General Science

TEACHER'S GUIDE

Grade 7

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Table of Contents

Unit 1: Basic Concepts of Science.....**1**
1.1. The Nature of Science and its Branches.....3
1.2. Common laboratory equipment, uses, safety rules and procedures in science laboratories.....6
Answer to Review Exercise.....**8**
UNIT 2: Matter in Our Surrounding.....**11**
2.1.Characteristics and nature of matter.....14
2.2. Physical and Chemical Properties of Matter.....22
2.3. Classification of substances.....25
2.4. Changes around us: Physical and Chemical Changes of Substances.....33
2.5. Separation of Mixtures and its Application.....38
Answers to Review Exercise.....44
Unit 3: Elements, Compound and Chemical Reaction.....**45**
3.1. Elements and their representation.....48
3.2. Compounds and their representation.....52
3.3. Simple chemical reactions and equations.....59
3.4. Uses of Chemical Reactions in Every Day Situation.....66
Answers to Review Exercise.....70
UNIT 4: Cells as the Basis of Life.....**71**
4.1. Purpose and invention of Microscop.....75
4.2. Cell.....76
Review Exercise.....83
Unit 5: Living Things and their Tiversity.....**84**
5.1. Living Things.....85
5.2. Kingdoms of Life.....88
Answer for Review Exercise.....102
UNIT 6: Earth in Space.....**109**
6.1. Shape and dimensions of the earth.....111
6.2. Parts of the Earth (Body & Atmosphere).....114
6.3. Earth's movements.....120
Answer for Review Exercise.....125

Unit 7: Motion, Force, Energy And Energy Resources.....128
7.1. Definition and types of motion.....130
7.2. Definition of force and gravitational force.....135
7.3. Effects of force.....138
7.4. Measuring forces.....141
7.5. Definition of Energy.....143
7.6. Forms and Conversion of Energy.....146
7.7. Energy Sources (sun, fuel, hydroelectric, wind, nuclear).....148
7.8. Wise use & Conservation of energy.....151
7.9. Resource depletion & environmental degradation.....153
AnswertoReviewExercise.....156

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Introduction to the Teacher's Guide

Some general aims of general science education

General science is a course of study incorporating elements of several different sciences, such as biology chemistry and physics. It deals with the things related to day to day life and develops skills that relate to a wider variety of topics, ideas and experiences. A knowledge and understanding of general science helps students to understand the world and appreciate how it works. It contributes to a society that benefits from this understanding, and produces people who realize how the Environment can be exploited in a sustainable way for the benefit of society.

At this cycle, the students are expected to gain knowledge of the basic theories, rules and procedures of general science. It is also expected that they should develop reliable skills for using this knowledge to solve problems independently.

To this end, the specific objectives of general science learning at this cycle are to enable them to:

- Gain a basic knowledge of general science
- Use general science in their daily life.
- To understand the world and appreciate how it works

The new general science curriculum takes a competency-based, active-learning approach, underpinned by three broad outcomes: *knowledge, skills, and values and attitudes*. The Students' Book and Teacher's Guide places emphasis on learner-centered classroom and field activities, not only to help students to acquire knowledge, but also to develop problem-solving and decision-making skills, as well as a good attitude to the natural environment.

It is very important for you, the teacher, to help your students understand that science is a dynamic activity. General science is not a set of rules but a body of knowledge that is growing all the time and is modified by experimentation.

There are many different approaches to teaching and learning, involving a range

When you identify students who are working either below the standard level or the minimum level, give them extra help. For example, you can give them supplementary presentations and reviews of the materials in the class. Extra time to study, and develop extra activities to those who are performing below the minimum level is commendable. You can also encourage high-level students with advanced activities and extra exercises. Some helpful references are listed at the end of this teacher's guide. For example, if you get an access for internet it could be a rich resource for you. Search for new web sites is well worth your time as you investigate your subject matter. Use one of the many search engines that exist – for example, Yahoo and Google are widely accepted. Do not forget that, although this guide provides many ideas and guidelines, you are encouraged to be innovative and creative in the ways you put them into practice in your classroom. Use your own full capacity, knowledge and insights in the same way as you encourage your students to use theirs.

