident in the classroom even in the present day. When taking the deterioration of the thinking skills, personal skills and social skills of school leavers into consideration, it needs no effort to understand that there is a need for the development of the learning-teaching methodology and how it should be effected.

In the transmission role while the teacher is considered an individual who knows everything, his task has become that of considering the student as one who does not know anything and of transmitting knowledge to him. This learning-teaching process that takes the guise of lectures is restricted only to the flow of knowledge from the teacher to the student, does not make an adequate contribution either to the stimulation of student thinking or to the development of his personal and social skills.

The dialogue initiated by the teachers within the class is the initial stage of the transaction role apart from the ideas that flow from the teacher to the class and from the class to the teacher. These dialogues get gradually transformed into discussions as a result of the student-student interaction that takes place subsequently. The teacher is continuously involved in the task of questioning in order to take the student from the known to the unknown, from the simple to the complex and from the concrete to the abstract.

While, in competency-based education, student tasks occupy a powerful position, the teacher occupies the position of a resource person who mediates in order to provide every student in the class with at least the competency proximate to each relevant competency. For this purpose the basic functions the teacher is expected to perform include planning of a learning environment consisting of the materials and other facilities necessary for learning, close observation of how students learn, identification of student abilities and inabilities and the promotion of student learning through feed back and provision of feed forward as well as the preparation of instruments of assessment for the extension of learning beyond the classroom. The teacher's role based eventually upon the tasks above is called the transformation role.

The series of activities that can be used in the implementation of the descriptive curriculum introduced in the first part of this course guide, has been included in its second part. Each of these activities has been developed so as to contain a minimum of three steps. It is expected to get the student involved in the learning process through the first step of the activities. As such, this step is called the "Engagement" step. As an introduction to this step, the teacher assumes the Transaction role and engages in a dialogue with the students. Later, along with the transformation of this dialogue to a discussion the students engage in exploration and are provided the opportunity to recall the pre-knowledge related to the basic competency they should develop and to acquire a hint regarding the future of the activity. The teacher possesses a host of strategies that can be used in these exchanges of ideas. Some of the devices at the disposal of the teacher for the exchange of these ideas are questioning/stimulants like pictures, newspaper advertisements and flash cards/ use of puzzles or case studies/dialogues, role play, poems, songs and demonstrations, video tapes or audio tapes. In summary, the first step of the activities is implemented with the objective of actualizing the three objectives below.

- Winning over of the attention of the class.
- Providing the students with the opportunity for students' recall of the necessary pre-knowledge.
- Introducing the elements of the explanation the students are expected to be directed to under the second step of the activity.

It is with the objective of providing the students with the opportunity of Exploration that the second step of the activity has been planned. Students base their exploration on a special leaflet prepared for the purpose. The teacher has to plan this explanation to enable the students to engage in cooperative learning through the exploration of various aspects of the problem, in groups. Some of the most important qualities of this step are involvement in the conscious group discussions and the use of the resource materials provided. As a result of involvement in group activities through a long period of time, student will acquire the ability to develop a number of skills like self-discipline, listening to others, working cooperatively with others, helping them, management of time, obtain creations of high quality, honesty etc. In directing students to exploration, while the teacher should avoid taking decisions regarding leadership, he should build up the background necessary to surface. Accordingly, the students will have the privilege of taking on leadership when opportune, based on hidden abilities.

During the 3rd step of the activity, every group will get the opportunity of presenting the results of its exploration for the enlightenment of the others. What the teacher has to do here is to encourage students to group presentations. It would be effective if students are directed so as to ensure that every member is given responsibility in the planning of the presentation. An important quality of

this step, related to the explanation of student findings, is the creation of the opportunity for the voice of students to be heard in the classroom where, commonly the voice of the teacher had dominated.

After the explanation of the findings in the third step of the activities, students should be directed to elaboration. Each group is given the opportunity to provide constructive suggestions on its findings first, and subsequently, members of other groups are given this opportunity. Anyway the final review is the responsibility of the teacher. The teacher is expected to touch on all the important points relevant to the students' exploration.

The main responsibility of the teacher in this learning teaching process is to monitor continuously, whether the classroom learning-teaching process is implemented successfully, as expected. While assessment and evaluation should be made use of for this purpose, the teacher is provided the opportunity, through planned activities, in the learning teaching process itself. The teacher is given the opportunity for assessment while the students are involved in exploration during the second stage of the activity and for evaluation when the students are involved in explanation and expansion during the third stage. A detailed inquiry into assessment and evaluation will be provided later on in this document.

The teacher is provided direction on the transformation role by the learning –teaching methodology described so far. While priority is given to group exploration here, the teacher is also afforded the opportunity for transaction, discussion and short lectures. While there is room for transaction and discussion, the teacher may also give a short lecture, under review, in the final stage. In the development of the learning-teaching methodology related to this curriculum, the first to be introduced under the curriculum reforms for the new millennium, the attention paid to the important features relevant to the transmission as well as the transaction roles of the teacher, apart from the transformation role, is a special feature of this methodology.

Competency 1.0 : Explores the dynamic nature of the environment.

Competency Level 1.1: Investigates the interactions between organisms.

Activity 1.1 : Can organisms live in isolation?

Time : 120 min.

Quality Inputs:

- **'Tale of the bird's nest'** given in annex 1.1.1
- Two copies of guidelines for group exploration given in annex 1.1.2
- The text book

Teaching-Learning Process:

Step 1.1.1 :

- Get a student to relate the **'Tale of the bird's nest'** to the class.
- Lead a discussion highlighting the following points.
  - 'Tale of the bird's nest' is a good example for an instance where plants and animals living together establishing various relationships.
  - Likewise organisms establish a variety of relationships with other organisms for their sustenance.
  - A vast number of relationships of this nature could be observed through exploring our environment.

(15 min)

Step 1.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 1.1.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - There are interrelationships between organisms that promote their sustenance.
  - Some of these are based on food whereas, some others are on safety.
  - Interactions based on food could be presented as follows;

- Plants - animals
  - Animals feeding on fruits, nectar, leaves, sap
  - Insectivoruos plants like pitcher plant, sundews, bladderworts depend on insects
- Plants - plants
  - Plants like *Loranthus* which live attached to some stems of trees where water and minerals are obtained from the stem.
  - *Cuscuta* living as a parasite on other plants
- Animals - animals
  - Mosquitoes living as parasites
  - Leopard living as predator
  - Animals feeding the young

- Interactions between plants and animals based on food could be identified as simple food chains.
- These food chains intertwine together to form complex food webs in the environment.
- Interactions of organisms based on safety could be presented as follows;
  - caring the young
  - camouflage
  - protective behaviours and strategies
- Some examples of animals and plants that exhibit camouflage could be presented as follows;
  - Leaf insect, preying mantis, frog, Lithops (plant)
  - Few examples of organisms that exhibit protective behaviours and strategies could be presented as follows;
  - Cuttlefish ejecting black pigment in the face of an enemy.
  - Electric eel generating electric shock.
  - Stout bodies of porcupine fish are covered by spines.
  - Hen hiding chicks under its wings in the face of an enemy.
  - Tilapia collect their young in their mouth when danger threatens
  - Rolling behaviour of millipedes and pangolins
- Interactions between various organisms result in the sustenance and maintaing the balance of the world of organisms.
- Well being of ourselves as well as the environment could be acheived through manipulation of the findings of exploration on the interactions between organisms.

(45 min)

Criteria for assessment and evaluation :

- Explains various interactions between organisms with examples.
- Agrees that interactions between organisms contributes to promote the sustenance of living world.
- Analyzes the interactions of organisms discovered by exploring the environment.
- Be sensitive to thr environment.
- Engages in scientific explorations.

Annex 1.1.1

Tale of the bird's nest

A small bird's nest in a branch of the Jambu tree. It is built using fine fibers, dried leaves, etc. Two cute birds gave birth by the eggs laid. Mother and father fed the little ones alternatively. Father brought a worm whereas the mother brought a berry.

Mother bird cried aloud at once. A serpent is creeping up the tree. Its trying to feed on the little ones. Father came rushing from somewhere. It pecked the serpent. Mother also helped the father.

They didn't allow the serpent to get near the nest at all. At last the serpent lost interset and went away.

Annex 1.1.2

Guidelines for group exploration

Can organisms live in isolation ?

- Focus your attention on one of the following topics assigned to your group.
  - Interactions based on food (plant-plant, animal-animal, plant-animal, food chains and food webs)
  - Interactions based on safety (caring the young, camouflage, protective behaviours and strategies)
- Explore the environment that you were directed and identify the interactions of organisms.
- Collect information on the topic by referring the textbook as well.
- Discuss about the experiences of the members within the group.
- Highlight the ways in which the interactions of organisms contributes to their sustenance.
- Humans are also animals.Therefore, compare the interactions that you discovered in relation to humans.
- Prepare for a creative presentation of your findings.

Competency1.0 : Explores the dynamic nature of the environment.

Competency Level 1.2 : Investigates the interactions between organisms and abiotic environment.

Activity 1.2 : Let's find out how organisms match up with the abiotic environment.

Time : 120 min.

Quality Inputs:

- Script of the role play **'A long journey'**(given in annex 1.2.1)
- Three copies of guidelines for group exploration (given in annex 1.2.2)
- Text book

Teaching-Learning Process :

Step 1.2.1 :

- Let students to present the role play.
- Provide opportunity to enrich the role play by adding new dialogues through their experiences.
- Lead a discussion highlighting following points.

  - Habitats of organisms are situated in the abiotic environment.
    - Materials like soil, water and air together with forms of energy like light and heat in the abiotic environment, affect the sustenance of organisms.
    - When the environmental factors get changed, the organisms adapt accordingly.
  - Abiotic environment is essential for the the sustenance of organisms.

(15 min)

Step 1.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 1.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

- Plants and animals promote their sustenance on the interactions they have with the abiotic environment
- Plants could be classified according to their habitat as mesophytes, epiphytes, xerophytes, hydrophytes and mangroves .
- Some of the common interactions based on habitats for most plants are as follows;
- Obtaining water and minerals from the substrate or the environment to which they are attached.
- Obtaining oxygen and carbondioxide from the environment.
- Adjusting to the existing heat and light conditions.
- Animals could be classified according to their habitat as terrestrial, tree-dwelling, aquatic, adapic etc.
- Some of the common interactions based on habitats for most animals are as follows;
- selecting suitable places to live in the environment.
- obtaining oxygen and water from the environment.
- releasing unnecessary materials to the environment.
- adjusting to existing heat and light conditions
- Plants and animals make various responses to the changes in the abiotic environmental factors accordingly.
- Various strategies employed by organisms to overcome extreme environmental conditions is called perennation.
- Some of such strategies employed by organisms are as follows;
    - Stems of plants like lotus, Cyperus and ginger survive under the soil during drought and sprout when rains come.
    - In plants like Balsm, Tumbleweed (*Amaranthus*), Sunflower etc, dispersed seeds act as unit of perennation as the plants die off during the dry season.
    - Fish like 'Kawaiya' and 'Magura' could survive under the mud even when the lakes and ponds run dry.
    - Animals like rabbits and squirrels fall into a deep sleep in holes of the ground or hollows of trees during the entire winter season is called **hibernation.**

- Birds like සුදුරෙදි හොරා, අවිච්චියා සහ flamingo migrate to other countries as means of perennation
- Abiotic environment is a system which is being subjected to various changes with time.
- All the organisms including humans should promote their sustenance by maintaining interrelationships as well as adapting to the changes in the abiotic environment.

(45 min)

Criteria for assessment and evaluation :

- Explains the way in which organisms interact with the environment.
- Agrees that all organisms should promote their sustenance by maintaining interrelationships as well as adapting to the changes in the environment.
- Presents a variety of creations to show how organisms have succeeded the abiotic environment.
- Exhibits the preparedness in adapting to the environment.
- Perseveres to have a scientific viewpoint of the world.

Annex 1.2.1

A long journey...

Flamingo peeped into the hollow of the tree...Squirrel is fast asleep.

Flamingo :-	Oh! Are you still sleeping? We are about to leave.
Squirrel :-	Fine. All the best. Let's meet after the winter. By then I'll be awake. (Again he yawned and turned the other side and fell asleep. Flock of flamingoes started to fly over the vast oceans amidst a heavy snowfall.)
Baby flamingo :-	Where are we going, ma?
Flamingo :-	To the same forest where we annualy visit. This time you also can enjoy the trip. (All arrived at the thicket in the jungle.)
Vegetation :-	Oh! Welcome. We were waiting for you eagerly. (Fock of flamingoes were warmly welcomed by the plant community.)
Vegetation :-	Better you rest for a little while. We know how tired you are, gliding thousands of kilometers at a stretch.
Leader of the flock :-	It's not that tired my dear. Gliding in the sense floating in moving air. We don't feel hungry either. On the other hand we had been preparing for this journey for several months. A thick layer of fat had been deposited by eating a lot. However it had utilized by now. By the way, I was thinking about how much trouble taken by the plants and animals throughout the world to meet the needs such as light, heat, air, soil and water.

Massive redwood tree :-	Anyway, you all can even migrate. We have to stick to the same place and face the challenge.
Flamingo :-	Yes, indeed. I agree with you. What you do is adapting to the habitat accordingly... Unless perennate. What a wonder? Believe it or not... In our country, there are animals who perennate as well!
Massive redwood tree :-	Really?
Baby flamingo:-	Of course. We have a squirrel friend. He sleeps continuously throughout the winter. He takes a small bite now and then, collected prior to winter.
Massive redwood tree :-	Oh! Its very common. That is called **hibernation**.

Annex 1.2.2

Guidelines for group exploration

Let's find out how organisms match up with the abiotic environment

- Focus your attention to the factor assigned to your group among factors based on the interactions between organisms and abiotic environment given below.
  - habitats
  - energy and material needs
  - changes in environmental factors
- Discuss with the members of your group on facts they know about the undermentioned plants and animals on factor assigned to you.

• Bee	• Snail	• Rubber
• Indian pitta	• Toad	• Cactus
• 'Kawaiya'	• Orchid	• Sunflower
• Polar bear	• 'Kirala'	• Baobab
• Mosquito	• Touch-me-not	• Lotus

- Study the information and diagrams given in the text book.
- Try to highlight the diversity of the factor assigned to you as much as possible by using the organisms given above.
- Find out the special adaptations of the above organisms relevant to the factor assigned to your group.
- Design a creation to highlight the above adaptations.
- Discuss about the contribution of the selected organisms to the sustenance of the living world.
- Highlight the contribution of abiotic environment on their sustenance.
- Prepare for a creative presentation of your findings.

Competency 1.0 : Explores the dynamic nature of the environment

Competency Level 1.3 : Investigates the mutual interactions between organisms and abiotic environment with time.

Activity 1.3 : This is how organisms invade the environment!

Time : 120 min.

Quality Inputs:

- Three copies of guidelines for group exploration (given in annex 1.1.2)
- The text book

Teaching-Learning Process :

Step 1.3.1 :

- Focus the attention of the class on picture of the abandoned building in the text book.
- Provide opportunity to present their views about the process that lead to the invasion of vegetation to the building.
- Lead a discussion highlighting following points.

• Always organisms invade the environment if a chance were given. • Establishment of a succession of organisms by invasion of plants and animals is a natural process that could occur in an open space like a hard rock surface or a bare land or an open reservoir.

(15 min)

Step 1.3.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 1.3.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high lighting the following points.

• Abiotic environment and the organisms therein changes with time. • The first invaders of a certain environment are the

organisms which can best fit to that particular environmental factors.

- When a particular group of organisms live in a certain habitat, they tend to change the composition of the environment with time.
- Afterwards a new set of organisms invade which are best suited for the new composition of the environment.
- Then the first group of organisms establish in a separate place in the same environment suitable for them.
- This process goes on for a long duration of time and a climax community is established at the end.
- Plants and animals in a climax community, can survive in that environment for a long time, as they are highly adapted to the factors in that particular environment.
- Phenomena of succession could be considered as a process of natural rehabilitation that takes place in a destroyed environment.
- This condition compensates the damages done to the living world sustaining their existence.
- We should be sensitive to make the process of succession advantageous to us while preventing its ill effects.

(45 min)

Criteria for assessment and evaluation :

- Explains the way in which a succession occurs in particular place.
- Accepts that establishment of organisms in various environments contributes to the sustenance of living world.
- Make presentations to illustrate the way in which a succession occurs with the aid of diagrams.
- Analyzes a current situation with the available information.
- Perseveres to have a scientific viewpoint of the world.

Annex 1.3.1

This is how organisms invade the environment!

- You are assigned to explore on how successions occur.
- Focus your attention to the type of succession you are assigned.
  - Invasion of vegetation on a rock bared upon due to a landslide
  - Invasion of vegetation on a forest destroyed by fire
  - Invasion of vegetation on an abandoned 'Wewa'
- Study the information and diagrams given in the textbook.
- Discuss about the experiences of the members of your group.
- Make an explanation adopting the information you gathered according to the theme assigned to you.
- Find out about how the changes that occur in the environment could be made use to our advantage while preventing its ill effects in our day-to-day activities.
- Prepare for a creative presentation of your findings.

Competency 1.0 : Explores the dynamic nature ofthe environment.

Competency Level 1.4 : Investigates the interactions in abiotic environment.

Activity 1.4 : Let's find about what's hapenning in the abiotic environment.

Time : 120 min.

Quality Inputs :
- The verse '**Looking back...**'(given in annex 1.4.1)
- Three copies of guidelines for group exploration (given in annex 1.4.2)
- The text book

Teaching-Learning Process:

Step 1.4.1 :
- Provide opportunity for a student to recite the verse '**I can remember**' to the class.
- Lead a discussion highlighting following points.

  - Following events are included in the verse.
    - rocks being broken down to small pieces
    - decomposition of a dead tree
    - soil being eroded from the hill
  - Events as such could be seen in the environment frequently.
  - These could be considered as interactions in the abiotic environment.

(15 min)

Step 1.4.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 1.4.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Digestion of rocks, decomposition of organic matter and soil erosion are interactions in the abiotic environment.
  - Following factors affect soil erosion.
    - heating and cooling of rocks
    - water in the crevices of rocks freeze to form ice
    - water running on the surface of rocks

- acid rain falling on the rocks
- cracks being formed due to the penetration of roots

- Decomposition of organic matter due to the action of saprotrophic organisms(bacteria and fungi)
- Following factors are needed to the action of saprotrophic organisms
  - moisture/water
  - relevant temperature
  - air/oxygen
- Compost is formed due to decomposition of organic matter
- Movement of soil from one place to another by natural means could be considered as soil erosion.
- Following factors affect soil erosion
  - flowing water
  - wind
- Exposed soil is subjected to soil erosion easily.
- Some of the human activities that affect the exposure of soil are as follows;
  - clearing of forests
  - irregular development of buildings
  - agriculture
- Washing away of river banks due to the speed of water currents is known as river bank erosion.
- Washing away of sea shore due to the speed waves is known as sea erosion.
- Rocks and minerals in the deeper layers of soil emerge due to soil erosion.
- Top soil is very important for crop cultivation.
- Therefore it is very important to conserve the top soil for the sustenance of humans.
- Formation of top soil is a long term interaction that had been going on throughout hundreds of years.
- Following action could be taken to prevent soil erosion;
  - introduction of cover crops
  - introduction of proper irrigation systems and bunds
    - establishment of forest plantations

- Digestion of rocks, decomposition of organic matter as well as soil erosion causes a degradation of abiotic environment to a certain amount.
- The understanding and experiences on this is important in keeping harmony with the environment.

(45 min)

Criteria for assessment and evaluation :

- Explains degradation of abiotic environment due to interactions therein.
- Accepts that the interactions in the abiotic environment could be made to the advantage of day-to-day activities.
- Designs experiments to demonstrate interactions in the abiotic environment.
- Make predictions for the future based on the existing conditions.
- Exhibits the ability to survive by adapting to the environment.

Annex 1.4.1

Looking back...

Upon the big hill
Bihind our home
Grew a small tree
On a rock dome.

The tree grew fast
Faster than I
Its roots ran deep
As the tree grew high.

Through the rock
The roots found their way
And the rock cracked
And crumbled away.

On one windy day
The big tree fell
The pieces of rock
Came tumbling as well.

By and by
Time and rain
Took the tree and the rock
And hid them unseen.