General outcomes of grade 7 general science

After completing grade 7 general science lessons, the students will be able to:

- ✓ Understand the basic concepts of nature of science, matter, elements, compounds, cell, living things and their diversity, Earth in space ,motion, force energy and energy resource
- ✓ Develop basic manipulative skills related to science laboratory, matter, elements, compounds, cell, living things and their diversity, Earth in space, motion, force energy and energy resource.
- ✓ Develop basic skills of performing practical activities in general science.
- ✓ Develop skills of applying science principles in production and evaluation of technology products.
- ✓ Develop positive interest and altitude for general science.

of teaching styles, along with practical activities and field work. By using a mixture of teaching styles in every lesson you will be able to engage the interest of all your students and help them to develop their knowledge and understanding of general science.

A student-centered classroom atmosphere and approach stimulates student's inquiry. Your role in such student-oriented approach would be a mentor who guides the student constructs their own knowledge and skills. A primary goal when you teach a concept is for them to discover the concept by themselves, particularly as you recognize threads and patterns in the data and theories that they encounter under the teacher's guidance. You are also encouraged to motivate students to develop personal qualities that will help them in real life. For example, student-oriented teachers encourage students' self-confidence and their confidence in their knowledge, skills and general abilities. Motivate your students to express their ideas and observations with courage and confidence. As the students develop personal confidence and feel comfortable they could motivate addressing their material to groups and to present themselves and their ideas well. Support students and give them chance to stand before the class and present their work.

This teacher's guide helps you only as a guide. It is very helpful for budgeting your teaching time as you plan how to approach a topic. The guide suggests teaching-time periods for each subject you will teach. The guide also contains answers to the review questions at the end of each topic.

Each section of your teacher's guide includes student-assessment guidelines. Use them to evaluate your students' work. Based on your conclusions, you will give special attention to students who are working either above or below the standard level of achievement. Check each student's performance against the learning competencies presented by the guide.

Be sure to consider both the standard competencies and the minimum competencies. Minimum requirement level is not the standard level of achievement. To achieve the standard level, your students must fulfill all of their grade level's competencies successfully.

Main contents of grade 7 general science

Units	Contents	Periods allotted
One	Basic Concepts of Science	11
Two	Matter in Our Surroundings	38
Three	Elements, Compound and Chemical Reaction	17
Four	Cell as the Basis of Life	23
Five	Living Things and their Diversity	23
Six	The Earth	16
Seven	Motion, Force, Energy and energy resources	28

General Information to the Teacher

The students' text is designed and prepared based on the participatory approach of the teaching – learning process. At present, it is believed that students should gain most of their knowledge from the teaching – learning process on their own and some from the teacher. The teacher is expected to give guidance and the necessary assistance, play a role as facilitator, harmonize concepts, provide students with materials required, create conducive atmosphere for the teaching – learning process and evaluate of students' performance. The teacher needs to assist students to discover facts, realize concepts, develop skills in performing experiments, solving problems etc. So, he/she should not dominate the teaching – learning process by giving lecture or explaining concepts throughout the period. Thus, whenever you have contact with your students, you need to plan how to promote active – learning. The strengths and weaknesses of a range of different methods are summarized below:

Brainstorming – teacher presents students with a word or concept and then writes down as many ideas about it or links to it as the students can provide.

This method is Useful for gauging how much students know, recognizing how many links between topic areas they have made, picking up misconceptions that the students may have.

- Can keep a record of initial brainstorm and return to it after the lesson– ask students to identify how many of their initial ideas were right and how many wrong.
- This reinforces new and accurate ideas.

Lecture – content is delivered to students by teacher.

In this method Students receive correct factual information from the teacher.

- Useful at the beginning of the lesson to stimulate thinking.
- Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions.
- Students develop qualities such as self-confidence, curiosity and inquiry. Useful for large numbers of students.
- Makes students passive because it is one-way communication. Makes learning difficult to assess.

Discussion – sharing of ideas between students and teacher.

In this method

- Allows sharing of each other's ideas
- Allows everyone to participate actively
- A few people may end up dominating the discussion.
- Not easy to conduct for large classes.
- Can be time-consuming.
- Teacher can easily lose track of the argument.

Question and answer – teacher asks questions, students answer and Students also ask questions.

This method is Useful for evaluating students' understanding or knowledge of fact or concept.

- Useful for beginning and ending a lesson.
- Can be counterproductive if the teacher asks too many questions.

Demonstration – teacher carries out practical work if materials/equipment are inadequate or the procedure is too complex or unsafe for students.

In this method

- Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions.
- Students develop desirable qualities such as self-confidence, curiosity, interest and cooperation.

Practical activities – students carry out practical work individually or in groups; students gain hands-on experience .*This method is highly recommended and should be used as much as possible.*

This method gives teacher an opportunity to develop students' interest in the subject.

- Teacher has opportunity to interact with students.
- Teacher provides the standard/expected results for each activity. Can be used with discussion method (during discussion of results).
- Students develop skills such as identification, observation, collecting, measurement, manipulation, data recording, investigation, making predictions, interpretation, evaluation, synthesis and drawing conclusions.
- Students develop desirable qualities such as self-confidence, curiosity, interest and co-operation.

Problem solving – students are presented with an exercise where they must find an answer to a problem.

In this method

- Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions.
- Students develop desirable qualities such as seeking knowledge, curiosity, enquiry and responsibility.
- Can waste time if not properly planned and guided.

Assignments – specific task given to students to find out about a particular problem or issue.

- ✓ In this method students have the opportunity to research a topic and look for information on their own.

Worksheets – handouts to guide students in practical work.

This method

- ✓ Allows students to think for themselves without outside influence.
- ✓ Allows individual ideas to be shared in a group.

Field work – outdoor learning activity.

This method

- ✓ Helps students develop skills such as identification, observation, collecting, measurement, data manipulation, recording, analysis, report writing and verbal reporting.
- ✓ Students appreciate the environment.
- ✓ Can waste time if not properly planned and guided

Role plays – students act out a variety of responses to a situation. All students listen respectfully to each group performing.

In this method particularly useful when exploring attitudes to a situation, e.g. people living with HIV/AIDS.

- ✓ Allows students to express ideas in a supportive context.
- ✓ Allows students to explore and discuss different approaches to the same problem.
- ✓ Certain students may dominate – have to make sure every voice is heard.
- ✓ Can be difficult in large classes but can be done.

Schemes of work, lesson plan and record of work

A **scheme of work** is a plan for how the topics in the syllabus will be covered over the course of the year. The scheme should be based on the General science syllabus. The construction of a scheme of work is an important role of a teacher. In this teacher's guide, a sequence of activities is suggested for each topic. An effective scheme can be developed and modified over a period of time, improving it from year to year as a result of teachers' experience. Schemes of work should always be prepared at the beginning of the school year.

A **lesson plan** acts as a guide for the teacher, outlining the activities that will be carried out in order to achieve the specific objectives of the lesson.

A **record of work** is compiled after every lesson. It is a brief report summarizing what has been covered in the lessons. It is hoped that the schemes of work and ideas for lesson plans in this teacher's guide will motivate teachers to develop their own schemes and lesson plans to suit their preferred teaching methods and resources available in their school.

Each topic in this book contains the following sections:

- Learning competencies
- Teaching notes and guides for active learning
- Guidelines for practical activities
- Answers to review and end of unit questions
- Further resources
- Additional exercise

Assessment and Evaluation

Assessment helps you identify whether learning has occurred, and is part of the teaching and learning process. The syllabus and minimum learning competency documents (included at the back of this teacher guide) give a large number of objectives that students are expected to achieve during the year. The review questions and end-of-unit questions are set to help test these.