Hasika Dilhani Jayasekara

Annex 1.4.2

Guidelines for group exploration

Let's find about what's hapenning in the abiotic environment

- Focus your attention to the theme assigned to you.
  - digestion of rocks
  - decomposition of organic matter
  - soil erosion
- Read the section relevant to your theme given in the text book.
- Arrange the interactions identified under the theme in order.
- Find out the scientific facts based on the interactions.
- Select an interaction of your choice and suggest a suitable experiment to demonstrate it.
- Perdict the results of your experiment.
- Consider about the advantages and disadvantages of this interactions in day-to-day life.
- Show how you act accordingly to minimize disadvantages and maximize advantages.
- Prepare for a creative presentation of your findings.

Competency 2.0 : Focuses attention on the environment quantitavely.

Competency Level 2.1 : Uses the measurements of volume to describe the materials and objects in the environment.

Activity 2.1 : Let's determine the volume of solids and liquids.

Time : 120 min.

Quality Inputs:

- Three copies of guidelines for group exploration (given in annex 2.1.1)
- The common table (given in annex 2.1.2)

Teaching-Learning Process:

Step 2.1.1 :

- Present a cuboid shaped solid object and a small piece of stone to the class.
- Inquire from students how we could determine the volume of these objects.
- Present a measuring cylinder with a label 'measuring cylinder' to the class.
- Let the students to observe and discover its shape, graduated scale, range of measurement and units.
- Direct the students to add various volumes of water to the measuring cylinder and take readings.
- Let the students to observe the way water rises in the measuring cylinder when a certain solid object is immersed.
- Lead a discussion highlighting following points.
  - Volume of a cuboid could be determined as follows;

    Volume of a cuboid = length × width × height
  - Measuring cylinders of diffrent sizes could be used to measure liquid volumes.
  - Range of the volume that could be measured is graduated in milliliters in each and every measuring cylinder.
  - Rise in water level in the measuring cylinder could be measured when a solid object is immersed in water.
  - Volume of the object immersed in water is indicated by the rise in the volume of water in the measuring cylinder.

(15 min)

Step 2.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 2.2.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

- Volume of a cube could be determined by measuring its length.
- Volume of a cuboid could be determined by measuring its length, width and height.
- Standard unit of volume is cubic meter (m^3)
- Objects of geometric shapes are called regular solid objects.
- Volume of these objects could be determined by measuring its dimensions.
- Not only cube and cuboid, there are sphere, cylinder and cone etc, as regular solid objects in the environment.
- As the thickness of a single paper could not be measured, thickness of a number of papers were measured and the average thickness is determined.

Voloume of a of paper = length x width x height

$$\text{Average thickness of a paper} = \frac{\text{Thickness of a number of papers}}{\text{number of papers}}$$

- Volume of the object immersed in water in a measuring cylinder is equal to the rise in the volume of water.
- Eye should be kept at the same horizontal level as the liquid meniscus when taking readings from the measuring cylinder.
- Volume of regular solid objects could be determined by following methods;
  - Calculated by measurements
  - Determined by the rise in water level of the measuring cylinder
  - Volume determined using the dimensions measured by meter rule is in cubic centimeters.
  - Volume determined by using a measuring cylinder is in milliliters.
- One cubic centimeter of a solid object is equivalent to one milliliter of water. $1m^3 = 1ml$

- Objects without particular geometric shapes are called irregular solid objects.
- Volume of such objects could be determined by dimensions.
- It is essential to use the measuring cylinder to determine the volume of irregular objects.

(45 min)

Criteria for assessment and evaluation :

- Explains the way of determining the volume of solids and liquids.
- Accepts that measurements of volume could be used to describe substances and objects quantitatively.
- Determines the volume of liquids and solids using measuring instruments.
- Quotes alternative methods to achieve objectives.
- Exhibits good work habits.

Annex 2.1.1

Guidelines for group exploration

Let's determine the volume of solids and liquids

- Your group is assigned to determine the volume of solid objects according to one of the themes given below.
  - determination of volume of regular solid objects using only the ruler
  - determination of volume of irregular solid objects using only the measuring cylinder
  - determination of volume of regular solid objects using both the ruler and measuring cylinder.
- Select the set of materials relevant to your group from the common table.
- Measure the volume of the solid objects by taking necessary measurements.
- Compare the volumes of objects.
- Discuss about the instances where you employ the above methods in measuring the volume of various objects in day-to-day activities.
- Prepare for a creative presentation of your findings.

Annex 2.1.2

The common table

- Prepare a common table by placing three sets of materials and equipments given below.
- **Set - 1**
  - Wooden cubes, boxes of incense sticks, a paper from an exercise book (place five books having similar paper without the cover pages), a brick, a meter rule.
- **Set - 2**
  - Glass stoppers, pieces of granite, mass of clay, madhatiya seed (place a container with about hundred madhatiya seeds), a meter rule, measuring cylinder, water.
- **Set - 3**
  - Two bar magnets (other suitable cubes or cuboids that could be immersed in water in a measuring cylinder), a meter rule, water.

Competency 2.0 : Focuses attention on the environment quantitavely.

Competency Level 2.2 : Uses the measurements of density to describe the materials and objects in the environment appropriately.

Activity 2.2 : Let's determine density.

Time : 120 min.

Quality Inputs :

- Five identical yoghurt cups filled with cotton wool, sand, flour, saw dust, rice, coriander etc, tightly closed with lids and named.
- Three copies of guidelines for group exploration (given in annex 2.2.1)
- The work-stations (given in annex 2.2.2)

Teaching-Learning Process:

Step 2.2.1 :

- Place the yoghurt cups on the teacher's table.
- Call a few students and inquire about the mass of the yoghurt cups.
- Get the students to indicate the mass of yoghurt cups in ascending order on the black board.
- Lead a discussion highlighting following points.

  - The volume of the contents of all the yoghurt cups are equal.
  - Even if the volumes are equal, the mass of yoghurt cups are different due to special characteristics of their contents.
  - Mass and volume could be used to find out the nature of materials which contribute to make different solid objects.

(15 min)

Step 2.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 2.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high lighting the following points.

- Masses of equal volumes of various materials have different values.
- Same value is obtained if mass of any part of a substance is divided by its volume.
- That value is called the **density** of that substance.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

- Each and every fragment of a broken object, eventhough they are of different shapes and sizes, possess the same density.
- Unit of density of small objects is expressed as grams per cubic centimeter.
- Standard unit of density is expressed as kilograms per cubic meter.
- Mass of equal volumes of different objects varies as their densities are different
- Density is a reliable characteristic for identifying substances.
- Examples for density of some substances are given below;
- Density of water is 1000 kilograms per cubic meter
- Density of steel is 7800 kilograms per cubic meter
- Density of petrol is 800 kilograms per cubic meter

(45 min)

Criteria for assessment and evaluation :

- Explains what is density and describes the way of determining density.
- Agrees that density is a reliable characteristic for identifying substances.
- Obtains accurate readings using various equipments.
- Manipulates relevant data to develop concepts.
- Perceives an overview by comparing various conditions.

Annex 2.2.1

Guidelines for group exploration

Let's determine density

- Focus your attention to the set of objects provided to your group.
  - three regular objects prepared using various substances.
  - three irregular pieces of varying sizes prepared using same substance.
  - three objects of various substances and various sizes.
- Determine the mass and volume of the objects supplied to you and record accordingly.
- Determine the density of objects.
- Compare the values of density obtained for each set of objects.
- Lead a discussion about the results.

- Find out the possible instances that density could be used in day to day life.
- Prepare for a creative presentation of your findings.

Annex 2.2.2

The work-stations

- Prepare three seperate work-stations according to the instructions, together with a scale to measure the mass and a copyof the card given below.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Example:- Volume of a metal sphere is 25 cubic centimetres.
Its mass is 200 g.

$$\text{Density of the metal sphere} = \frac{200}{25} = 8 \text{ grammes per cubic centimetre}$$

Work-station I

- Cuboids of equal length, width and height (made of clay,cement, pulp, wood etc.)
- Meter ruler

Work-station II

- A piece of granite broken into three small pieces of different sizes
- A measuring cylinder with water

Work-station III

- A lead pellet, quartz pebble and a piece of ceramic plate (keep some excess materials as well.)
- A measuring cylinder with water

- (NB:- Provide suitable spring balances and measuring cylinders.)

Competency 2.0 : Focuses attention on the environment quantitavely.

Competency Level 2.3 : Uses the measurements of speed to describe the phenomena in the environment appropriately.

Activity 2.3 : Let's determine the speed of a journey.

Time : 120 min.

Quality Inputs :
- A script of the role play **'A rush'** (given in annex 2.3.1)
- Three copies of guidelines for exploration (given in annex 2.3.2)
- Instructions to prepare the common table (given in annex 2.3.3)

Teaching-Learning Process:

Step 2.3.1 :
- Let students to present the role play **'A rush'**.
- Lead a discussion to highlight the following points.

  - The instrument to measure the speed of a vehicle is the speedometer.
  - It indicates the speed of the vehicle continuously.
  - When a vehicle moves along a road, changes in speed could be observed in each and every moment.
  - The average speed of a vehicle could be determined by dividing the total distance travelled by the total time taken.
  - It could be expressed as follows;

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

(15 min)

Step 2.3.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.5.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high lighting the following points.

- The distance travelled in unit time is called speed.
- Speed could be determined by measuring the time taken to travel a known distance.
- Units are used to measure the speed.
- The standard unit of speed is meters per second. (ms^{-1})
- Speed is also measured by kilo meters per hour. (km/h, $km\ h^{-1}$)
- The drivers use the speedometer to know the speed of the vehicle right throughout the journey.
- Every moving object has a speed.

(45 min)

Criteria for assessment and evaluation :

- Defines what is speed and names its units.
- Agrees that speed is used to describe the motion of an object.
- Determines the speed of a moving object by using relevant techniques.
- Engages in time management.
- Records data accurately.

Annex 2.3.1

A rush

(Father is waiting for his son restlessly in the driving seat the son came running to the car.)

Son : "Hurry up dad, hurry up. Its already 7.30. We have to be present for the inetrview at 9.45 in Colombo. Fifty kilo meters to be travelled."

Father : (Started the vehicle.)
"We cannot rush as you say. This is office rush hour. A heavy traffic as well. We have plenty of time. So please don't bother."
(After some time...)

Son : "Oh! Look at the truck full of sand crawling ahead of us. Why don't you take a chance and overtake even from left."

Father : "Please keep in mind , that there are rules and regulations in driving. And a discipline as well. People fall into trouble by disregarding those."
(The car is cruising.)

Son : "What a traffic? It seems that I won't be able get there on time for the interview... indicator of the speedometer is continuously at 10.
Oh...! It seems now the road is getting clear ahead of us. Let's speed up."

Son : "Oh my god! Dad... apply brakes... brakes. A cow is running across."
(Somehow, the cow runs away. The car came to a halt at once.)

Father : "Thank god! If it hit the car everything would have been over."

(Starts the car again... Arrives Colombo passing a long way.)

Son : "Dad, look at the name board of the building ahead... Stop. This is the place."

Father : (Stopped the car.)
"Still it is 9.30. Anyway, it took two hours for the 50 kilometer journey."

Son : "By the way, we have travelled at a speed of 25 kilometers per hour."

[Get three students for the characters of farther, son and the other to act as the indicator of the speedometer as well.]

Annex 2.3.2

Guidelines for group exploration

Let's determine the speed of a journey

- Focus your attention to one of the events given below.
  - sac race
  - coconut shell race
  - lime on a spoon race
- Select the relevant material from the common table.
- Provide opportunity to each and every member of your team to run 25 meters.
- Measure the time taken in seconds.
- Determine the distance travelled by each member in one second.
- Now, allow each member to engage in the event for five seconds and record the distance seperately.
- Determine the distance travelled in one second as in the previous occasion.
- Compare the speed of each member in both occasions.
- Select the winner according to the data gathered.
- Prepare for a creative presentation of your findings.

Annex 2.3.3

The common table

Arrange a common table with materials and equipment given below.

- A gunny bag, two coconut shells with a rope attached, a lime, a table spoon, measuring tape, three stop watches/digital watches.

Competency 2.0 : Focuses attention on the environment quantitavely.

Competency Level 2.4 : Uses the concept of rate to describe the phenomena in the environment appropriately.

Activity 2.4 : Let's determine the rate

Time : 120 min.

Quality Inputs:

- Two copies of guidelines for group exploration (given in annex 2.4.1)
- The work-stations (given in annex 2.4.2)

Teaching-Learning Process:

Step 2.4.1 :

- Let a student to write the word 'rate' ten times accurately on the board.
- Let two students to write fast and slow than on previous occasion the word 'rate' ten times accurately on the board.
- Lead a discussion highlighting the following points.

  - All three students did the same task.
  - The rate at which they wrote the words are different.
  - In day-to-day life we come across phenomena where we have to reduce or increase the rate.

(15 min)

Step 2.4.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 2.4.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Some of the phenomena that occur around us are recurrent.
  - The number of ocurrences of phenomena in a unit time is called the rate.
  - As a standard, the rate is measured as the **number of phenomena occuring in a second.**
  - The rate could be presented as follows;

$$\text{Rate} = \frac{\text{number of occurences}}{\text{Time taken for occurences (in seconds)}}$$

- There are different rates for various phenomena in the environment.
- The rate at which an object cover a particular distance is called the speed.
- If some phenomena takes place fast, the rate is high.
- If some phenomena takes place slow, the rate is low.
- Rates of some phenomena have to be manipulated in order to make the day-to-day activities productive.

(45 min)

Criteria for assessment and evaluation :

- Describes the rate in relation to different phenomena.
- Agrees that the rate is an important factor associated with the efficiency of day-to-day activites.
- Determines the rate of various phenomena.
- Exhibits the ability to work efficiently and efectively.
- Motivates to work towards development.

Annex 2.4.1

Guidelines for group exploration

Let's determine the rate

- Focus your attention to the condition on the change in rate assigned to you.
  - reducing the rate
  - increasing the rate
- Plan the phenomena/activities at work stations.
  - Seeping of drops of water from a wet cloth
  - Skipping
  - Oscillation of a simple pendulum
  - 'Tiki' sound produced by a toy made with an immature coconut.(Kurumbatti machine)
- Measure the time taken to complete ten of the above phenomena/activities.
- Determine the rate or the number of occurrences per second of each and every phenomena/activity.
- Conduct the activities or allow the phenomena to occur at the condition assigned to you (reducing or increasing the rate) and determine the rate.
- Describe the process you followed in order to change the rate accordingly.
- Discuss among the group about the instances where you have to increase or decrease the rate in order to make the day-to-day activities more productive.
- Be prepared to make an innovative presentation about your findings.

Annex 2.4.2

The work-stations

- Arrange two work stations with following materials and equipments.
  - A beaker filled with water
  - A big handkercheif
  - a toy made with an immature coconut.(Kurumbatti machine)
  - A skipping rope
  - A piece of thread and a weight to prepare a simple pendulum
  - A stop watch or a clock/watch that could measure seconds.

(Allow one end of the handkerchief soaked with water in the beaker in order to seep drops of water.)

Competency 3.0 : Investigates the organizational patterns in the bodies of organisms.

Competency Level 3.1 : Investigates the patterns in the organization of animal body to perform life functions.

Activity 3.1 : Let's get to know about the systems of human body

Time : 120 min.

Quality Inputs :
- Microscopic set ups or photomicrographs of blood, epithelial tissue and cells of buccal cavity(given in annex 3.1.1)
- Three copies of guidelines for group exploration (given in annex 3.1.2)
- The text book

Teaching-Learning Process:

Step 3.1.1 :
- Present microscopic set ups or photomicrographs of blood, epithelial tissue and cells of buccal cavity in order to show the cellular organization of human body.
- Direct the students to identify smaller units in them.
- Lead a discussion highlighting following points.

• Body is composed of small units called cells. • Cells of different areas of the body shows a diversity. • A group of cells adapted to perform a particular function is called a tisssue.

(15 min)

Step 3.1.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 3.1.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

• There is a common organizational pattern in animal body • Head, thorax, abdomen and appendages could be identified as main parts in an animal body.

- Man is also a one of the animals in the world of organisms.
- Human body is composed of head, trunk and limbs.
- Trunk is divided as thorax and abdomen.
- There are a number of systems in the human body.
- Some of them are given as follows;
  - Respiratory system
  - Digestive system
  - Excretory system
  - Blood circulation system
  - Nervous system
  - Reproductive system
- All systems are composed of a number of basic parts.
- Basic parts in a system is made up by different tissues.
- All tissues are made up of cells.
- Respiratory system is adapted to gas exchange.
- Prominent basic parts of the respiratory system are nasal passage, trachea, bronchioles and lungs.
- Digestive system is adapted to digestion and absorption of food.
- Prominent basic parts of the digestive system are mouth, oesophagus, stomach, liver, intestines and anus.
- The main functions of blood circulation system are transport of materials throughout the body and protection against diseases.
- Prominent basic parts of the blood circulation system are heart and the blood vessels.
- Kidneys, ureters, bladder and urethra could be considered as the basic parts of the excretory system.
- Filtering the unnecessary substances from the body and excretion as urine is the main function of excretory system.
- The basic parts of the nervous system are brain, spinal cord and peripheral nerves.
- Major functions of the nervous system are control of body functions, maintaining the relationships with the environment and the process of thinking.
- There are two reproductive systems as male and female.
- Reproductive systems contribute to produce offspring.
- Basic parts of the male reproductive system are testis, vasdeferens, urethra and penis.
- Ovaries, womb and vagina are basic parts of the female

reproductive system.

- All the systems in the human body play a vital role in the sustenance of man.
- They are located in such a manner which suits to achieve the maximum efficiency.
- We should pay due attention to healthy maintainance of these systems.

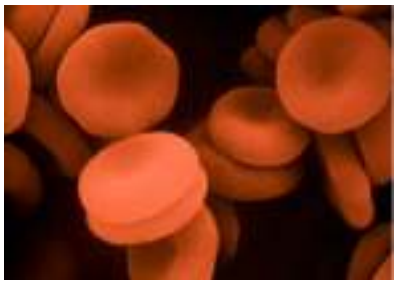
(45 min)

Criteria for assessment and evaluation :

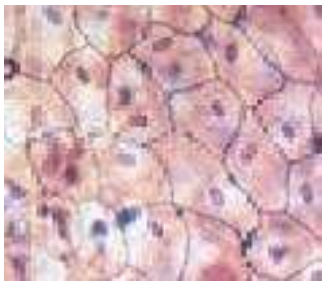
- Identifies and names the basic parts of systems in the human body.
- Agrees on that the collective contribution of a number of systems are necessary for the sustenance of the human body.
- Presents models to illustrate the location of different systems in the human body.
- Identifies the sequence of a process.
- Discovers the entire organizational pattern by basic parts and appendages.

Annex 3.1.1

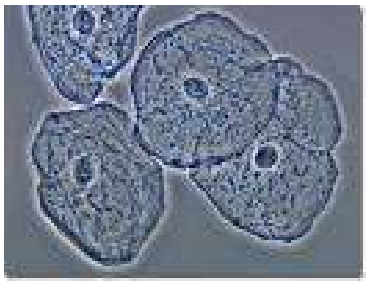
Photomicrographs of human blood, epithelial tissue and cells of buccal cavity



Blood cells



Epithelial cells



Cells of buccal cavity

Annex 3.1.2

Guidelines for group exploration

Let's get to know about the systems of human body

- Focus your attention to the pair of systems assigned to you which are adapted to perform different functions in the human body.
  - respiratory and digestive systems
  - reproductive and excretory systems
  - nervous and blood circulatory systems
- Study the diagrams given in the text book.
- Illustrate the location of the systems assigned to you by making a drawing considering the main parts head, thorax, abdomen and limbs in the human body.
- Name the major parts of systems.
- Make a discussion on how these systems are adapted to perform that particular function.
- Predict on the situation created if the systems cease to function.
- Prepare for a creative presentation of your findings.

Competency 3.0 : Investigates the organizational patterns in the bodies of organisms.

Competency Level 3.2 : Investigates the patterns in the organization of plant body to perform life functions.

Activity 3.2 : Let's have a look at the patterns of plant body

Time : 120 min.

Quality Inputs:

- Instructions for selecting the set of plants.(given in annex 3.2.1)
- Two copies of guidelines for group exploration (given in annex 3.2.2)

Teaching-Learning Process:

Step 3.2.1 :

- Let the students observe an epidermis of a betel leaf or any other plant tissue under the microscope or a photomicrograph of a plant tissue.
- Present the plant and the part by which the tissue was obtained to the students.
- Lead a discussion to highlight the following points.

  - Plant is composed of building units called cells.
  - All the parts in a plant are built up by tissues made by groups of cells.
  - Aerial shoot system and underground root system could be considered as two major systems in plants.

(15 min)

Step 3.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 3.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - A plant body could be divided into two parts as shoot system and root system.
  - Aerial part which grow upward from the ground is called shoot system.

- The part which grow underground is called the root system.
- Some plants have underground stems.
- Plants with roots above the ground level such as prop roots, stilt roots, clinging roots, aerial roots etc, could be seen in the environment.
- Stem, leaves, flowers, fruits, branches and twigs, buds etc, are parts of shoot system.
- Plants have a diversity of shoots such as branched stems, unbranched stems, shrubs, vines etc.
- Tap root system comprising of a primary root from which lateral roots grow and fibrous root system are two major types of root systems in plants.
- Stems carry the shoot system in air and distribute water and minerals throughout the shoot.
- Main function of leaves is photosynthesis.
- Flowers, fruits and seeds perform a reproductive function.
- Buds contribute to the formation of leaves, flowers and branches.
- Roots perform the functions of attaching the plant to soil, absorption of water and minerals and sometimes storing food.
- Any part of an any system of a plant body performs an important role in the sustenance of plant.
- Major tissues in plants that are made up of a group of cells are parenchyma, collenchyma, sclerenchyma as well as xylem and phloem.

(45 min)

Criteria for assessment and evaluation :

- Explains the structure and the function of shoot system and root system
- Agrees that each and every part of plant plays an essential role to its sustenance.
- Develops structure-function relationship by observing plants.
- Reveals the value of environment.
- Discovers the organizational patterns.

Annex 3.2.1

Instructions for teachers to select the set of plants

- Select the set of plants having stem, roots,leaves, flowers and fruits.
- Select two grasses which bear two different types of flowers.
- Select two dicotyledenous herbs which are in abundance.

Guidelines for group exploration **Annex 3.2.2**

Let's have a look at the patterns of plant body

- Your group will be assigned to explore on the general plan of the plant body.
- Focus your attention to the set of plants assigned to you.
  - two plants (chillie and grass)
  - two plants (brinjal and grass)
- Compare the root systems and shoot systems of the pair of plants supplied to you through careful observation.
- Identify the main parts of root system and shoot system.
- Find out the role played by these main parts.
- Predict on the problems that are encountered in the following instances.
  - Drying up of soil
  - Aerial part being eaten by an animal
- Lead a discussion on how parts of plants and their functions contribute to the sustenance of animals including man.
- Prepare for a creative presentation on your findings.

Competency 4.0 :Makes inquiry to identify the nature of earth and space.

Competency Level 4.1: Investigates on the components of lithosphere.

Activity 4.1 : **Let's peep into the interior of earth**.

Time : 120 min.

Quality Inputs:

- **'The story about the interior of earth.'**(given in annex 4.1.1)
- Three copies of guidelines for group exploration (given in annex 4.1.2)
- The text book

Teaching-Learning Process:

Step 4.1.1 :

- Let a student to present the story to the class.
- Lead a discussion highlighting the following points.

• We are living on the surface of the earth's crust. • Rocks, minerals and soil could be considered as the basic constituents of the lithosphere which is the topmost part of the crust.

(15 min)

Step 4.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 4.1.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high lighting the following points.

• Core, mantle and crust are three main layers of the earth from the centre to the surface respectively. • Core, the innermost part of the earth is composed of iron, nickel and a variety of substances in molten form, due to its high temperature. • Earth's crust is a very thin layer with compared to its radius. • Its thickness is in the range of 15 - 75 km. • It contains a high percentage of silicon. • Granite, limestone, marble etc, are examples for rocks. • Rocks and minerals are used as raw materials in building

construction and as raw materials for chemical industries.

- Silica, quarts, gold, silver, gemstones etc, are examples for minerals.
- Rocks are broken down to small particles due to various interactions of the environment.
- It is named as digestion of rocks.
- Soil originates from the digested rocks together with organic matter.
- It is a long term process.
- We have to plan actions in order to conserve soil.

(45 min)

Criteria for assessment and evaluation :

- Explains about the facts on lithosphere which is the outermost part of the earth.
- Values the importance of the lithosphere for the sustenance of life.
- Differentiates varieties of rocks, minerals and soils in the abiotic environment.
- Highlights the remarkable objects out of totality.
- Exhibits the ability to select substance acoording to needs.

Annex 4.1.2

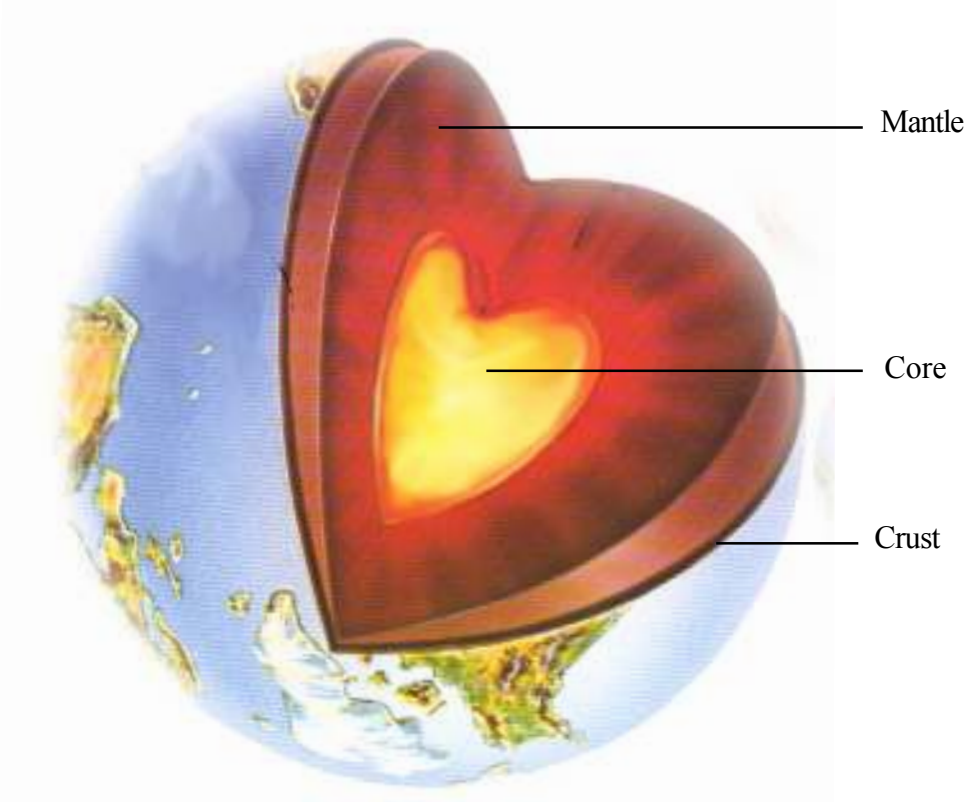
Guidelines for group exploration

Let's peep into the interior of earth

- You are assigned to explore on one of the components of lithosphere given below.
  - rocks
  - minerals
  - soil
- Observe the garden for ten minutes.
- Try to collect some substances relevant to your theme from the environment.
- Find the information relevant to the collected substances from the text book.
- Extract the direct and indirect applications of the relevant component in day-to-day life.
- Imagine a world without the component assigned to you. If it is so, discuss how it influence the sustenance of organisms including man.
- Prepare for a creative presentation of your findings.

Annex 4.1.1

The story about the interior of earth



Focus your attention on the above picture. It shows the inside of the earth. The core, which the centre part of the earth is still a warm liquid of high temperature. What is contained in that ? It is mostly molten metals like iron and nickel.

Now look at the surface of the earth. The thin layer running down to a certain depth from the surface is called crust. Lithosphere is part of this crust. Rocks, minerals and soil are the important components of the lithosphere.

The part in between the crust and the core, is mantle.

Competency 4.0 : Makes inquiry to identify the nature of earth and space.

Competency Level 4.2: Utilizes soil while conserving its quality effectively.

Activity 4.2 : Let's get the maximum use of valuable soil.

Time : 120 min.

Quality Inputs :
- Three copies of guidelines for group exploration (given in annex 4.2.1)
- The work-stations (given in annex 4.2.2)

Teaching-Learning Process:

Step 4.2.1 :
- Prepare two small teams for a short debate on the theme 'Development of a country **leads / does not lead** to soil erosion.'
- Lead a discussion highlighting following points together with the facts that came up during the debate.

  - Soil erosion is unavoidable in implementing development projects.
  - Soil erosion should be minimized in sustainable development efforts.
  - The quality of soil is degraded due to soil erosion.
  - It is important to study about the quality and the constituents of soil for agriculture.

(15 min)

Step 4.2.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 4.2.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - There is a layer of soil on the surface of the earth .
  - Depth of soil layer differs from place to place.
  - The basic solid constituents of the soil acoording to their

size could be considered as coarse sand, fine sand, silt, clay and humus respectively.
- Soil water, soil air and soil organisms are also constituents.
- Soil could be classified according to the abundance of constituents as follows;
  - Clayey soil
  - Sandy soil
  - Loam soil
- There are organisms adapted to live in all the classes of soils.
- Loam soil is suitable for cultivation of many crops.
- The following characteristics could be seen in loam soil;
  - optimum aeration
  - optimum drainage
  - presence of adequate water and minerals
  - decomposition of organic matter
- Vegetation which cover the soil is removed due to development activities including agriculture as well.
- Soil erosion occurs as a result.
- Removal of top soil by factors such as water, wind etc, is called soil erosion.
- The soil which we utilize is a result of a process occurring throughout millions of years.
- It is therefore, extremely important to conserve soil for the sustenance of mankind.

(45 min)

Criteria for assessment and evaluation :

- Classifies the soil according to the abundance of its constituents.
- Values the importance of soil conservation.
- Conducts simple experiments to illustrate the quality of soil.
- Acts to discover existing situations.
- Exhibits the competence of conserving the environment.

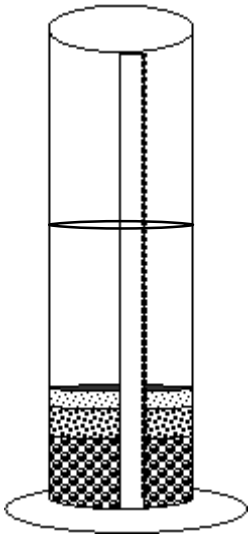
Annex 4.2.1

The work-stations

- Place materials and equipments given below in each work-station.
  - Three empty yoghurt cups
  - One litre of water
  - Provide one yoghurt cup full (more than if possible) of each soil sample given below.
    - A sandy soil
    - A clayey soil
    - A soil rich in organic matter

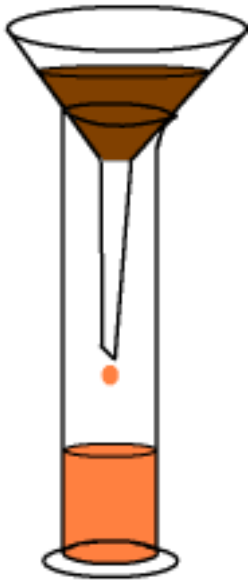
- Arrange three seperate work-stations keeping materials given below.

- **Work-station-I**
  - Three similar jam jars and a ruler (measuring cylinder more suitable)
  - A stick to stir
  - The card given below.



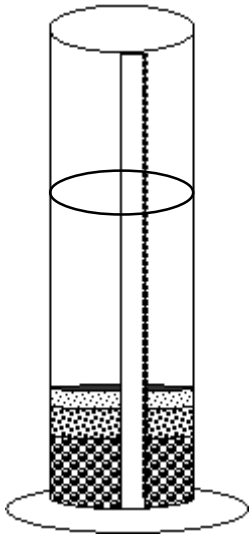
- This is a soil sample mixed well in water.
- Prepare all three soil samples as above.

- **work-station-II**
  - Three similar jam jars and a ruler (measuring cylinder more suitable)
  - Three funnels
  - Tree pieces of thin cloth
  - The card given below.



- Amount of water drained after absorbing to the soil sample is indicated in the picture.
- Prepare all three soil samples as above.

- **work-station-III**
  - Three measuring cylinders
  - A stick to stir
  - The card given below.



- Add two yoghurt cups full of water to the measuring cylinder.
- Add one yoghurt cup of soil sample, mix well and take the reading of the water level.
- Prepare all three soil samples as above.

To the teacher...

- In determining the volume of soil air, the rise of water level indicates the volume of soil in the yoghurt cup. Volume of soil air is obtained by substracting the volume of soil, by the volume of one yoghurt cup full of water.
- Direct the students to obtain soil volumes compacting by hand after filling the yoghurt cups and cutting off the excess.

Annex 4.2.2

Guidelines for group exploration

Let's get the maximum use of valuable soil.

- Focus your attention to one of the activities given below.
  - quantifying the constituents of soils
  - quantifying the water retained in soils
  - quantifying the amount of air in soils
- Arrange setups using the soil samples, materials and equipments kept in work-stations.
- Record the results by engaging in the activity.
- Discuss the suitability of each soil type for cultivation of crops, according to the results obtained.
- Make suggestions to improve the quality of each soil type for the cultivation of various crops.
- Prepare for a creative presentation of your findings.

Competency4.0 : Makes inquiry to identify the nature of earth and space.

Competency Level 4.3 : Investigates on the solar system.

Activity 4.3 : Let's be curious about the space

Time : 120 min.

Quality Inputs :
- Script of the drama **'Conflict in the solar system'** (given in annex 4.3.1)
- Four copies of guidelines for group exploration (given in annex 4.3.2)
- The text book

Teaching-Learning Process:

Step 4.3.1 :
- Let a group of students to present the drama.
- Lead a discussion highlighting following points.
  - It was decided to name Pluto as a dwarf planet considering its size, which had been identified as a planet before.
  - It is accepted that there are eight planets in our solar system
  - Exploring more information on solar system leads to the well being of mankind.

(15 min)

Step 4.3.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 4.3.2 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - Sun, planets, moons, dwarf planets and asteroids are all belong to the solar system.
  - Sun is one of the infinite number of stars in the universe
  - There are bigger and smaller stars than the sun in the universe.
  - Sun is composed of hydrogen and helium gasses.

- Temperature of the inner core of sun is about 15 million centigrade
- Temperature of the surface of sun is about 6000 k.
- Sun's energy is recieved by the earth mainly as heat and light.
- It takes about eight minutes and 18 seconds to reach the light from sun to earth.
- Sun is the energy source of earth.
- Scientists have made predictions that sun would fade away in another billions of years.
- Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune are the eight planets in the solar system.
- Each planet keeps rotating with its sattelites while revolving around the sun continuously.
- The earth takes 365 and 1/4 days to revolve once around the sun.
- The earth takes 24 hours to rotate once.
- The objects that revolve around the sun which are not big enough to be named as planets are called dwarf planets.
- According to the latest classification Pluto, Ceres and Xena are considered as dwarf planets.
- Thousands of asteroids which exist in between orbits of Mars and Jupiter together with comets are called small solar-system bodies.
- Comets that are moving in an elliptical path come closer to the earth from time to time.
- Comets that are moving in paraboloid or hyperboloid paths come closer to sun and the earth once and move far away into the universe.
- Any celestial body from the universe which enter the earths' atmosphere is called a meteor.
- Pieces of meteors remaining without burning in the atmosphere are called meteorites.

(45 min)

Criteria for assessment and evaluation :

- Names and explains the characeristics of planets and other celestial bodies.
- Agrees that discoveries about the celestial bodies affect the well being of mankind.
- Communicates information innovatively.
- Observes the environment broadly.
- Makes the habit of finding new information.

Annex 4.3.1

Conflict in the solar system

Seven students are seated in front of the class with the name boards of Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune. . බුධ, සිකුරු, අඟහරු, බ්‍රහස්පති, සෙනසුරු, යුරේනස්, නැප්චූන් There are three vacant chairs as well. Two students enter the class with name boards of Sun and Earth. Standing ovation for the newcomers.

Sun : Aren't all the planets in the house, are they?

Mars : Yes indeed, sir. (looking around) All have come.

Neptune : You are highly mistaken. Can't you see that one chair is vacant?

Uranus :- Oh yes. Pluto is absent. May be he hasn't got the notice about the meeting. .

Saturn :- (with pride and grandeur) All who were expected have come. Do remove that chair. Pluto will not participate for the assemblies of planetary committee any more.

Mercury : How unfair it is? He had been regular for planetary committee so far. I can't imagine why he has quit?

Earth : Please don't get involved in unnecessary conflicts! It is revealed that Pluto doesn't have required minimum qualifications to be a planet. So he will not be identified as a planet anymore. Its a very important decision.

Jupiter : You please tell us now the criteria to be fulfilled to qualify as a planet.

Earth : There are three. First one...It should have a definite orbit to move around the sun. Second one...Its magnitude should be sufficient enough to generate a gravitational force which enable to keep its spherical shape. Third one...It should be capable not to have any other object in its orbit.

Venus : Pluto is a celestial body which revolves around the sun and it has a sattelite as well. But still it is not considered as a planet because it is unable to maintain its orbit free of other objects, that means, he cannot qualify the third factor as earth said.

Anyway I would like to invite our leader Sun to elaborate on this.

Sun : (In a reserved manner, with a gentle smile)

Thank you very much.

Well...I know that Pluto's friends are hurt for the absence of Pluto, in this audience.

But as the fact raised by Venus, Pluto himself deliberately resigned from the planetary committee.

Now he is a member of the society of dwarf planets. As you know Ceres and Zena are also active members of that society. Anyway, planetary committee, society of dwarf planets, assembly of sattelites are all doing a tremendous service for advancement and sustenance of solar system under my leadership. I hope that in future more new members would be introduced to our solar system.

But remember... myself...your caretaker...is also not the biggest star in the universe. It is not an exaggeration, if I say that not being the largest star in the universe has not in anyway disturbed my valuable duties or my personality at all!

Neptune: (Overjoyed)

Exactly. You are a noble leader.

We too shine with your luster.

Guidelines for group exploration **Annex 4.3.2**

Let's be curious about the space

- Focus your attention to the celestial body/bodies assigned to you, which belong to the solar system.
  - Sun
  - Planets
  - Sattelites and dwarf planets
  - Small solar system bodies
- Refer the text book and find information related to the celestial body/bodies assigned to you.
- Collect the information under the themes given below.
  - Name
  - Location and behaviour
  - Nature - characteristics
- Discuss about the possibility of inhabiting the celestial body/bodies assigned to you by organisms including man.
- Explain scientifically the effects caused by the celestial body/bodies have on organisms living in earth.
- Prepare for a creative presentation of your findings.

Competency 4.0 : Makes inquiry to identify the nature of earth and space.

Competency Level 4.4 : Investigates on the space explorations.

Activity 4.4 : How did you get to know about the sky?

Time : 120 min.

Quality Inputs:

- Two copies of guidelines for group exploration (given in annex 4.4.1)
- The text book

Teaching-Learning Process:

Step 4.4.1 :

- Display the pictures of space crafts and telescopes given in the text book to the students.
- Inquire from the students the advantages of those.
- Lead a discussion highlighting following points.

  - There are two methods of observing the objects in the space as given below.
    - Collecting information by getting closer to the object.
    - Using telescopes.
  - With the development of technology man has made considerable achievements in space exploration from both of these methods.

(15 min)

Step 4.4.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 4.4.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Rockets, space shuttles, space labs or space stations and artificial sattelites could be identified as spaceships.
  - Some of the problems faced in space travel could be presented as follows;

- An instance similar to floating as a weightless condition prevailing due to the zero gravity in space.
- Differences in the body occurs in space.
- Difficulties in performing routine bodily functions such as walking, consuming food, washing the mouth, bathing, using the wash room, sleeping etc.
- Deterioration of mental health during the life in space.
- Accidents occurring in space crafts and space stations.