Learning assessment is expected to be under taken at all levels of the teaching learning processes. It is a continuous process and helps to clearly identify the interest potentials of each student.

Continuous assessment helps teachers to ensure that all students have the opportunity to succeed in school – in any class there may be a wide range of abilities or needs, and by using continuous assessment, teachers can adapt their approach to all of them. The teacher should continually observe the students to see what they know and can do. There are many different kinds of assessment activities included in this course: some, like the review questions, ask students to recall information, while others, such as the boxed activities, focus on processes such as analysis, constructing or showing a skill.

Assessment techniques are set in correspondence with learning objectives and contents.

The following assessment techniques can be used in continuous assessment; for grade 7 general science lessons.

- Observation
- Presentation
- Participation in group work
- Oral question
- Reports (written)
- Demonstration

In both continuous assessment and regular testing/exam-setting, teachers should assess all aspects of knowledge and understanding – knowledge, comprehension,

application, analysis, synthesis and evaluation.

Knowledge means recalling previously learned information, such as terminology, classifications, sequences and methods. In tests, some of the key words used for this sort of question are: *list, define, describe, label, name.*

Comprehension means understanding the meaning of information. A comprehension question uses key words such as: *summaries, interpret, contrast, predict, distinguish, estimate, discuss.*

Application is the use of previously learned information to solve problems in new situations. It is identified by key words such as: *demonstrate, calculate, complete, illustrate, relate, classify*.

Analysis means the breaking down of information into its component parts, examining and trying to understand such information to develop conclusions by identifying causes, making inferences, and/or finding evidence to support generalizations. Questions contain key words such as: *explain, separate, order, arrange, compare, select, compile*.

Synthesis means applying prior knowledge and skills creatively to produce a new or original thing. Questions contain key words such as: *plan, rearrange, combine, modify, substitute, rewrite*.

Evaluation means judging the value of something based on personal opinion, resulting in a final opinion, with a given purpose, without really right or wrong answers. Students might have to compare and discriminate between ideas, assess the value of some evidence of a theory, or make choices based on a reasoned argument. Examples of key words are: *assess, recommend, convince, select, summaries, criticize, conclude, and defend*.

Unit 1 Basic Concepts of Science

i. **Time allotted to the unit : 11 periods**

ii. **Unit over view:** This unit deals about basic concepts of science it encompasses the following sub units the nature of science and its brunches and the common laboratory equipment ,uses, safety rules and procedures in laboratory role. The first sub unit defines science, explain the branches of science, discuss about science and technology and scientists and ethical principles. The second sub units discuss common laboratory apparatus, laboratory safety rules, laboratory safety symbol and hazard sign explained**.**

iii. **Learning Competencies for Unit 1**

After completing this unit the students should be able to:

- Define science as a body of knowledge and the processes and practices used to add to that body of knowledge and describe the main branches of science and explain their relationship.
- Describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others, and the environment.
- Appreciate the role and contribution of science and technology in the understanding of the world.
- Provide examples of Ethiopian scientists who have contributed to science and technology, and describe their contributions
- Discuss the importance of scientific values in decision making and problem solving.
- Select and use tools to observe, measure, and construct. Including: microscope, concave and convex mirrors and lenses, chemical apparatus
- Show concern for their own safety and that of others in carrying out activities and using materials work collaboratively while exploring and investigating.
- Access information, using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, Internet
- Identify potential hazards and implement appropriate safety procedures when working in the laboratory

These learning objectives have to be implemented. The minimum learning competencies have to be achieved by the majority of students. You have to sure this happened through continuous assessment techniques.

iii. ***Contents of the unit***

1.1. The Nature of Science and its Branches

- Definition of science
- Branches of natural science
- Science and technology
- Scientists and ethical discipline

1.2. Common laboratory equipment, uses, safety rules and procedures in science laboratories

- Common laboratory equipment
- Laboratory safety rules
- Science Laboratory safety symbol and hazard signs, and meanings
- Steps to write Laboratory report

iv. ***Suggested teaching methods ;***

- Discussion
- Explanation
- Questioning and answering
- Individual work based on the activities.
- Group work based the activities given.

v. ***Teaching Aids***

- Photographs of famous scientists
- Different laboratory tools: Beakers, flasks, boiling tubes, test tubes, balances, thermometers and Bunsen burner etc.