- Various strategies are employed to face challenges in the space.
- Milestones in the development of space exploration could be presented as follows;
  - Space photography was initiated when French physicists Jean Forcault and Almond Fiso photographed the surface of the sun in 1845.
  - The concept of 'rocket' was first introduced by Constantine Tsiolkovsky through an article written on space travel in 1895.
  - First rocket sent to space by Robert Goddard in the year 1926.
  - 'Hale' telescope, which was the largest of all at that time, was established in mount Paloma, in California in 1948.
  - In 1952 Russia launched the spacecraft Sputnic I into the space.
  - 'Lyka', the bitch was sent to space in Sputnic II spacecraft.
  - The honour of moon-landing goes to Russians in 1957 when the spacecraft 'Luna II' landed on moon.
  - First man to be in earths' orbit was the Russian national Yuri Gagarin in April, 1961.
  - Niel Armstrong was the first man on the moon on 21st July, 1969 by the spacecraft Apollo 11.
  - Worlds' first space station 'Salute-1' was launched by Russians orbitted the earth in 1971.
  - Russian spacecraft 'Venera 9' landed on Venus in 1975 and sent photographs of the surface of Venus to the earth.
  - Viking-1 and 2 of NASA, orbitted Mars in 1976.

- In 1977, 'Voyager' spacecraft left earth to study the external planets.
- Space shuttle 'Colombia' was introduced by NASA in 1981.
- 'Hubble' telescope orbitted earth in 1990.
- Work on a huge international space station which is to orbit around the earth was initiated in 1998.
- The secrets of the universe are being discovered continuously due to the fact that scientists focus their constant attention on space exploration.

(45 min)

Criteria for assessment and evaluation :

- Elaborates on the information related to space exploration.
- Values the need of space exploration on the well being of the mankind.
- Analyzes the problems encountered in space travel and the remedial measures taken to avert them.
- Exhibits the preparedness in facing challenges in productive activities.
- Be inquisitive about the space.

Guidelines for group exploration **Annex 4.4.1**

How did you get to know about the sky?

- Focus your attention on the topic assigned to you on space exploration.
  - Space travel
  - The history of space travel
- Collect relevant information by studying the text book.
- Discuss the facts relevant to the topic assigned to you on the areas given below.
  - Background
  - Spacecrafts
  - Challenges
  - Overcoming the challenges
- Lead a discussion on the productive outcomes that could be achieved through space exploration.
- Prepare for a creative presentation of your findings.

Competency 5.0 : Inquires on the properties, uses and interactions of matter.

Competency Level 5.1 : Classifies matter using various criteria.

Activity 5.1 : Let's classify the things around us as scientists.

Time : 120 min.

Quality Inputs:

- Article **'A knife is born'** (given in annex 5.1.1)
- Four copies of guidelines for group exploration (given in annex 5.1.2)
- The common table (given in annex 5.1.3)
- The text book

Teaching-Learning Process:

Step 5.1.1 :

- Let a student to speak up as knife in relation to the article **'A knife is born'**.
- Lead a discussion highlighting following points.

  - The blade of the knife is made up of steel, which is a an alloy.
  - Steel is a mixture of the metallic iron and the non-metal carbon.
  - Iron and carbon are pure materials.
  - Pure substances such as this in the environment are called elements.
  - Iron is extracted by heating the iron ore to a high temperature till it turn to liquid form.
  - Iron ore is a type of soil rich in iron oxide, which exist as a compound in earth.
  - Many solid substances turn to liquid on heating where further heating turns the liquid to a gas.
  - Things around in the environment could be classified based on various characteristics.

(15 min)

Step 5.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.1.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Substances in the environment could be classified using various criteria.
  - Some of the criteria could be identified as follows;
    - Classifying as solids, liquids and gasses according to the physical state.
    - Classifying as pure substances and mixtures.
    - Classifying as elements and compounds.
    - Classifying as metals and non-metals.
    - Having a definite shape and volume are basic characters of solids.
  - Having a definite volume but not having a definite shape, i.e, taking the shape of the container are basic characters of liquids.
  - Not having a definite volume as well as a shape , i.e, dispersing in the existing space are basic characters of gasses.
  - Pure substances which are neither mixtures nor compounds are called elements.
  - Examples for common elements are given below.
    - Copper, Iron, Sulphur, Mercury, Lead, Carbon, Oxygen, Nitrogen, Gold, Silver etc.
  - Substances that are made up by more than one element are compounds.
  - Some examples for common compounds are given below.
    - Water, carbondioxide, salt(Sodium Chloride), lime stone (Calcium carbonate), baking soda (Sodium bicarbonate), camphor (Napthalene), surgical spirits (Ethyl alcohol), vinegar (Acetic acid)
  - Compounds when are not mixed with other substances could be considered as pure compounds.
  - Following are some examples for metals which are

found in abundance;

- Metallic elements - copper, iron, mercury, lead, gold, silver, tin, platinum, sodium, aluminium.
- Alloys - brass, steel, bronze, gold sovereign.
- Following are some examples for non-metals which are found in abundance;
  - Sulphur, Carbon, Phosphorous, Oxygen, Nitrogen, Silicon.
- Classifying the substances in the environment using scientific criteria, makes the study easy.

(45 min)

Criteria for assessment and evaluation :

- Explains the criteria for classification of substances.
- Agrees that by classifying the substances in the environment using scientific criteria, makes the study easy.
- Classifies substances according to the given scientific criteria.
- Identifies the differences between the substances that we use.
- Selects substances according to the need.

Annex 5.1.1

A knife is born

I'm proud to say that I'm the smartest of all in the kitchen. Think for a while... How can you cut, chop, peel, scrape and slice without a knife ? I'm made of steel. What do you mean by steel ? Steel is an alloy made up with a mixture of two elements. Metallic iron and non-metallic carbon. We get iron from the earth. But not the pure iron. It exists as iron oxides. We call it iron ore. It's not that easy to obtain iron from iron ore.

This is the process.

First we heat the iron ore to a very high temperature till it melts. Then only we can get pure iron. This process is called iron extraction. Here undesirable gasses are also released to the environment.

Steel is produced by heating the iron mixed with carbon. Steel so produced is much stronger than the iron. If I were produced with just pure iron, I wouldn't have been so strong.

Do remind... If you buy a knife...buy one like ME!

Annex 5.1.2

Guidelines for group exploration

Let's classify the things around us as scientists.

- Focus your attention on one of the following themes.
  - Physical states of solid, liquid and gas
  - Homogenous and heterogenous mixtures
  - Compounds and elements
  - Metals and non-metals
- Refer the text book and find out the information relevant to your theme.
- List out the features that could be used to identify the substances coming under your theme.
- Select five suitable substances for the theme appropriately.
- On what features did you decide to select those substances. Discuss.
- Name some other substances in the environment that could include under your theme.
- Discuss the instances where you use those substances in day to day life.
- What features of the above substances promote the use of them.
- Prepare for a creative presentation of your findings.

Annex 5.1.3

The common table

- Arrange a common table by placing the following materials.
  - Iron powder, salt, sugar, pieces of aluminium, powdered sulphour, iodine pieces, four candles, four boxes of matches, four baloons filled with exhaled air, four poythene bags filled with normal air, vinegar, soil solution, four pieces of wood, four pieces of granite, brewed tea, copper wire, pieces of lead, wheat flour, talcum powder, spirits of wine or eau de cologne, water, salt solution, sugar solution.
- You can select suitable substances instead of the above.
- Get at least 20 substances representing all four categories assigned to the groups.

Competency 5.0 : **Inquires on the properties, uses and interactions of matter.**

Competency Level 5.2 : Inquires on the interactions of various substances with water, acids and bases.

Activity 5.2 : Let's manipulate interactions productively.

Time : 120 min.

Quality Inputs:

- The script of role play **'Interactions in the kitchen.'** (given in annex 5.2.1)
- Three copies of guidelines for group exploration (given in annex 5.2.2)
- The work-stations (given in annex 5.2.3)

Teaching-Learning Process:

Step 5.2.1 :

- Let two students to present the role play to the class.
- Inquire about information on similar experiences from students.
- Lead a discussion highlighting following points.

  - Tomatoes have an acid and soap has a base.
  - Various substances interact with acids, bases and water.
  - Inquiring about the substances which interact with acids, bases and water is productive for day to day life.

(15 min)

Step 5.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Wax doesn't interact with acids, bases or water.
  - Salt interact with water by dissolving or dissolving in other solutions.

- Even distribution of molecules of the substance in water occurs when dissolving substances.
- White anhydrous copper sulphate hydrates and turns blue in the presence of water or substances containing water.
- Some substances interact with water, acids or bases and make products which are entirely different from the initial substances.
- Such interactions are called chemical reactions.
- Aluminium reacts with both acids and bases.
- Magnesium and limestone evolve gas bubbles when reacting with acids.
- Limestone doesn't dissolve either in water or bases.
- Instances where substances interacting with water, acids or bases could be seen in abundance in the environment.
- Those interactions are sometimes advantageous as well as disadvantageous to us.
- The quality of the day to day activities could be made productive by manipulating the interactions of substances with water, acids and bases.

(45 min)

Criteria for assessment and evaluation :

- Explains the interactions of various substances with water, acids and bases.
- Agrees that quality of a variety of activities could be made productive by manipulating interactions productively.
- Demonstrates the way that interactions occur by conducting experiments.
- Exhibits the awareness on changes.
- Makes trials on phenomena.

Annex 5.2.1

Interactions in the kitchen

Mother is engaged in cooking. Kokila entered the kitchen.
"Oh. What's this? Why did you cook tomatoes in this aluminium saucepan?"
" So. What's the matter?"
"Don't you know that aluminium is a metal... that, tomatoes contain an acid... and...that metals interacts with acids?"
"Now. we have to throw away the tomato curry."
"Why not? Unlike the loss(Disregard the loss of tomatoes)...if it gets intoxicated."
"You say that aluminium only reacts with acids? Look here...
I washed my hands and kept the piece of soap on that aluminium lid.
See. There is a big scar. I washed it several times, but it didn't disappear."
"Aluminium reacts with acids as well as with bases. Why. Soap is a basic substance."
"Another point... This piece of kithul jaggery...I just took it to have a cup of tea and kept it on an aluminium pan. Now its almost dissolved."

"Now, this time its not the effect of aluminium. That has dissolved due to the exposure to air."
"How can you say that? How could air dissolve jaggery?"
"Yes of course. Some substances dissolve by absorbing water vapour from air."

Guidelines for group exploration **Annex 5.2.2**

Let's manipulate interactions productively

- You are directed to explore on some interactions of a variety of substances.
- Focus your attention on the theme assigned to you.
  - Interactions with water
  - Interactions with acids
  - Interactions with bases
- Identify the substances kept in the work stations.
- Conduct experiments on the interaction relevant to you using all the substances.
- Record your observations.
- Classify the interactions as dissolving, hydration or chemical reaction by referring to the text book as well.
- Sought out instances where those interactions are advantageous as well as disadvantageous to us in day to day life.
- Prepare for a creative presentation of your findings.

Annex 5.2.3

The work-stations

- Put the undermentioned substances in labelled bottles and keep in three work stations.
  - Water
  - Sodium hydroxide solution
  - Dilute hydrochloric acid
- Keep the following set of substances in each work station.
  - Anhydrous copper sulphate
  - Well ground limestone
  - Six test tubes clean and dry
  - A piece of magnesium strip
  - Salt
  - A small piece of wax
  - Demy sheets and pastel

Competency 5.0 : Inquires on the properties, uses and interactions of matter.

Competency Level 5.3 : Uses the concept of specific gravity in day to day pursuits.

..

Activity 5.3 : Do objects sink or float in water?

Time: 120 min.

Quality Inputs:

- A set of materials containing a rigifoam block, a blown baloon, a piece of granite, a piece of metal, a small glass bottle, a metal cup and a trough with water.
- Three copies of guidelines for group exploration (given in annex 5.3.1)
- The common table (given in annex 5.3.2)

Teaching-Learning Process:

Step 5.3.1 :

- Present the trough with water to the class.
- Direct the students to place each object in the given set in water one by one.
- Provide opportunity for the students to raise the objects which sank in the water as well as to push the objects which float in the water.
- Lead a discussion highlighting following points.
  - There are objects which are floating, floating and sinking, and sinking in water in the environment.
  - When floating objects like the blown baloon and rigifoam block are pushed into the water, we feel an an upward thrust to the hand.
  - Small glass bottle and metal cup floated until they are filled with water and afterwards sank to the bottom.
  - It is interesting to study the behaviour of objects when we put them in water.

(15 min)

Step 5.3.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.3.3 :

- Get one group to present their findings to the class.

- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - The density could be determined if we know the volume and mass of an object.
  - The density of water is 1000 kg per cubic meter.
  - It could be expressed as 1g per cubic centimeter.
  - The relative density of a substance is the ratio of the density of a substance to the density of water.
  - This could be expressed by an equation as follows;

$$\text{relative density of a substance} = \frac{\text{density of an object}}{\text{density of water}}$$

  - There are no units for relative density.
  - The relative density of water is 1.
  - All the objects whose relative density is greater than 1 sinks in water.
  - All the objects whose relative density is less than 1 remain completely floating or partially sinking and floating in water, where they are called ඉපිලෙන .....objects.
  - When a downward force is applied to a ඉපිලෙන .....object, it further sinks and one could feel the upward force acting from the object to the hand.
  - Upward force acts even for an object which is completely submerged in water.
  - Upward force acting on partially or completely submerged objects in water is called **upthrust**.
  - Manipulation of submarines and use of hydrometers could be considered as examples for the uses of specific density in day to day life.

(45 min)

Criteria for assessment and evaluation :

- Explains the terms specific density and upthrust.
- Agrees that the specific density of an object could be assumed by its nature of floating or sinking in water.
- Determines the density and specific density of objects.
- Highlights the scientific background of natural phenomena.
- Investigates on the prevailing situations.

Annex 5.3.1

Guidelines for group exploration

Do objects sink or float in water?

- Your group is assigned to determine the specific density of one of the following objects/ substance.
  - Bag containing kerosene oil
  - Bag containing water
  - Quarts pebble
- Discuss about the ways and meansof determining the specific density of the relevant substance/object.
- Select the appropriate material and equipment from the common table.
- Determine the density of the substance with the aid of previous knowledge and experinces.
- Considering the density of water is $1 cm^3$ per gramme, calculate the specific density by the equation given below.

$$\text{Specific density of the object} = \frac{\text{Density of the object}}{\text{Density of the water}}$$

- Observe the position attained by the object/substance when it is placed in the water in the measuring cylinder.
- Find out whether there is a relationship between the position and the specific density of that object/substance.
- What conclusion could be drawn on the above?
- Hang the object/substance on to the spring balance by a thread.
- Place your hand below the object/substance and hold it up.
- Record your observations.
- Put the object/substance hanging on the spring balance to the water in the container.
- Agin record your observations.
- What conclusions could you make on the observations you obtained on two occasions?
- Highlight the events of floating, floating and sinking and sinking in day to day activities.
- Prepare for a creative presentation of your findings.

Annex 5.3.2

The common table

- Prepare a common table by placing the following materials and equipments.
- Prepare two separate thin polythene bags containing kerosene oil and water devoid of air bubbles.
- Bag containing 100 ml of kerosene oil
- Bag containing 100 ml of water
- About 100 g of quarts pebbles
- Three measuring cylinders
- Three 100 cm^3 beakers
- Three spring balances
- Thin thread
- Demy sheets and pastel

Competency 5.0: Inquires on the properties, uses and interactions of matter.

Competency Level 5.4 : Inquires on the changes in properties of substances subjected to heat.

Activity 5.4 : Look... heat harms as well as helps.

Time: 120 min.

Quality Inputs:

- The handout **Heat hurts too!** (given in annex 5.4.1)
- Two copies of guidelines for group exploration (given in annex 5.4.2)
- **The change heat made** (given in annex 5.4.3)
- The common table (given in annex 5.4.4)
- The text book

Teaching-Learning Process:

Step 5.4.1 :

- Present the handout **Heat hurts too!** to the class.
- Inquire about the type of energy responsible for all the phenomena.
- Lead a discussion highlighting the following points.
  - Heat caused damages to the above mentioned materials.
  - It is called **thermal degradation**.
  - Ways and means like covering with other suitable materials, keeping inside packages etc, could be used to minimize thermal degradation.
  - Productive changes in substances could be obtained by exposing them to heat.

(15 min)

Step 5.4.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.4.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - Various chemical reactions occur in substances due to heat.

- When certain substances are heated, reactions occur producing substances having different properties to that of initial substances.
- Many combustible substances when heated to ignition temperature, burn reacting with oxygen producing carbon dioxide and water.
- Condis when heated to dissociation temperature produces oxygen and other chemical substance
- Fuels are also combustible materials.
- Damage causing fires are instances of devastations.
- Fire could be used in productive activities in day to day life.
- Production of lime could be considered as a productive effect of thermal dissociation.
- Various substances get destroyed by thermal degradation.
- Heat is an energy source which could be manipulated for productive uses.

(45 min)

Criteria for assessment and evaluation :

- Explains the changes that occur in substansec due to heat.
- Agrees that eventhough heat causes destruction in some instances, it could be manipulated effectively for the advantage of various activities.
- Designs experiments to show combustion and dissociation.
- Acts according to the advise given.
- Shows the ability to work productively.

Annex 5.4.1

Heat hurts too!

Bright colors of the dress become faded by ironing it frequently.

Places where the sunlight falls on curtains have been faded.

The paint had been cracked on the pole that is heated during day time.

The brightness of the polished door in the veranda has vanished.

Annex 5.4.2

Guidelines for group exploration

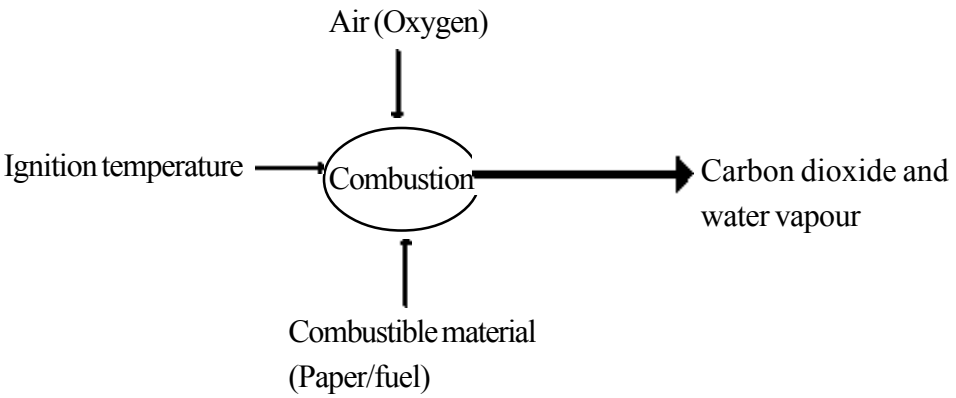
Look... heat harms as well as helps.

- You are assigned to find out about the changes that occur in substances due to heat.
- Focus your attention to the topic assigned to you out of the undermentioned.
  - Combustion of paper by providing heat
  - Dissosiation of condis by providing heat
- Collect information related to your topic from the text book.
- Design a suitable activity by reading the leaflet **The change heat made.**
- Demonstrate the activity by selecting the necessary materials and equipments from the common table.
- Discuss about the changes that has taken place in substances after the activity.
- Find out the instances where combustion/dissosiation has made productive uses whereas destructions in day to day activities.
- Prepare for a creative presentation of your findings.

Annex 5.4.3

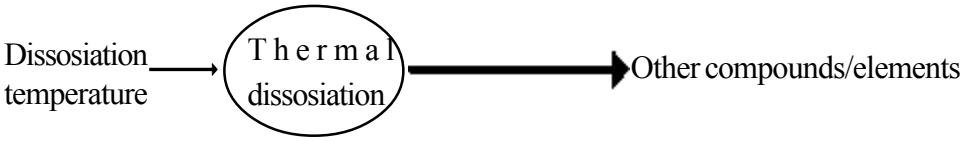
The change heat made

Combustion of a paper



- A certain substance reacts with oxygen when burning in air.
- Carbon dioxide and water vapour is obtained as results.
- A certain substance should be heated to attain ignition temperature in order to burn it.
- Carbon dioxide gas turns lime water milky.
- Water turns white anhydrous copper sulphate blue.

Heating condis



- In a dissociation, a certain compound is broken down to other compounds or elements.
- When condis is supplied with dissosiation temperature, it dissociates in to oxygen and other compounds.
- A purple colour appears when water is added to condis before heating.
- When water is added to the residual substance, it turns dark green.
- When a glowing splint is brought near the evolving oxygen, it lights with a flame.

Annex 5.4.4

The common table

- Prepare a common table by keeping materials and equipment given below.
  - two candles
  - two boxes of matches
  - a trough with water
  - an empty jam bottle
  - anhydrous copper sulphate
  - small amount of lime water
  - small amount of condis
  - a glowing splint
  - a test tube holder
  - two test tubes
  - demy sheets and pastel

Competency 5.0 Inquires on the properties, uses and interactions of matter.

Competency Level 5.5 : Uses thermal properties of substances effectively.

Activity 5.5 : Let's find out about thermal properties.

Time: 120 min.

Quality Inputs:

- Three copies of guidelines for exploration (given in annex 5..5.1)
- The work-stations (given in annex 5.5.2)

Teaching-Learning Process:

Step 5.5.1 :

- Discuss about the bioling of water filled in a kettle.
- Inquire about the observations on the phenomenon from the students.
- Lead a discussion highlighting the following points.

  - Temperature of the water is risen when the kettle of water is heated.
  - We cannot touch the kettle as the metal by which it is made up is heated.
  - The kettle could only be held by the wooden or plastic handle.
  - As the water boils it pours out from the neck.
  - Boiling water liberates water vapour.
  - All the above mentioned changes occurred due to the heat energy obtained by the flame.
  - Various changes occur when sun's energy, which is the basic energy source fall on earth.
  - A variety of changes occur in substances due to heat (thermal properties) could be used productively.

(15 min)

Step 5.5.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.5.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.

- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Transfer of heat from one place to another is called **heat transmission.**
  - Heat transmission occurs through following means;
    - Conduction
    - Convestion
    - Radiation
  - Following phenomena could be used to explain heat transmission;
    - Handle of the metal spoon gets hot when stirring a curry while cooking.
    - A rack fixed at a higher position to the hearth is kept warm by a hot convectional air current in some traditional kitchens.
    - Feeling hot when inside a house with metal roofing sheets.
  - Increase in length and volume of substances when heated is called **thermal expansion**.
  - Solids become liquids and gases when heating and whereas gases in turn become liquids and solids when cooling is called **the change of state**.
  - The specific temperature in which a solid becomes liquid is called **melting point,** whereas the specific temperature in which a liquid becomes gas is called **boiling point** .
  - Melting point of water is $0^{\circ}C$ and the boiling point is $100^{\circ}C$
  - Some solid substances straight away turn to gaseous state on heating.
  - This phenomenon is called **sublimation.**
  - Thermal properties of substances are considered in many day to day activities.

(45 min)

Criteria for assessment and evaluation:

- Explains the thermal properties of substances and their uses.
- Agrees that thermal properties of substances should be taken into account for many day to day activities.
- Demonstrates the thermal properties of substances using simple set ups.
- Discovers the concepts through practical activities.
- Exhibits the ability to select material for a specific purpose appropriately.

Annex 5.5.1

Guidelines for group exploration

Let's find out about thermal properties

- Focus your attention to the theme assigned to your group related to thermal properties of substances.
  - Heat transmission
  - Expansion
  - Change in state
- Study the materials, equipments and diagrams in the relevant work station.
- Make a discussion on how to demonstrate the thermal property assigned to your group using the given items.
- Find out about the thermal property conducting suitable experiments.
- Record all the observations you made.
- Highlight the instances where thermal properties of substances are experienced in day to day life.
- Get ready to present your findings to the class innovatively.

Annex 5.5.2

Instructions to prepare work stations

- Prepare three work stations keeping the article and relevant materials and equipment prescribed in it.

Heat is capable to do a lot

I Heat transmission

Heat is conducted through some solid substances. Those substances are called conductors. Some other solids do not conduct heat. Those substances are called insulators.
Conduction is a means of heat transmission.

- Metals/glass/wood/plasticbars

Air travels upwards on heating.
Such a transmission of heat is called convetion.

- An empty jam bottle
- A flame
- an incense stick
- A piece of cardboard and a pair of scissors

Sun's heat is transmitted to the earth as rays. This type of heat transmission is called radiation.

- A concave mirror
- A match stick

II Thermal Expansion

Length, breadth and thickness increases when solid substances are heated. This is expansion of solids.

- A glass ball
- A flame
- A metal ring
- A spanner

Volume of a liquid increases on heating. This is called liquid expansion.

- Small glass bottle with a rubber stopper
- A flame
- Water
- A thin glass tube

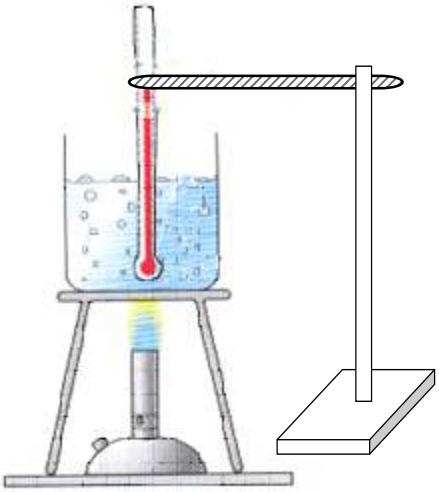
Volume of a gas increases on heating. This is called gas expansion.

- Small glass bottle with a rubber stopper
- A flame
- Water
- A thin glass tube

III Change of state

Ice on heating turns to water. Then its temperature is 0°C. This is the melting point of water.
Water turns in to ice on cooling.
Then its temperature is 0°C. This is the freezing point of water.

- Ice
- Thermometer
- A beaker and a funnel



Boiling water vapourizes and become steam. Then its temperature is 100°C. This is the boiling point of water.

- A beaker
- Thermometer
- A flame
- A stand

A solid become a liquid at first on heating. If heated further heated it become a gas. This process is called change of state.
Some solid materials when heated directly turns to gas instead of becoming a liquid first. This is called sublimation.

- Powdered camphor or pieces of Iodine.
- A test tube
- A flame
- A test tube holder

Competency 5.0: Inquires on the properties, uses and interactions of matter.

Competency Level 5.6 : Explores the nature and effects of static electricity.

Activity 5.6 : Let's find out about the charges in the objects.

Time: 120 min.

Quality Inputs :
- Two copies of guidelines for group exploration (given in annex 5..6.1)
- The common table (given in annex 5.6.2)

Teaching-Learning Process :

Step 5.6.1 :
- Provide opportunity for the students to present their knowledge on the damages caused by lightning strikes.
- Inquire from the students about the precautionary measures to be taken in order to protect from lightning strikes.
- Lead a discussion highlighting following points.

  - Lightning strikes could be disastrous.
  - A large amount of electricity is contained in a lightning strike.
  - Origin of a lightning strike could be explained scientifically.

(15 min)

Step 5.6.2:
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.6.3:
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.

  - Light feathers/small pieces of paper/dry tea dust, will be attracted to a glass rod rubbed with a silk cloth for sometime.
  - Invisible particles called electrons in the glass rod were transferred to the silk cloth.

- It is considered that the glass rod is positively charged whereas the silk cloth is negatively charged.
- Any object which is positively or negatively charged attracts small particles.
- Light feathers/small pieces of paper/dry tea dust, will be attracted to a ebonite stick rubbed with a flanel cloth for sometime.
- Invisible particles called electrons in the flanel cloth were transferred to the ebonite stick.
- It is considered that the flanel cloth is positively charged whereas the ebonite stick is negatively charged.
- If a group of charges are contained in an object, those charges have been identified as electrostatic charges.
- Electrostatic charges are generated when certain substances are rubbed together.
- These electrostatic charges vanish when these substances touch each other.
- The clouds get immensely charged when touched by the passing high speed wind in the sky.
- Electrostatic charges in such clouds are quickly attracted to the earth.
- In such instances a huge spark is produced together with a large amount of heat and a big sound.
- This condition is known as a lightning strike.
- A lightning strike could be disastrous.

(45 min)

Criteria for assessment and evaluation :

- Explains how electrostatic charges are being generated.
- Agrees that lightning strikes are a result of electrostatic charges.
- Demonstartes how electrostatic charges are generated.
- Discovers the scientific background of phenomena.
- Works in a group productively.

Annex 5.6.1

Guidelines for group exploration

Let's find out about the charges in the objects.

- Focus your attention to the pair of substances assigned to your group.
  - A dry glass rod and a piece of silk cloth
  - A dry ebonite stick and a flanel cloth
- Collect small light feathers, small pieces of paper, dry tea dust, a piece of rigifoam and a vessel of water from the common table.
- Rub the given stick thoroughly with the relevant cloth for some time and take it near the light objects without touching the stick with your hand.
- Break the rigifoam into smaller pieces of different sizes and take the stick near them as you did above.
- Touch the stick with your hand after rubbing with the cloth and engage in the two activities mentioned above.
- Rub the stick with the cloth soak in water and engage in the two activities as above .
- Prepare for a creative presentation of your findings. .

Annex 5.6.2

The common table

- Prepare a common table keeping the following material.
  - A dry glass rod and a piece of silk cloth
  - A dry ebonite stick and a piece of flanel cloth
    (use alternative material in the absence of the above)
  - Two sets of small light feathers, small pieces of paper, dry tea dust, a piece of rigifoam and a vessel of water

Competency 5.0: Inquires on the properties, uses and interactions of matter.

Competency Level 5.7: Selects appropriate materials to manipulate the electric current according to the situation.

Activity 5.7 : Through which material does an electric current flow?

Time: 120 min.

Quality Inputs:

- A coil of nicrome wire
- The common table (given in annex 5.7.1)
- Three copies of guidelines for group exploration (given in annex 5.7.2)

Teaching-Learning Process:

Step 5.7.1 :

- Get a student to fix a simple circuit to light a bulb.
- Make changes in the circuit by attaching about 2 cm, 5 cm, 10 cm and 30 cm of nicrome wire and direct the students to observe the brightness of the bulb in each instance.
- Lead a discussion to highlight the following points.

  - An electric current flows through the circuit because of the cell.
  - The bulb lit due to an electric current flowing through the closed circuit.
  - An interruption caused to the flow of current as the length of the nichrome coil increased.
  - The interruption to the flow of electricity through a circuit is called electrical resistance.
  - Manner by which an electric current flows through a circuit depends on the nature of the circuit.

(15 min)

Step 5.7.2:

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.7.3:

- Get one group to present their findings to the class.

- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.

  - Substances that allow the flow of an electric current is called electrical conductors.
  - Substances that do not allow the flow of an electric current is called insulators.
  - Substances that allow an electric current to flow to a lesser amount than conductors are called semi-conductors.
  - Light emitting diodes(LED) contain semi-conductor substances.
  - An electric current flows through semi-conductors only in one direction.
  - The interruption to the flow of electricity through a circuit is called electrical resistance.
  - If the electrical resistance of a conductor is zero, it is considered as a super-conductor.
  - We do not find super-conductors in real life.
  - If proper attention is focussed on electrical conduction, we are capable of preventing accidents as well as making our day to day activities more productive.

(45 min)

Criteria for assessment and evaluation :

- Explains the way of electrical conduction through materials.
- Agrees that due attention on how electrical conduction occurs could prevent accidents as well as making our day to day activities more productive.
- Classifies conductors, semi-conductors and insulators scientifically.
- Selects materials according to their properties.
- Acquires the practice of making things.

Annex 5.7.1

The common table

- Arrange a common table by placing the set of materials given in the group exploration sheet, two electric cells, a bulb and required amount of wire to prepare an electric circuit, demy sheets and pastel.

Annex 5.7.2

Guidelines for group exploration

Through which material does an electric current flow?

- Focus your attention to the set of materials provided to your group.
  - A metal paper clip, piece of wire, a polythene sheet, a small wooden stick, a Light Emittting Diode (LED).
  - A nail, piece of iron, a piece of cardboard, a glass rod, a Light Emittting Diode (LED).
  - A metal stopper, a pin, a broad rubber strip, a piece of rigifoam, a Light Emittting Diode (LED).
- Select relevant material to prepare an electrical circuit.
- Prepare an electrical circuit providing a gap to attach a variety of substances/materials.
- Fix the materials from the given set one by one to the gap in the electrical circuit.
- Again fix the materials from the given set one by one by changing their direction to the gap in the electrical circuit.
- Record the observations.
- Lead a discussion on the observations.
- Find out about the instances of application/s of materials having properties you observed on electrical conduction.
- Prepare for a creative presentation of your findings.

Competency 5.0 : Inquires on the properties, uses and interactions of matter.

Competency Level 5.8 : Develops simple electric circuits

Activity 5.8 : Let's set up circuits.

Time: 120 min.

Quality Inputs:

- Dynamo
- The common table (given in annex 5.8.1)
- Two copies of guidelines for group exploration (given in annex 5.8.2)

Teaching-Learning Process:

Step 5.8.1 :

- Present a bicycle dynamo to the class.
- Inquire about how a dynamo works from students.
- Fix a LED between the terminals of the dynamo and direct a student to light it.
- Lead a discussion highlighting following points.
  - Dynamo is a source of electricity.
  - As the head of the dynamo rotates, the magnet fixed to it also rotates accordingly, while an electric current is generated in the coil inside it.

(15 min)

Step 5.8.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.8.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - Bicycle dynamo, electric cell and generator could be considered as elctrical sources.
  - An electric cell connected to a bulb by an electrical conductor is called a closed circuit.

- When a cell is connected to a circuit there is a possibility of an electric current to flow from its positive terminal to the negative terminal through the circuit.
- The reason for an electric current to flow through is the potential difference of the circuit.
- It is stated as the unit volt (V) on the cell.
- A voltmeter is used to measure the potential difference.
- Electric current flowing through a circuit could also be measured.
- An ammeter is used to measure the current.
- The unit used to measure an electric current is Ampere(A).
- Ammeters voltmeter, resistors, switches etc, could be classified as circuit components.
- A bulb and a motor are examples of electrical appliances.
- Benefits from electricity could be obtained by setting up the circuits in an orderly manner.

(45 min)

Criteria for assessment and evaluation :

- Explains the concepts current and potential difference.
- Values the need of setting up the circuits properly in order to manipulate electricity productively.
- Sets up simple electric circuits using electric circuit components.
- Acts in accordance with conventions.
- Manipulates energy productively.

Annex 5.8.1

The common table

Prepare a common table placing materials and equipments given below.

- Wire needed to set up electric circuits.
- Four cells and two torch bulbs.
- A voltmeter and an ammeter
- Two switches
- Two five ohm rsistors
- Two small motors
- Demy sheets and pastel

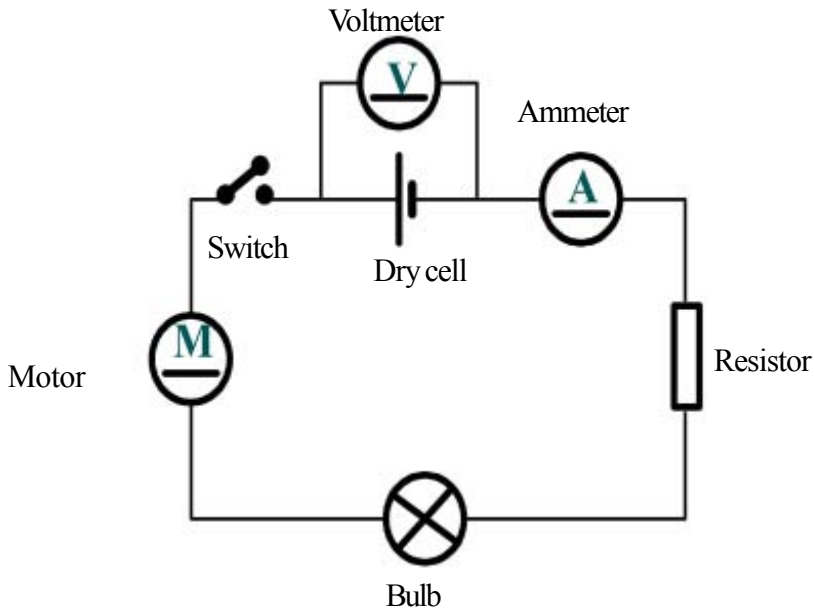
Annex 5.8.2

Guidelines for group exploration

Let's set up circuits.

- Focus your attention to the circuit component assigned to your group.
  - Ammeter - measuring the current - unit Ampere - A
  - Voltmeter - measuring the potential difference - unit Volt - V
- Select necessary materials and equipments from the common table to set up a simple circuit and light a bulb.
- Study the given diagram.
- Obtain information from the text book.
- Obtain readings from the equipment provided to you by attaching one cell and two cells.
- Obtain readings from the equipment provided to you for the conditions given below. (with one cell and two cells)
  - When a small electric motor is attached to the circuit
  - When a resistor is attached to the circuit
  - When switch of the circuit is open and closed
  - When cells of the circuit is removed
- Discuss about the advantages that could be obtained by the equipment in day to day life.
- Prepare for a creative presentation of your findings.

Circuit diagram



Competency 5.0 : Inquires on the properties, uses and interactions of matter.

Competency Level 5.9: Conducts experiments to identify the chemical nature of substances that are in day to day

Activity 5.9 : Let's identify chemicals in our home.

Time: 120 min.

Quality Inputs:

- Three labelled bottles containing water, lime juice and soap solution and litmus.
- Three copies of guidelines for group exploration (given in annex 5.9.1)
- The common table (given in annex 5.9.2)

Teaching-Learning Process:

Step 5.9.1 :

- Present three labelled bottles containing water, lime juice and soap solution to the class.
- Get a few students to demonstrate the colour change of litmus paper when treated with the solutions.
- Lead a discussion highlighting following points.
  - Water, lime juice and soap solution are neutral, acidic and basic respectively.
  - A variety of indicators like litmus could be used to identify neutral, acidic and basic substances.
  - Acidic food used in our homes could be identified by tasting.
  - Substances like soap could be identified by touch.
  - It is dangerous to identify some substances using our sense organs.
  - Methods which are not dangerous could be employed to identify substances.

(15 min)

Step 5.9.2:

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 5.9.3:

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.

- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.
  - A lot of chemicals are used in carrying out day to day household activities.
  - These could be classified as neutral, acidic and basic substances.
  - Some examples for acidic substances commonly found in our homes are as follows;
    - lime, vinegar විනාකිරි, fruit juices, *Garcinia* ගොරකා
  - Some examples for basic substances commonly found in our homes are as follows;
    - baking soda, ash, lime used to chew betel, soap
  - Some examples for neutral substances commonly found in our homes are as follows;
    - water, salt, sugar, surgical spirits
  - Certain substances show a colour change when exposed to acids, bases and neutral substances.
  - These substances could be used as indicators to identify acids, bases and neutral substances.
  - Boiled extracts of shoe flower, areca nut, crude extract of..... කටරොළු මල් යුෂ and saffron in solution are some examples.
  - There are a number of acids in the laboratory as well.
  - Hydrochloric, sulphuric and nitric are some of these.
  - There are a number of bases in the laboratory as well.
  - Sodium hydroxide, potassium hydroxide and calcium hydroxide are some of these.
  - Litmus paper could be used to identify acidic and basic substances in the laboratory.
  - Common usages of acids in day to day life are as follows;
    - as a flavouring agent in food preparations
    - in batteries of vehicles
    - to remove stains from clothes
  - Common usages of bases in day to day life are as follows;
    - to wash away oil and dirt from clothes
    - to make hoppers and bakery products
    - as medication

(45 min)

Criteria for assessment and evaluation :

- Names the acidic, basic and neutral substances used in domestic activities.
- Agrees that acids, bases and neutral substances could be differentiated using a variety of indicators.
- Conduct experiments to differentiate acids, bases and neutral substancesusing a variety of indicators.
- Classifies substances using ways and means.
- Pays due attention to the environment.

Annex 5.9.1

Guidelines for group exploration

Let's identify chemicals in our home.

- Focus your attention to the indicator provided to your group.
  - boiled areca nut extract
  - boiled shoe flower extract
  - crude extract of *Buahinia* flowers (නිල් කටරොළු මල් යුෂ)
- Collect the relevant indicator and the set of substances from the common table.
- Record the colour change obtained when each and every substance in the given set of substances is mixed with the indicator.
- Seperate the set of substances as acids, bases and neutral substances.
- Find out about the acids, bases and neutral substances which you handle in say to day activities.
- Prepare for a creative presentation of your findings.