1.1 The Nature of Science and its Branches

1. Proposed number of periods = 6 periods

2. Competencies

At the end of this lesson the students should be able to:

- Define science as a body of knowledge and the processes and practices used to add to that body of knowledge.
- Distinguish between the Indigenous Science and Conventional Science.
- Describe the main branches of science.
- Explain the relationship among the branches of science.
- Explain how the development of science and technology affect one's beliefs, practices, and ways of thinking.
- Identify the significant contributions of Ethiopian and International Scientists in science and technology.
- Discuss the importance of scientific values in decision making and problem solving.
- Discuss the importance of ethical disciplines in scientific investigations.

3. *Suggested teaching methods ;*

- Discussion
- Explanation
- Questioning and answering
- Individual work based on the activities.

Group work based the activities given.

4. *Teaching Aids*

- Photographs of famous scientists in Ethiopia and world
- Chart showing branches of science
- Photographs of technological products

5. *Facilitating the learning process*

Answers to activity 1.1

Let the teacher initiates the students to includes the following ideas in their answer

I, science as the way to explore natural phenomena, to investigate new ideas etc.

ii. sciences can be divided into two major group natural **sciences** and **social science.**

iii. **Conventional science:** acquired through the scientific methods and considered as western science whereas the **indigenous science** is built by group of people through the accumulation of experience, religious education, informal experiment and intimate understanding of environment in a given culture.

Answer to activity 1.2

Let the teacher give hints to the students considering the following ideas; the ways of food preservation methods, drug extraction from medicinal plant, water purification, environmental conservation etc.

Answer to Activity 1.3

1. There are two major branches of science. These are

i. Natural science and

ii. Social science

2.

a. Biology is a branch of natural science which studies about living things.

b. Chemistry is a branch of natural science which deals with the properties, composition, structure and transformation of substances.

c. Physics is the branch of natural science. It is the study of the nature of matter, energy and their interactions.

d. Geology is the study of earth and how it is formed.

Students would acquire scientific knowledge and the skills through observation and experimentations. Therefore practical activities are very important in teaching science.

Before defining physics, chemistry and biology directly, let the students say something (brainstorming) about science and classification of science by discussing activity 1.1 in the text book.

Science is the study of the world and the universe around us. It is based on natural laws. All the living and non-living things make up our environment act according to natural laws. Science divided into two broad categories:

a. **Natural science**: the study of nature. It includes biology, chemistry, physics, geology, astronomy, etc.
b. **Social science**: studies about people and their interaction.

Based on this discussion let the students answer Activity 1.2

Write on the black board student's answers for Activity 1.2 the give summary and precise definition of Physics, Chemistry, and Biology.

6. Stabilization

- Summarize the lesson by giving them short notes. Ask them to do selected questions from exercise and end unit questions as a class work and home works and further reading assignment,
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Answers for Exercise 1.1

1. Science is a systematic method of gaining knowledge about the physical and natural world and the social aspect of human society. It provides an ordered way of learning about the nature of things, based on observation and evidence.

2. Biology, chemistry, physics.
3. Physical chemistry.

4. Biophysics is the study of physical phenomena and physical process in living things.

Biochemistry is the study of chemical processes within and related to living organism.

Answer to Exercise 1.2 Questions

1. D 2. A 3. D

4. C 5. C

1.2 Common laboratory equipment, uses, safety rules and procedures in science laboratories

1. Proposed number of periods = 5 periods

2. Competencies

At the end of this lesson the students should be able to:

- Identify different laboratory tools
- Demonstrate safe ways of using apparatus in the laboratory.
- Practice precautionary measures in the laboratory
- Exhibit knowledge of lab safety rules and procedures.
- Identify potential hazards and implement appropriate safety procedures when conducting laboratory.