Indicator	colour in acids	colour in bases
bolied areca nut extract	no change	brownish yellow
bolied red shoe flower extract	bright red	purple
crude extract *Buahinia* flowers (නිල් කටරොළු මල් යුෂ)	red	green

Annex 5.9.2

The common table

- Prepare a common table by placing the following substances and equipment.
  - A beaker of bolied areca nut extract
  - A beaker of bolied red shoe flower extract
  - A beaker of crude extract of *Buahinia* flowers (නිල් කටරොළු මල් යුෂ)
  - Three sets of following substances.
    - Water, salt solution, sugar solution, cow's milk, vinegar, a dilute acid obtained from the laboratory, a sample of sour tasting fruit juice, soap solution, ash, baking soda, lime water.
    - ten test tubes
    - demy sheets and pastel

Competency : 6.0 Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.1: Effectively manipulates force at appropriate instances.

Activity 6.1 : Let's push-pull-do some productive work.

Time: 120 min.

Quality Inputs:
- Three copies of guidelines for exploration (given in annex 6.1.1)
- The work-stations (given in annex 6.1.2)
- The text book

Teaching-Learning Process:

Step 6.1.1 :
- Ask from students, "What shall we do?"
- Allow students to present various actions.
- Let students to classify them as actions done using a force and actions done without a force.
- Lead a discussion highlighting the following points.
  - We engage in various activities in day to day life.
  - A number of forces act in each and every activity.

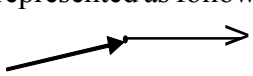
(15 min)

Step 6.1.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.1.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - Any force is either a push or a pull.
  - International unit used to measure the force is Newton (N).
  - Force has a direction as well as a magnitude.
  - Any force exerted on an object has a point of action.
  - It is called.....උපයෝගී ලක්ෂ්‍යය

- Newton scale is used to measure the force.
- Force could be represented as follows.

Point of application 

- Forces are applied in each and every action in day to day life.

(45 min)

Criteria for assessment and evaluation :

- Describes 'force' according to relevant criteria.
- Agrees that forces are applied in each and every action in day to day life.
- Demonstrates forces in a variety of ways.
- Analyzes natural phenomena scientifically.
- Communicates using symbols.

Annex 6.1.1

Guidelines for group exploration

Let's push-pull-do some productive work.

- Focus your attention to the topic assigned to your group given below.
  - dragging an object along a planar surface
  - lifting an object lying on the ground
  - Exertion of an upthrust by water on an object
- Select the suitable workstation and design appropriate activities relevant to your topic
- Exract the relevant information from the text book and engage in the activity to discover the facts given below.
  - Magnitude of the force in Newtons (N)
  - Direction of the force
  - Point of application of the force
- Indicate the forces you applied by using arrows appropppriately.
- Lead a discussion to find out about the other forces you have experienced.
- Prepare for a creative presentation of your findings.

Annex 6.1.2

The work-stations

- Prepare three work stations seperately with the materials and equipments given below.

  Work-station I

  - Five small objects different from each other which could be able to drag on a flat surface
  - Twine
  - Newton scale

  Work-station II

  - Five small objects different from each other which could be lifted from the ground.
  - Twine
  - Newton scale

  Work-station III

  - Five small objects different from each other which could be immersed in water.
  - Twine
  - Newton scale
  - A container with water

Competency 6.0 : Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level6.2: Investigates on various forces and their applications.

Activity 6.2 : Let's explore the unseen force.

Time : 120 min.

Quality Inputs:

- Instructions on activity 'Roll the cylinder'. (given in annex 6.2.1)
- Two copies of guidelines for group exploration (given in annex 6.2.2)
- The work-stations (given in annex 6.2.3)
- Two copies of article, 'forces we find' (given in annex 6.2.4)

Teaching-Learning Process:

Step 6.2.1 :

- Let students to do the activity 'Roll the cylinder'.
- Give them an opportunity to describe about the forces acted when cylinder was rolling in each of the instances
- Lead a discussion highlighting following points.

  - A force was needed to move the cylinder.
  - At the first instance it was moved by touching and pushing by a stick.
  - At the second instance the cylinder was moved by providing a force without touching it.
  - We find a veriety of forces acting in the environment.

(15 min)

Step 6.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.

  - If the force is applied by touching the object, it is called a contact force.

- Examples for contact forces are as follows;
  - Impulsive force - eg:- a ball hitting on a wall.
  - Friction - eg:- application of brakes of a vehicle.
  - Tension - eg:- a bucket hanging on a rope
  - Thrust - eg:- a parcel kept on a table
- Forces exerted on an object without touching it are distant forces.
- Examples for distant forces are as follows;
  - Gravitational force - eg:- weight of a bag acting downwards
  - Magnetic force (attraction and repulsion) - eg:- attraction of a piece of iron to a magnet and repulsion of similar poles of magnets
  - Electrostatic force - eg:- ligtning strike from a cloud to earth
- We could avoid the difficulties and carryout productive work in day to day life by having an understanding in manipulating the variety of forces.

(45 min)

Criteria for assessment and evaluation :

- Explains contact forces and distant forces by giving examples.
- Accepts that the difficulties could be avoided and carryout productive work in day to day life by having an understanding in manipulating the variety of forces.
- Demonstrates the ways in which the forces are in action.
- Exhibits the ability to administer environmental phenomena in order to make day to day activities easy.
- Compells to classify according to criteria.

Annex 6.2.1

Roll the cylinder

Prepare the following material.

Aluminium soft drink can, a table with a smooth surface, a piece of PVC pipe, dry piece of polythene.

Step 1

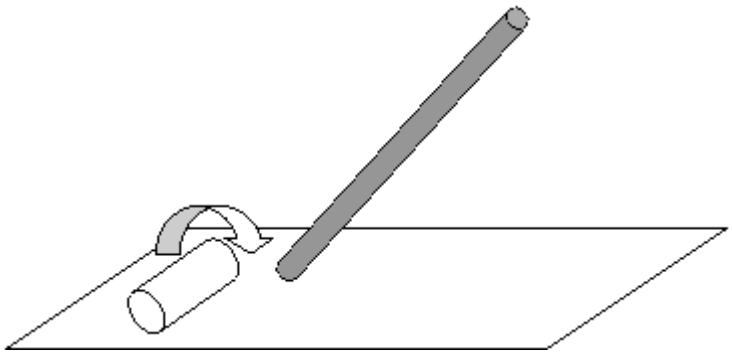
Place the aluminium can on the table and push it in a number of directions to roll it.

Step 2

Place the aluminium can on the table. Rub the PVC pipe with the dry polythene sheet and bring it closer (without touching) to the can.

Then can starts to roll towards the pipe. Again bring the PVC pipe in opposite direction of the can. Then it stops and starts to roll in the opposite direction (towards the pipe)

Guidelines for group exploration



Let's explor

- Focus your attention to the topic assign
  - Contact forces
  - Distant forces
- Collect facts by referring the given article and the textbook.
- Make a discussion to decide what kind of materials and equipments are needed to demonstrate the relevant force through an activity.
- Select the suitable work station for the above activity.
- Demonstrate the types of force assigned to you.
- Collect examples for the various forces that you have identified and thier uses in day to day life.
- Prepare for a creative presentation of your findings.

Annex 6.2.3

The work-stations

- Arrange two work stations by placing materials and equipments given below seperately.

  Work-station I
  - Piece of thread, piece of coil spring, a block of wood, a small ball, a small stone,empty bottle of saline, basin of water, rubber strip.

  Work-station II
  - A little iron dust/pins, two short plastic pipes(15 cm), two pieces of polythene, two pieces of silk cloth, two glass rods,two bar magnets, spring balance.

Annex 6.2.4

Forces we find

We engage in a variety of acts in life. Each of them is an aggregation of forces.Just imagine of an instance about walking. When we walk, we keep one leg forward, and then we push the ground back while the other leg is taken forward. The foot kept first does not slip off due to friction between the foot and the ground. Friction is the force that opposes the motion of an object when the object is in contact with another object or surface.

When a bunch of plantains is hung with a rope, the rope bears the bunch of plantains by exerting a force. The force that is exerted by the extended rope is called tension. Tension could be experienced when climbing a mountain with the aid of a rope.

A strong force acting during a short period of time or instantaneously, is called an impulsive force. Shooting at a target is an example of this.

Imagine on an instance where a weight is kept on a baloon filled with air.The pressure generated by the weight changes the shape of the baloon.Sometimes the baloon could burst.This type of a force is called as thrust. The atmosphere around the earth, also exerts a thrust on us. It is the atmospheric pressure. We do not feel that because we have been living in the bottom of the atmosphere since our birth.

Friction, impulsive force, tension and thrust are all forces acting when objects are in touch with each other. These are all examples for types of contact forces.

When forces act without touching the objects, they are called distant forces.Gravitational force, magnetic force and electrostatic force could be considered as distant forces.

You may have experienced the characteristics of magnets. Magnets can attract pieces of iron as well as other magnets and two equal poles of magnets repulse. Such forces are called magnetic forces.

A fruit falls from a tree. Why does it happen? The reason is earth attracts the fruit released by the tree. Just think that at any place of the earth attracts the objects above it. This is due to the gravitational force of earth. So that the earth is also an enormous magnet.

Have you experienced that dust particles and other light /soft material are attracted to some substances? It is because those substances are electrostatically charged. When a certain substance is rubbed with some other substances both of them get charged. Attractive force such generated is called electrostatic force.

In such an instance, both rubbed substances get positively and negatively charged. When a galss rod is rubbed with a woolen cloth, glass rod gets positive charges where the woolen cloth gets negative charges. Two such positively charged glass rods will repel on bringing closer.

When an ebonite rod is rubbed with a silk cloth, ebonite rod gets negative charges where the silk cloth gets positive charges.

If the afore said glass rod is brought closer to the ebonite rod charged as above, they attract due to having opposite charges.

Competency 6.0: Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.3 : Investigates on types of motions and their applictions.

Activity 6.3 : Objects in motion.

Time : 120 min.

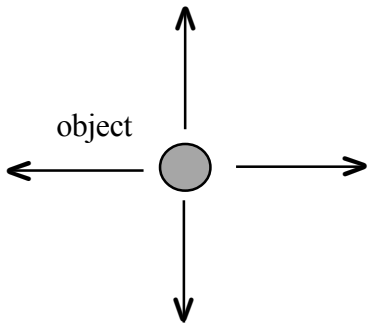
Quality Inputs:

- The common table (given in annex 6.3.1)
- Three copies of guidelines for group exploration (given in annex 6.3.2)
- The text book

Teaching-Learning Process:

Step 6.3.1:

- Show the diagram below to the class.



- Ask students whether they have seen instances of objects moving up, down and sideways as in the diagram.
- Lead a discussion highlighting following points.

  - There are various objects in motion in the environment.
  - Some of them move in a straight line.
  - Movement of objects in a straight line is called rectilinear motion.
  - Following are some examples;
    - A rocket shot to the space.
    - A fruit falling
    - A carrom piece in motion
  - There are objects which do not show rectilinear motion as well.

(15 min)

Step 6.3.2:

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.3.3 : • Get one group to present their findings to the class.
• Secondly give that group an opportunity to cover the gaps in their presentation.
• Then allow the other groups to give any constructive proposals.
• Next present teacher's elaboration to cover the missing points.
• After giving an opportunity to all the groups,summarize, highlighting the following points.

- Objects moving in a straight line show rectilinear motion.
- An object falling from above is an example for this.
- Objects moving in a circular path show circular motion.
- Planets rotating round the sun is an example for this.
- Objects moving around its own axis show revolving motion.
- A toy top revolving around its own axis is an example for this.
- The motion of an object hanging by a string is called vibrational motion.
- Swing is an example for that.
- There are components in machinery we find in day to day life which has all types of motion mentioned above.

(45 min)

Criteria for assessment and evaluation :

- Explains the types of motion shown by objects in various instances.
- Accepts that types of motion could be used productively.
- Demonstrates the various types of motion.
- Shows sensitivity to the environment.
- Manages the resources accordingly.

Annex 6.3.1

The common table

- Prepare a common table by placing material and equipment given below.
- Few small stones
- Twine
- Lids of cans pierced at the center
- Nails
- Saw blade placed in between the planks of a table
- Materials required to prepare a machine made out of very young female coconut flower (කුරුම්බා ඇට්ටි මැසිමක්)
- Materials and equipment to show rotational , circular and vibrational motion.

Annex 6.3.2

Guidelines for group exploration

Objects in motion

- Types of motions made by employing a force is given below.
- Focus your attention to the theme assigned to your group.
  - circular motion
  - rotational motion
  - vibrational motion
- Collect information relevant to your type of motion by referring the text book.
- Select the necessary materials and equipment from the common table and design the suitable activities for the theme.
- Demostrate the types of motion.
- Explain the following facts related to the object.
  - behaviour of the object
  - path of the object
  - speed of the object
- Find out the instances of motion similar to your theme, where you come across in day to day life in the environment.
- Prepare for a creative presentation of your findings.

Competency 6.0 : Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.4 : Uses machines to do work at ease.

Activity 6.4 : Let's do work easily and joyfully.

Time: 120 min.

Quality Inputs:

- Four copies of guidelines for group exploration (given in annex 6.4.1)
- The work-stations (given in annex 6.4.2)
- The text book

Teaching-Learning Process:

Step 6.4.1 :

- Write the proverb given below on the chalk board.
  "Don't burn your hand when there is a tool!"
- Inquire from students the purpose of the tool.
- Lead a discussion highlighting the following points.

  - It is possible to find ways and means to do various work easily.
  - Those are called simple machines.

(15 min)

Step 6.4.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.4.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Day to day activities could be done easily with simple machines.
  - Examples for the types of simple machines are as follows;
    - Levers
    - Inclined planes
    - Pulleysකප්පි
    - Wheel and axle
  - A lever works by making the effort from one place and

getting the work done in another place.

- Getting work easy by using a plane with a gradient is expected from an inclined plane.
- Getting work done easily through a convenient direction is done by pulleys.
- However, no matter how complicated a machine is, it is composed of some combination of the four simple machines.

(45 min)

Criteria for assessment and evaluation :

- Explains the working of simple machines while introducing them.
- Accepts that various work could be done easily by employing simple machines.
- Classifies simple machines.
- Exhibits the ability to do work easily.
- Uses appropriate strategies to suit the needs.

Annex 6.4.1

Guidelines for group exploration

Let's do work easily and joyfully

- Focus your attention to the class of machines assigned to you.
  - Levers
  - Inclined planes
  - Pullies
  - Wheel and axle
- Select the work station that suits you.
- Study the machines kept there.
- Read the indformation given in the text book as well.
- Discuss about the ways in which these machines have contributed to do work easily.
- Design an innovation using the technology contained in these machines.
- Find out whether the simple machine type you are dealing with is employed as a component in another large machine.
- Prepare for a creative presentation of your findings.

Annex 6.4.2

The work-stations

- Prepare four work stations by placing materials and equipment given below.
- **Work-station** I
  - Pair of scissors and a pair of pliers
  - Forcep and food tong
  - ....රථය and a picture of a wheel barrow

- **Work-station** II
  - Screw nails
  - A knife/axe blade
  - A picture of a staircase

- **Work-station** III
  - Laboratory pulley types
  - A pulley fixed on a water well
  - A picture of as crane

- **Work-station** IV
  - A pedal of a bicycle
  - A toy top/ table coconut scraper
  - A picture of a wheel and axle

Competency 6.0 : Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.5: Generates energy by various sources.

Activity 6.5 : How does the energy store?

Time : 120 min.

Quality Inputs: :
- A piece of square card board, a pin, pair of scissors and a wooden stick.
- Two copies of guidelines for group exploration (given in annex 6.5.1)
- Two copies of article **'Energy brought by Shakthi'** (given in annex 6.5.2)
- The text book

Teaching-Learning Process:

Step 6.5.1 :
- Get a student to prepare a simple fan by using the piece of square card board.
- Provide opportunity for another student to hold it to the wind and make it work.
- Show that when the pin is removed the parts of card board tend to unfold.
- Lead a discussion highlighting the following points.

  - Fan rotated due to the energy which was stored naturally in the wind.
  - Energy was artificially stored when the piece of card board was folded.
  - Different forms of energy are stored in objects.

(15 min)

Step 6.5.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.5.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize,

highlighting the following points.

- The primary energy source that we obtain energy is the sun.
- All the other forms are energy are derived from sun's energy.
- All the organisms will die off if the sun's energy is not available.
- Examples for the instances where energy is stored naturally are given as follows;
  - Food, fuel wind, flowing water, ocean waves.
- Examples for the instances where energy is stored artificially are given as follows;
  - Solar cells, chemical cells, changing the location of an object by placing it in a higher point, changing the form of an object.
- The energy stored in an object could be used to do productive work.

(45 min)

Criteria for assessment and evaluation :

- Explains the ways in which the primary energy obtained from the sun are stored naturally as well as artificially.
- Accepts that sustenance of all organisms depend on the energy recieved from the sun.
- Presents innovatively the phenomena related to the storage of energy.
- Discovers the necessary facts by analyzing the information.
- Engages in seeking alternatives.

Annex 6.5.1

Guidelines for group exploration

How does the energy store?

- Two types of stored energy are given below.
- Focus your attention to the type of energy assigned to your group.
  - Energy stored naturally
  - Energy stored artificially
- Find out information about energy by referring the text book.
- Read the article **Energy brought by Shakthi** and seperate out the suitable facts relevant to your topic.
- Discuss about how the energy stored in such a manner could be used in day to day activities.
- Prepare for a creative presentation of your findings.

Annex 6.5.2

Energy brought by Shakthi

Shakthi came towards us.

"Oh come, come. It's a pleasure meeting the illustrious friend sent by the sun."

Shakthi always likes to boast. But each and every word he utter is sensible.

"Do you all know? Every thing that you eat and drink is stored with the energy brought from the sun by me."

"How can you say that? We eat the food produced by plants."

Shakthi laughed sarcastically.

"Is that the way you think? I brought the energy from the sun. Will trees grow otherwise? Does photosynthesis occur? Leaves-flowers-friuts ever grow ? Isn't that your food?" Everybody kept silent.

"Look at that moving vehicle. It also runs with my energy. Just imagine of my power."

"Pardon me for saying this. Vehicles are run by the fuel."

Shakthi laughed aloud. Did a cartwheel with joy.

"Didn't anyone in this audience could think of how fuel was formed?

Fuel is formed by decomposition of plants and animals grown using the energy which I brought. It takes a very long duration of time for this organic materials to convert into fuels. Isn't that the energy which I brought had made the fuel?"

So, why not I'm deserving to get the credit for making fuel?

Everyone became silent. Next Shakthi was walking rythmically while singing a song.

"Flowing water, sea waves and the breeze...

It's the solar energythat's behind all these,

There won't be life on Earth if not for me.

So stop your boasting! It's stupid, you see?"

Indeed it's true...Everybody thought. But one person broke the silence.

"Listen to me Shakthi, we agree that you have come from sun and stored naturally in various forms like food, fuel, wind, ocean waves, flowing water etc... But you also have to agree with this...We also can store enegy artificially and use it as we wish."

"Yes indeed, it's true, it's true. We also can do it artificially."

Shakthi paused for a moment, and began to speak.

"You feel it like that. Isn't it?

Now you better give some examples to prove it."

All started to quote examples eagerly. No one could outdo another.

"Focus your attention on a chemical cell. It gives us current. Chemicals contained it react to generate electricity. A certain form of energy is stored within those chemicals. That is our creation. Storing energy artificially. How about it?"

"Look here. Now I am keeping this stone at a higher point. Then a certain amount of energy is stored in it. Now I'm going allow it to fall. It falls releasing the stored energy. I gave energy to it artificially."

Another one spoke.
"This is a mainspring of a clock. Energy is stored when it is wound. This is a ballon. Energy is stored in its air when we blow it. When we loose them, the energy is released.
That means we can store energy artificially by changing their form too."
"And one more thing to say. Do you know... that we can convert your energy to electricity and get some work done. Don't think that you are a big man... This is also an artificial activity. Electricity so generated could be stored in a chemical cell."
Shakthi just listened while swinging his legs. All the other faces were lit up with pride.
At last Shakthi started to speak.
"Have all of you finished speaking?
So, according to what I heard, you can produce all your energy requirements without me. Therefore, from tomorrow I won't come. What do you say?"
Smile faded away from all the faces. A sense of uncertainity was among the crowd.
"How on earth could we obtain energy without him? All what we did was with his energy. Isn't it?"
Everyone muttered.
Shakthi spoke aloud.
"Chemical substances are compounds. Which energy made these compounds? The energy to lift the stone came from food you eat. Which energy is stored in food?
Someone showed a solar cell and spoke impressively. He said that my energy is transformed to electricity. If I won't come? If you don't get the sun's energy?"
All responded to Shakthi with a note of respect.
"What you say is true. None of the forms of energy could be obtained or stored without sun's energy. Is that right?
"No. No.That is not the way to put it. You should say like this...
Shakthi started his usual impressive speech.
"Sun is our primary energy source. That means the energy provided by sun is contained in all the types of energy found on earth. If the energy from the sun is interrupted not a single living being will survive."
Words if Shakthi were full of vigor.

Competency 6.0 : Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.6 : Uses strategies for transmission of mechanical energy according to the circumstances.

Activity 6.6 : Let's take the energy to another place.

Time : 120 min.

Quality Inputs:

- Four copies of guidelines for group exploration (given in annex 6.6.1)
- Four copies of picture leaflet 'Let's transmit energy' (given in annex 6.6.2)
- The common table (given in annex 6.6.3)

Teaching-Learning Process :

Step 6.6.1 :

- Remind the students of a sewing machine/bicycle or show pictures of those to the class.
- Inquire from students about how the energy of the feet was used to do work in a different location.
- Lead a discussion highlighting following points.
  - In a sewing machine an endless cord attached to the wheel connected to the pedal, transmits the energy applied to the pedal, to the smaller wheel.
  - In a bicycle, an endless chain transmits the energy applied to cog wheel (big wheel attached to the pedal) to free wheel(small wheel attached to the hub).
  - There are other means of transforming energy.

(15 min)

Step 6.6.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.6.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.

- Transmission of mechanical energy from one place to another to do various work is called energy transmission.
- Energy transmission is important in making work easy and orderly.
- Some ways and means employed to transmit energy are as follows;
  - endless belts
  - endless chains
  - toothed wheels
  - shafts
  - liquid/hydraulic
  - air/pneumatic
- In all of the above methods the energy supplied to a particular point is transmitted to another point where some work is done.
- There are many instances where energy transmission in use.

(45 min)

Criteria for assessment and evaluation :

- Explains ways and means of transmitting energy.
- Accepts that energy transmission contributes to make the work easy and orderly.
- Demonstrates the methods of energy transmission.
- Tries out techonological methods.
- Exhibits the ability of creativity.

Annex 6.6.1

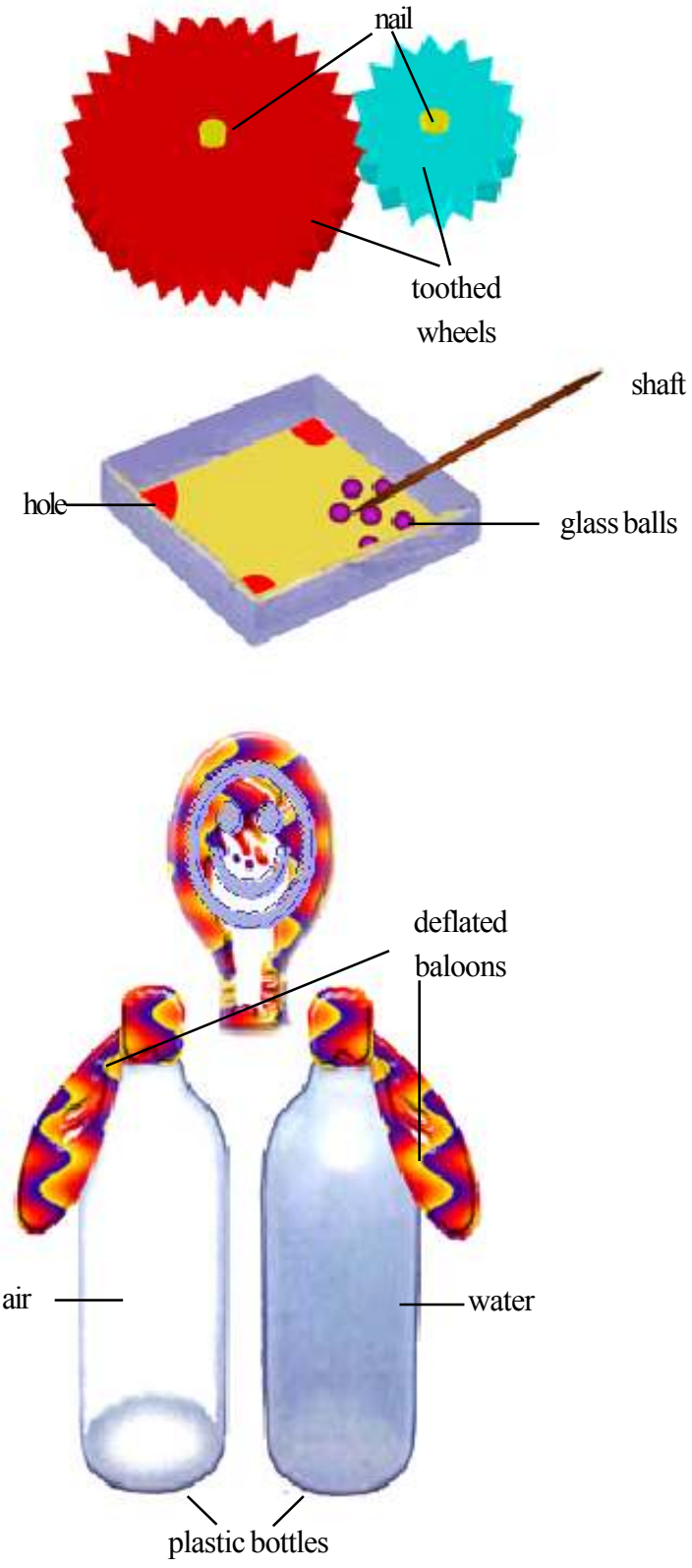
Guidelines for group exploration

Let's take the energy to another place

- Focus your attention to the method of energy transmission assigned to your group.
  - energy transmission by toothed wheels
  - energy transmission by shafts
  - energy transmission by liquid/hydraulic
  - energy transmission by air/pneumatic
- Study the diagram and select the relevant design.
- Collect the materials and equipment from the common table necessary to fabraicate the design.
- Demonstrate the ways and means of transmission of energy assigned to you.
- Lead a discussion among your group on the entire process of energy transmission to explain it scientifically.
- Make a list of life experiences you have come across related to the type of energy transmission process.
- Prepare for a creative presentation of your findings.

Annex 6.6.2

Let's transmit energy



Annex 6.6.3

The common table

- Arrange a common table by placing the materials and equipment given below.
  - two rigifoam sheets of about the thickness of 1 cm
  - five no's glass balls
  - a straight shaft of the diameter of about 1 cm and the length of about 60 cm
  - Two plastic bottles having a small opening
  - water
  - Two small baloons
  - a blade or a thin knife blade

Competency 6.0 : Uses the concepts, principles and theories related to energy, work and force effectively.

Competency Level 6.7 : Employs strategies to use energy effectively.

Activity 6.7 : Let's utilize energy sensibly.

Time : 120 min.

Quality Inputs:

- Two copies of the script on dialogue 'Let's utilize energy sensibly.' (given in annex 6.7.1)
- Three copies of guidelines for group exploration (given in annex 6.7.2)
- The text book

Teaching-Learning Process:

Step 6.7.1 :

- Get two students to present the dialogue to the class.
- Lead a discussion highlighting following points.

  - The energy resources that could be utilized on earth are depleting rapidly.
  - We should utilize energy sensibly.

(15 min)

Step 6.7.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 6.7.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Energy is used to meet the strong needs of the day to day life in a sensible and cautious manner.
  - Rapid depletion of energy resources and inability to regenerate it are burning issues.
  - Some substances which are used to fulfill domestic energy needs are as follows;
    - fuel wood, gas, electricity, kerosene
  - Some substances which are used to fulfill institutional energy needs are as follows;

- electricity and fuel
- Some substances which are used to fulfill industrial energy needs are as follows;
  - electricity, gas and liquid fuel, fuel wood, coal
- Some substances which are used to fulfill transportational energy needs are as follows;
  - liquid fuel,gas, coal, electricity
- Electricity is used to fulfill energy needs in public places.
- Prevention of waste in energy utilization is a strongly felt need.
- Problems mentioned below could also arise in energy utilization.
  - ocurrence of accidents
  - environmental pollution
  - production of unwanted end products
- All of us should act with good attitudes in order to conserve energy.

(45 min)

Criteria for assessment and evaluation :

- Explains the ways and means in which energy could be utilized in a sensible and safe manner.
- Agrees that depleting energy resources should be utilized in a sensible way.
- Develop creative materials on conservation of energy.
- Exhibits the ability to manage resources.
- Suggests practical solutions for problems.

Annex 6.7.1

Let's utilize energy sensibly

- "Can you remember, you said that all the forms of energy on earth have originated from sun's energy?"
- "Yes indeed, there's no doubt about that.
- "But, we have to come down a few steps from the sun and discuss. It's about energy utilization, rather."
- "I'm not clear about your adea."
- "Then listen for a while.
  You cannot put the sun to your heath and cook the rice; you need fuel wood.
  You cannot put the sun into your nehicle and run; you need fuel.
  You cannot hang the sun in your roof and light the home; you need electricity.
  - "Now this story is not new. Everybody know about it. There you have the sun. So it radiates energy at its own will. Why not utilize energy as you wish?"

- "That's where you are wrong. Sun is shining bright. Do we have an ample supply of fuel wood? Do we have gas and fuel supplies to utilize for ever? Can we find resources to generate electricity at ease? We should therefore, utilize energy in a sensible and cautious manner, enabling the folks of next generation to use.
  Stop wastages as much as possible. That is an act of wisdom. Unless the future generations will find fault with us for the fact that we have been selfish."
- "Tha's right. They will go ahead with the new technology and act more wisely than us. They will opt for alternative energy sources like alcohol-even may be water to meet their energy demands.
  Anyway there's a point in your argument. We should conserve energy resources without letting it to waste."

Annex 6.7.2

Guidelines for group exploration

Let's utilize energy sensibly

- You are given the opportunity to explore the possibilities of utilizing the energy resources in a sensible and cautious manner.
- Focus your attention to the topic assigned to you.
  - energy utilization in homes
  - energy utilization in institutions and industries
  - energy utilization in transport and public places
- Find out the energy requirements relevant to the area covered by the topic.
- Make a discussion within the group on the types of energy resources to be utilized to meet the above mentioned requirements.
- Read the information given in the text book.
- Collect facts on the problems that arise in energy utilization in that particular field.
- Suggest ways and means to solve those problems.
- List out the ways in which the energy is wasted.
- Look for practical solutions that could be carried out to cut down watages.
- Develop a slogan or a short innovative design to provide the public with a strong message to inculcate attitudes towards the conservation of energy.
- Prepare for a creative presentation of your findings.

Competency 7.0 : Discovers the values of marvels in the environment.

Competency Level 7.1 : Discovers the information on marvels in the world of plants.

Activity 7.1 : Let's perceive the marvels of plants.

Time : 120 min.

Quality Inputs :

- Products made of plants like wood carvings/coconut shell spoon/ an ekelbroom/a broom/a cain bag
- Four copies of guidelines for group exploration (given in annex 7.1.1)
- The text book

Teaching-Learning Process :

Step 7.1.1 :

- Present the products made of plants to the class.
- Inquire from the students that is it possible to make those products using any other plant in the environment.
- Lead a discussion highlighting the following points.

  - A variety of products could be made using different parts and components of plants.
  - A particular part of the plant components have contributed in making these products.
  - Plants are specific in that aspect.

(15 min)

Step 7.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 7.1.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - Plants are unable to move.
  - Plants have been adapted therefore, to the environmental factors prevailing in a particular habitat through a number of millions of years for their survival.
  - Therefore each and every plant is a specific and a marvellous creation of nature.

- Marvel of plants could be seen if clearly observed.
- Plants have acquired these characteristics by creative-fragile-strategic mechanisms while adapting to meet the following needs;
  - to face the difficulties in the environment
  - for reproduction and dispersal
  - for safety
  - to meet the needs of nutrition
- It is interesting to inquire about the specific and marvellous characteristics of plants.

(45 min)

Criteria for assessment and evaluation :

- Describes the deviations of some plants that have made them marvellous in the world of plants.
- Accepts the fact that each and every plant has a specific identity.
- Enagages in observation to identify marvellous characters in plants.
- Be sensitive to the environment.
- Exhibits the innovativeness.

Annex 7.1.1

Guidelines for group exploration

Let's perceive the marvels of plants

- Focus your attention to the topic assigned to your group.
  - herbs
  - shrubs
  - trees
  - vines
- Select one or few plants in your environment relevant to your topic.
- Make a close observation on the components of shoot like stem, leaves, flowers, fruits and seeds and the root system of the selected plant or plants.
- Find out how it has adapted to live in that particular habitat as well as to perform various functions.
- Make a discussion on how the plant you selected could be considered as specific among the other plants in that environment.
- Try to discover some marvel out of that specific characters.
- Refer the text book and identify the marvellous characters of plants contained in it.
- Design interesting creations for presentation considering the specific characters of plants.
- Prepare for a creative presentation of your findings.

Competency 7.0 : Discovers the values of marvels in the environment.

Competency Level 7.2 : Discovers the information on marvels in the world of animals.

Activity 7.2 : Let's perceive the marvels of the animal world.

Time : 120 min.

Quality Inputs :

- The verse **'From amaizing animals...'** (given in annex 7.2.1)
- Four copies of guidelines for exploration (given in annex 7.2.2)
- The text book

Teaching-Learning Process :

- Let a student to present the verse to the class.
- Lead a discussion to highlight the following points.
  - Man has developed a lot of various useful creations by imitating the shapes of the body and certain organs of animals.
  - Mavels in the world of animals could be seen by close observation of animals and their different organs.
  - It is interesting to study the marvels in the world of animals.

(15 min)

Step 7.2.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 7.2.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.
  - There are specific appendages and organs in animals adapted for movement.
  - Appendages and organs for movement as well as the other organs are adapted according to the environment they live.
  - There are specific characters which are identical to each

and every animal.

- Marvels of the world of animals could be discovered by observing the specific characters of animals.
- Marvels of the world of animals are developed according to the needs given below;
  - to protect from enemies
  - to catch prey easily
  - to face the challenges of the environment
  - for reproduction and dispersal
- It is interesting to discover the marvels in the world of animals.

(45 min)

Criteria for assessment and evaluation :

- Describes the marvellous characters identified in animals.
- Accepts the fact that each and every animal has an identity for its specific characters.
- Engages in observation to discover the specific characters of animals.
- Shows enthusiasm to perceive the beauty of the nature.
- Exhibits the ability to make designs for new creations.

Annex 7.2.1

'From amaizing animals...'

Look at the bird up in the sky
And ask him how the airoplane fly
Look at the fish swimming over there
And think of a ship, what do they share?
Look at the caterpiller eating leaves
Compare with him how the caterpiller moves
Seek more the talents animals have got
What we learn help us a lot.

Hasika Dilhani Jayasekara.

Annex 7.2.2

Guidelines for group exploration

Let's perceive the marvels of the animal world.

- Focus your attention to the topic assigned to your group.
  - a bird
  - a fish
  - a reptile
  - an insect
- Select an animal relevant to the topic assigned to you in the environment you live.
- Closely observe the nature of the body, organs used for movement and other appendages of that animal.
- Find out about how the nature of the body, organs used for movement and other appendages are adapted to live in that particular environment and perform various functions.
- Make a discussion on how the animal you selected could be considered as specific among the other animals in that environment.
- Try to discover some marvel of the animal out of that specific characters.
- Design interesting creations for presentation considering the specific characters of plants.
- Prepare for a creative presentation of your findings.

Competency 7.0 : Discovers the values of marvels in the environment.

Competency Level 7.3 : Discovers the information on marvels of earth and space.

Activity 7.3 : Mysterious but it's...true

Time : 120 min.

Quality Inputs :

- Three copies of guidelines for group exploration (given in annex 7.3.1)
- Poster on 'Wonderful Tornado (given in annex 7.3.2)
- Three copies of the verse **'Nature's Wonders !'** (given in annex 7.3.3)
- The text book

Teaching-Learning Process :

Step 7.3.1 :

- Present the poster to the class.
- Inquire from the students on the information they know about tornadoes.
- Lead a discussion highlighting the following points.
  - Tornadoes are destructive kind of cyclones.
  - But formation of a tornado in the atmosphere is a wonderful phenomenon.
  - Tornado is a large column of air as a conical spiral pushed upwards with a great force.
  - All the objects at the surface of the earth are dragged to the sky in a tornado.
  - A tornado is generated by the differences of pressure in the atmosphere.
  - There are a lot of wonderful phenomena of this nature related to earth and space.

(15 min)

Step 7.3.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 7.3.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.

- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, high-lighting the following points.
  - There are mysterious phenomena related to earth and space.
  - There is a scientific basis for these mysterious phenomena.
  - Studying about this information is an interesting activity.

(45 min)

Criteria for assessment and evaluation :

- Describes the mysterious information related to earth and space scientifically.
- Accepts that each and every mysterious phenomena around us has a scientific basis.
- Prepares a variety of creations using information on the mysterious phenomena related to earth and space.
- Looks at phenomena scientifically.
- Explores the environment

Annex 7.3.1

Guidelines for group exploration

Mysterious but it's...true!

- Focus your attention to the topic assigned to your group.
- water
- land
- space
- Read the verse provided and enjoy it's aesthetic beauty.
- Identify incidents related to your topic out of the enjoyable information contained in it.
- Discover the scientific background of those incidents by referring the text book.
- Prepare an interesting creation which is informative to communicate the scientific background of the information you gathered. (eg:- poster/commics/cartoon/illustrated pictures/book marks etc.)
- Prepare for a creative presentation of your findings.

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Annex 7.3.2

Poster

A Tornado developing from a distance

Mysterious Tornado

Annex 7.3.3

Nature's Wonders !

Amaizing I...

Look, the **Dead Sea!**
I created it!
Don't worry
It won't drown you...

I shoot up steam
And hot water !
And... behold !
A **Geyser !**

Boom !!
Ah...listen to me
Rising upwards
Among the rocks
In a **Blowhole !**
It's I...
Doing all these
Amazing things !

I'm a wonder too...

Come, you must...
And see the wonder
Of the **Devils Tower**

Don't be frightened
Though it is
Indeed frightening
When the earth
Has cracked open...
The **San Andreas Fault !**

Look!
At the huge **Crater**
Created by
A metor
Fallen
Many a year ago
In all these wonders
I silently relish...

I surprize myself...

Observe the space
See the shooting stars
Enjoy
The magic
Of the mirage
And the blue sky...
Wether you
See that or not,
Aren't they all wonders?

Hasika Dilhani Jayasekara.

Competency 7.0 : Discovers the values of marvels in the environment.

Competency Level 7.4 : Discovers the information related to marvels of human creations.

Activity 7.4 : Let's inquire about great personalities in science and their inventions.

Time : 120 min.

Quality Inputs :
- Three copies of guidelines for group exploration (given in annex 7.4.1)
- The text book

Teaching-Learning Process :

Step 7.4.1 :
- Present the characters of world renown Sri Lankan scientists to the students through a role play.
- Lead a discussion highlighting the following points.
  - Distinguished engineer D. J Wimalasurendra introduced the production of hydro-electric power in Sri Lanka.
  - Eminent scientist Dr. A. N. S. Kulasinghe introduced the pre-fabricated concrete technology in Sri Lanka.
  - World renowned Dr. Arthur C. Clarke introduced the concept of communication technology which covers the whole world.
  - Senior scientist Dr. Sarath Gunapala of NASA Jet Propulsion Laboratory was a prominent figure in devel oping a four-band infrared focal camera-first of this kind.
  - Professor Cyril Ponnamperuma who worked in the laboratory studies on the origin of life, headed the team for analyzing the soil samples taken from the moon in Apollo moon exploration project.
  - A lot of great inventions have been made by the scientists throughout the history of mankind .
  - Scientists and inventors have produced an incredible num ber and a variety of scientific and technological break throughs which have changed the world in a magical way.

(15 min)

Step 7.4.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 7.4.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups,summarize, highlighting the following points.

  - An invention or a discovery made by some individual is based on earlier developments or the knowledge base present at the time of that particular event.
  - New inventions are created either as an effort to find a solution to a burning human need or as an experience gained at an unexpected instance.
  - Printing machine, steam engine, internal combustion engine, and computer could be considered as the great inventions which enabled to change human civilization.
  - Sir Albert Einstein, Thomas Alva Edison, Charles Babbage, Sir Isaac Newton, Sir Charles Darwin are some of the eminent personalities who made great discoveries, inventions and breakthroughs in the sphere of science and technology.
  - Among the prominent figures who developed great discoveries and a vast amount of knowledge for the benefit of human race were higher level academics as well as who even did not receive a proper formal school education.
  - Innate characters and potential given below are the reasons behind their success.
    - sharp observation ability
    - untiring effort
    - logical thinking ability

(45 min)

Criteria for assessment and evaluation :

- Names the great inventions and describes about the field of science and the responsible inventors.
- Accepts that Sri Lankans have also contributed in introducing great inventions to the world.
- Analyzes the ways in which the great inventions were made throughout the history.
- Inquires about the causes and effects to understand it to a great depth.
- Exhibits the preparedness to face the future by making the advantages of the past and present experiences.

Annex 7.4.1

Guidelines for group exploration

Let's find about great people and their great inventions

- Focus your attention to the field assigned to your group out of the fields related to the routine daily life of man.
  - Communication
  - Transport
  - Energy utilization
- Refer the text book.
- Find out about the great inventions made related to the field assigned to you.
- Identify the personalities who pioneered it.
- Make a discussion as to why did you consider the inventions you selected as great.
- Try to explain the history of the development of that particular field that you are directed to.
- Describe the other inventions related to the field assigned to you, which is combined in various other ways according to the following themes;
  - invention
  - inventor
  - It's importance
- Prepare for a creative presentation of your findings.

Competency 8.0 : Exhibits the preparedness in management of natural disasters and associated risks.

Competency Level 8.1 : Contributes to minimize the risks associated with floods.

Activity 8.1 : Let's get ready to deal with flood situation sensibely.

Time : 120 min.

Quality Inputs :

- The verse,'Yes, we are not afraid of floods'(given in annex 8.1.1)
- Three copies of guidelines for group exploration (given in annex 8.1.2)
- The text book

Teaching-Learning Process :

Step 8.1.1 :

- Get a student to present the verse.
- Let the students to explain their experiences on floods.
- Lead a discussion highlighting the following points.

  - Flood is a natural disaster.
  - We can minimize the damages caused by floods, if we are pre-prepared for such a situation

(15 min)

Step 8.1.2 :

- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 8.1.3 :

- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups, summarize, highlighting the following points.

  - Some short term scientific factors based on floods could be presented as follows;
  - A large volume of water flowing into shallow rivers rapidly due to heavy rain
  - Release of excess water of reservoirs through sluice gates
  - Decrease in flood retention areas due to filling of low lying land

- Some long term scientific factors based on floods could be presented as follows;
  - Siltation of river beds for longer durations
  - Deforestation
  - Changes in whether and climate due to human impacts on environment for a longer period
- Damages caused by floods could be mitigated by proper management of flood disaster situation
- Predictions could be made on floods considering the climatic and environmental conditions prior to disaster
- Flood disaster situations should be dealt prudently with an understanding and pre-preparedness
- It is essential to take special consideration for health and safety after floods

(45 min)

Criteria for assessment and evaluation:

- Explains scientific facts related to floods.
- Accepts that damages due to floods could be minimized if there is an organized pre-preparedness.
- Develops ways and means to make aware the masses to minimize the damages caused by floods.
- Exhibits the preparedness in facing challenging situations with courage and intelligence.
- Works in harmony.

Annex 8.1.1

Floods Never Couse Us Serious Harm!

We aren't afraid of floods
The river is our friend
What else to do when the burden is heavy
But to overfloor at the end?

When rain explodes with roaring thunder
When water is brown and muddy
Gathering all our pre-packed goods
To the village temple we hurry.

Our mothers and aunts together cook
Enormous pots of rice and curry
While playing enjoying and having fun
We don't forget to learn and study.

Grandpa sits on the temple steps
And with lots of colour, elaborates
How animals acts before a flood

And stores of floods in good old days.
When rain has ceased and water has tamed
It's time for us to return home
Because we are all aware and ready
Floods never cause us serious harm!
(Hasika Dilhani Jayasekara)

Annex 8.1.2

Guidelines for group exploration

Let's get ready to deal with flood situation sensibely

- Focus your attention to one of the following instances regarding floods.
  - Immeadiately before a flood
  - During a flood
  - Soon after a flood
- Lead a discussion on the instance assigned to you with reference to the environmental and climatic changes that could be identified as well as the personal experiences of the members of your group.
- Extract necessary information from the text book.
- Find out the long term and short term scientific factors based on floods
- Suggest suitable practices that could be taken in a flood to face the situation assigned to you effectively in order to minimize the damages.
- Prepare a creative product to make aware the masses, from the information you gathered.
- Prepare for a creative presentation of your findings.

Competency 8.0 : Exhibits the preparedness in management of natural disasters and associated risks.

Competency Level 8.2 : Contributes to minimize the risks associated with landslides.

Activity 8.2 : Let's be prepared to deal with landslide situations wisely.

Time : 120 min.

Quality Inputs :
- Three copies of guidelines for group exploration (given annex 8.2.1)
- The text book

Teaching-Learning Process :

Step 8.2.1 :
- Present pictures related to landslide situations to the class.
- Provide opportunities for the students to discuss about their experiences on landslides.
- Lead a discussion to highlight the following points.

• Landslide is a natural disaster. • Instances of landslides are reported from many areas in Sri Lanka at present. • Damages due natural disasters could be minimized by proper management.

(15min)

Step 8.2.2 :
- Group the class according to the exploration instructions.
- Guide them to explore,by providing instruction sheets.
- Direct the students to observe the activities of the other groups as well.
- Give pre and post feed back.
- Encourage the students to give an innovative presentation.

(60 min)

Step 8.2.3 :
- Get one group to present their findings to the class.
- Secondly give that group an opportunity to cover the gaps in their presentation.
- Then allow the other groups to give any constructive proposals.
- Next present teacher's elaboration to cover the missing points.
- After giving an opportunity to all the groups, summarize, highlighting the following points.

• When landslides occur, rocks and soil together with the vegetal cover are being slipped down the slope. • Accelerated and disorganized development projects may be a short term scientific factor leading to landslides. • Gradual decreases in vegetal cover could be considered as a long term scientific factor for the occurence of landslides. • Predictions could be made by considering whether and environmental conditions prior to landslide disasters. • Landslide disaster situations should be dealt prudently with an understanding and pre-preparedness

- It is essential to take special consideration for health and safety after landslides.
- Damages caused by landslides could be mitigated by proper management of flood disaster situation

(45 min)

Criteria for assessment and evaluation:

- Explains scientific facts related to landslides.
- Accepts that damages due to landslides could be minimized if there is an organized pre-preparedness.
- Develops ways and means to make aware the masses to minimize the damages caused by landslides.
- Exhibits the preparedness in facing challenging situations with courage and intelligence.
- Works in harmony.

Annex 8.2.1

Guidelines for group exploration

Let's get ready to deal with landslide situation sensibely

- Focus your attention to one of the following instances regarding landslides.
  - Immeadiately before a landslide
  - During a landslide
  - Soon after a landslide
- Lead a discussion on the instance assigned to you with reference to the environmental and climatic changes that could be identified as well as the personal experiences of the members of your group.
- Extract necessary information from the text book.
- Find out the long term and short term scientific factors based on landslides.
- Suggest suitable practices that could be taken in a landslide to face the situation assigned to you effectively in order to minimize the damages.
- Prepare a creative product to make aware the masses, from the information you gathered.
- Prepare for a creative presentation of your findings.

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 1, Tool-01

2.0 Competency levels to be covered : 1.1, 1.2, 1.3, 1.4

3.0 Content covered :
- Interactions between organisms
- Interactions between organisms and abiotic environment
- Involvement of organisms for the succession in the environment
- Interactions in the abiotic environment

4.0 Nature of the tool : **Role play**

5.0 Objectives :
- To make an awareness on the continuous changes that occur in the environment
- To communicate scientific concepts using the skills of fine arts
- To acquire a joyful experience

6.0 Instructions to carryout the tool :

For the teacher :
- Establish four groups and divide the competency levels among them.
- Assign the groups to prepare a script for a drama within a maximum of ten minutes.
- Make sure to cover the whole subject content through the script.
- Allow two weeks time to practice.
- Provide opportunity to perform to the whole class.

For the student :
- Prepare the script for the role play in such a manner to ensure all the members of the group get a main role.
- Practice well.
- Pay due attention to the following points when you perform the role play.
  - Communicating the information accurately.
  - Drawing the attention of the audience and be decent.
  - Be attractive

7.0 Evaluation model :

Criteria	Names of the students											
• Correct and appropriate information												
• Well practiced												
• Attractive presentation												
• Giving a valuable contribution to the group												
• Following accepted conventins												

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 1, Tool-02

2.0 Competency levels to be covered : 2.1, 2.2, 2.3, 2.4

3.0 Content covered :
- Introducing volume, density, speed and rate and measurement
- Presenting phenomena

4.0 Nature of the tool : **Seminar**

5.0 Objectives :
- Cultivating the basic concepts of Physics in students and creating an attraction.
- Developing presentation skills

6.0 Instructions to carryout the tool :

For the teacher :
- Assign four themes for small groups.
- Advice the students to act as a group of resource persons considering the limits of syllabus.
- Direct each student to present their subject area by preparing a written paper.
- Insist that each group will only get twenty minutes during the seminar.

For the student :
- Plan your presentations well for the seminar.
- Make a short note of the subject area covered by your presentation as a leaflet.
- Conduct a rehersal to make sure not to exceed the time restrictions given.
- Pay due attention to the following points when conducting the presentations.
  - Presenting approriate demonstrations
  - Matching the daily life activities
  - Suggest where the cocepts could be used productively

7.0 Evaluation model

Criteria	Names of the students									
• Information given are adequate										
• Communicating clearly										
• Using a variety of communicating media										
• Using diagrams and pictures										
• Be an exceptional creation										

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 1, Tool-03

2.0 Competency levels to be covered : 3.1, 3.2

3.0 Content covered :
- Common organizational plan of plant and animal bodies
- Systems, structure and function

4.0 Nature of the tool : Literature survey

5.0 Objectives :
- To identify the systems in the body.
- To ascertain how structure and function of each system contributes to the maintenance of life of organisms.
- To promote learning to learn by using various communication media.
- To provide scientific experiences.

6.0 Instructions to carryout the tool

For the teacher :
- This is an individual activity.
- A duiration of about two weeks is sufficient.
- Advice each student to choose a plant or animal of his/her choice. (Ensure that no two students choose the same animal or plant.)
- Direct them to collect information from books, articles, electronic media, new technological means etc.
- Provide opportunity to present all the written materials on a specified date and allow students to carryout a peer evaluation.

For the students :
- You are assigned to collect written information on a plant or animal of your choice from various sources.
- Try your best to explain the structure and function using diagrams and pictures.
- Find out the adaptations of the organism that make it fit for the particular environment.
- Present your findings using written communication method innovatively.

7.0 Evaluation model

Criteria	Names of the students									
• Information given are adequate										
• Communicating clearly										
• Using a variety of communicating media										
• Using diagrams and pictures										
• Be an exceptional creation										

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 2, Tool-01

2.0 Competency levels to be covered : 4.1, 4.2

3.0 Content covered :
- Basic units of the earth's crust
- Soil and its diversity

4.0 Nature of the tool : **Specimen collection**

5.0 Objectives :
- To make aware about the lithosphere as a component of abiotic environment.
- To make an effort in identifying the specimens of rocks, minerals and soils in the lithosphere.
- To enhance the skills of scientyific enquiry.

6.0 Instructions to carryout the tool

For the teacher :
- It is expected to provide opportunity for the students to make a scientific enquiry on the diversity of rocks, minerals and soils.
- Instruct the students to collect specimens of readily available rocks, minerals and soil types individually or in groups.
- Assign students to prepare information sheets and implement strategies to store the collected specimens in an orderly manner.
- Consider it as a responsibility to get the maximum contribution of each and every student.
- Evaluate by monitoring right throughout the the activity.

For the students :
- Collect specimens of rocks, minerals and soil types that are readily available as individuals or in groups.
- Use appropriate ways and means to prepare information sheets including the collectors name and store the collected specimens in a formal way.
- Be considerate on the commitment on collecting specimens and the accuracy of the information you provide, as this collection would be a teaching aid for the future generation of students.

7.0 Evaluation model

Criteria	Names of students											
• Number of collected specimens												
• Adequacy and accuracy of ionformation												
• Formal strategies for storage of specimens												
• Commitment												
• Completing in the given duration												

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 2, Tool-02

2.0 Competency levels to be covered : 4.3, 4.4

3.0 Content covered :
- Celestial bodies that belongs to solar system
- Space travel

4.0 Nature of the tool : **Wall newspaper**

5.0 Objectives :
- To enhance creative skills.
- To provide opportunity to have a joyful experience by exploring on the celestial bodies that belongs to solar system and space travel.
- To promote collaborative activities.

6.0 Instructions to carryout the tool :

For the teacher :
- Divide the entire subject content to a number of small themes.
- Provide the themes for students individually by drawing lots .
- Advice students to collect information using various sources.
- Develop the wall newspaper with a variety of items like short essays, reports, pictures, photographs, dialogues, cartoons, poems, posters, crossword puzzles etc.

For the students :
- Prepare a suitable attractive creation that you can pass a strong message to the society on the theme assigned to you.
- Try to present your creation in a novel way. .
- Cooperate with others to develop the wall newspaper innovatively.

7.0 Evaluation model

:

Criteria	Names of students											
1. Accuracy of the information												
2. Appropriate to the theme												
3. Attractiveness												
4. Ability work cooperatively												
5. Updated information												

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 2, Tool-03

2.0 Competency levels to be covered : 5.1, 5.2, 5.4,5.5, 5,6, 5.7, 5.8 and 5.9

3.0 Content covered : Content given under the competency levels.

4.0 Nature of the tool : **Quiz**

5.0 Objectives :

- To make an awareness on the properties, Uuses and interactions.
- To develop abilities on conducting a quiz programme and to face the challenges encountered therein.
- To acquire abilities of preparing challenging questions.

6.0 Instructions to carryout the tool

For the teacher :

- Divide the class into several groups and assign the subject content among the groups.
- Plan to conduct the programme in a number of rounds.
- Provide opprotunity to all the groups to act as quiz masters.
- When a group of students act as quiz masters, engage the rest of the class as audience.
- Be responsible on moderating the questions that students prepare and make sure that they are challenging.

For the students :

- Prepare a set of novel questions that suits the theme assigned to the group by conducting a discussion.
- Try your best to present models, materials and equipment as much as possible.
- Participate in the program with discipline.
- On each and every occasion where a satisfactory answer is not recieved by the audience state the correct answer with respect.

7.0 Evaluation model

Criteria	Names of students											
1. Presenting appropriate questions												
2. Clear communication												
3. Arriving at correct decisions on responses												
4. Discipline and patience												
5. Working cooperatively												

Indicate the proficiency level as A, B, C, D.

A - Very good

B - Good

C - Average

D - To be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 3, Tool-01

2.0 Competency levels to be covered : 6.1, 6.2, 6.5, 6.7

3.0 Content covered :
- Manipulating forces
- Diversity of forces
- Storing energy
- Management of power and energy

4.0 Nature of the tool :
- **Panel discussion**

5.0 Objectives :
- To enhance the competencies in usage of power and energy in day-to-day activities
- To provide opportunities grasp updated information from sources.
- To inculcate attitudes on caring and sharing.

6.0 Instructions to carryout the tool :

For the teacher :
- Divide the class into four groups and assign the subject content.
- Provide opportunity for each and every group to share knowledge and experience through a discussion by a panel of four randomly selected students.
- Allow the rest of the students to participate actively as audience.
- Conduct four rounds of discussions.

For the students :
- Divide the assigned subject content among the members of the group.
- Collect updated data and information from various sources.
- Be commited to use in-depth and appropriate facts as much as possible.
- Ensure to finish the discussion on the allocated time.
- Be disciplined during the discussion.

7.0 Evaluation model

Criteria	Names of students										
• Appropriate information											
• Presenting skills											
• Logical facts											
• Content coverage											
• Discipline											

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

A - very good
B - good
C - fair
D - to be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 3, Tool-02

2.0 Competency levels to be covered : 6.3, 6.4, 6.6

3.0 Content covered

- Types of motion of moving objects
- Making work easy by simple machines
- Ways and means of mechanical energy transmission

4.0 Nature of the tool : **Exhibition**

5.0 Objectives :

- To use concepts related to mechanical energy in day-to-day life.
- To enrich the learning experiences through making self directed creations.
- To enhance creative thinking.

6.0 Instructions to carryout the tool:

For the teacher :

- Give freedom for the students to work individually as well as in groups as they wish.
- Direct students to make creative items such as useful demonstrations, working models, new creations, set-ups, designs etc, that cover the subject content.
- Help the students in their scientific and technological needs.
- Encourage the students by expressing highest level of appreciation, no matter what kind of creation they are involved in.
- Conduct an exhibition at the end of the term.

For the students :

- Design suitable exhibits based on the experience gathered from the classroom activities.
- Use as much as possible the abundant/cheap/ discarded resources in the environment to make these exhibits.
- Focus your attention on the ability to improve your creative exhibits for some kind of development that leads to an innovation.

7.0 Evaluation model

Criteria	Names of students											
• Appropriateness of the exhibit												
• Does it make a novel experience?												
• Finish of the product												
• Developmental contribution												
• Attractiveness												

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

A - very good
B - good
C - fair
D - to be developed

Tools for extended teaching-learning process

1.0 Evaluation stage : Term 3, Tool-03

2.0 Competency levels to be covered : 8.1, 8.2

3.0 Content covered :
- Minimize the state of risks related to floods
- Minimize the state of risks related to earthslips

4.0 Nature of the tool : **Project**

5.0 Objectives :
- To direct towards proper management of natural disasters and related risks.
- To get prepared to face challenges.
- To acquire the ability to get desired outcomes in the special events of life (festivals, conflicts, emergencies, benefits, etc,) through management with an organizational plan.

6.0 Instructions to carryout the tool :

For the teacher :
- Explain to the students that this project is done in order to provide them with management skills on facing the natural disasters and the state of related risks.
- Instruct student groups to select small themes/ tasks, which they can intervene and suits their age on floods or earthslips within two weaks time.

  Example:
  - Pre-preparedness and identifying the warning signs before floods/earthslips
  - Be aware on the personal safety measures during the disaster situation.
  - Preparedness to face the challenges after the disaster.
- Introduce the basic features of a project and the project proposal (see annex)
- Instruct student groups to complete the given project proposal format through discussion.
- Continuously monitor the field note books maintained on individual basis as well as by student groups throughout the project period.
- Provide opportunity to present project reports and participate in a group discussion on a pre-determined date.

For the students :

- Focus your attention to the following facts when preparing the project proposal according to the theme assigned to your group.
  - Achievable objectives and outputs.
  - A methodology that could be adopted according to the time frame.
  - Readily available inputs.
- Log day-to-day data using a format (Field note book).
- Prepare a group product by individually collected data.
- Present the project report by the contribution of all the members of the group considering the following points as well.
  - The problems encountered while engaged in the project and how do you solve those problems.
  - How you could contribute to a national task through this kind of a project?

7.0 Evaluation model

Criteria	Names of students											
• Recording information formally												
• Achievement of objectives												
• Dividing the work												
• Not exceeding the prescribed time												
• Attractiver presentation												

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

A - very good
B - good
C - fair
D - to be developed

Annex

Basic features of a project

- Where are we going to? — Objective
- How do we know that wehave reach the destination? — Outputs
- What measures do we take to reach it? — Activities
- What are the resources neede? — Inputs

Format for the project prposal

- Project title -
- Project background -
- Objectives -
- Expected outputs (evidence for acieving the objectives) -
- Activities (steps taken to achieve outputs)
- Inputs (time needed, human and other resources)
- Project team
- Recommendation of the class teacher:-

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Signature