3. *Suggested teaching methods ;*

- Discussion
- Questioning and answering.
- Group work based the activities given.
- Visual based learning

4. ***Teaching Aids***
    - Different laboratory tools: Beakers, flasks, boiling tubes, test tubes, balances, thermometers and Bunsen burner etc.
    - Hazard symbol and sign
5. ***Facilitating the learning process***

In this section the lesson have to focus on different Common laboratory equipment, uses, safety rules and proce dures in science laboratories.

Dear Teacher; to be well inform the students about apparatus, hazard symbol and safety rule, it should be advisable or better to take them to the laboratory class for demonstration.

This section starts with activity 1.6 helps students to identify different laboratory tools and their uses. Activities 1.6 are designed to explore different laboratory tools from locally available materials so promote the students to do and evaluate their works. Based on the discussion of activity 1.6 the students enable how to save themselves from hazardous chemicals by understanding laboratory safety rules.

Throughout the lesson assess students learning using different review questions makes sure that all students have attained the set minimum learning competencies.

6. Stabilization
    - Summarize the lesson by giving them short notes.
    - Ask them to do selected questions from unit exercise, review questions, homework and further reading assignment.
    - Give them feedbacks to their classwork and homework activities.
    - Support the students who failed to answer the checklist questions.

Additional Questions

1. What is experiment?
2. What is the first step in scientific method?
3. What is hypothesis?

Challenging questions

•The first student wants to study the microorganisms that might be found in the water.

• The second student wants to investigate the amounts of force required to lift the bucket and to carry it over various distances, and also to study the interaction of light rays with the water.

• The third student wants to study the tastes, odors and changes of substances when they are dissolved in the water. Questions:

i. Which one of the areas of studies described above is related to the field of:
a chemistry b biology c physics

Answer for Additional Questions

1. An experiment is a planned activity carried out using certain equipment, apparatus and chemicals.
2. Observation
3. Is a new and untested theory.
4. First students study biology, the second students study about physics, third students study about chemistry.

Answer to Exercise 1.3 Questions

1. C 2. C 3. B

Answer to Review Exercise

i. **True and False questions**
1. True 2. False 3. True

ii. **Choose questions**
1. **C** **2. B** **3. B** **4. B** **5. D**

iii. **Matching Question**
1. **C** **2. D** **3. A** **4. B**

iv. **Fill the blank Question**
1. Laboratory
2. Technologist
3. Professor. Gebisa Ejeta

v. **Give short answer questions.**

1. Technology is a combination of technique, skills, processes, design, products, etc. which is dedicated to creating instruments or gadgets or to complete scientific investigation. It is a set of knowledge that has practical application in the creation, designing and utilization of products for industrial, commercial or everyday use.

2. Key Differences between Science and Technology; the points given below, explain the basic differences between science and technology:

- Science can be defined as an organized way of gathering knowledge on a subject, through various observations and experiments. Technology is the practical usage of the laws of science for different purposes.

- Science is nothing but a process of exploring new knowledge, whereas technology is putting scientific knowledge into practice.

- Science is very useful to gain knowledge about a natural phenomenon, and their reasons. On the contrary, technology can be useful or harmful, i.e. technology is both a boon and bane, such that if it is used in the right way, it can help humans in solving a number of problems, however, if it is put to wrong uses, it can cause destruction of the whole world.

- Science remains unchangeable; only additions are made to further knowledge. Conversely, technology changes at a rapid pace, in the sense that, improvement in previous technology is made constantly.

- Science stresses on discovery, like facts and laws of nature. Unlike technology, focuses on the inventions, such as the development of latest technique, to ease the work of humans.

- Science is the study of structure and behavior of natural and physical world, to create premises. In contrast, technology deals with putting those premises into practice.

- Science is concerned with analysis, deduction and theory development. On the other hand, technology is based on analysis and synthesis of design.

- Science is used to make predictions whereas technology simplifies the work and fulfill the needs of people.

3.

i. *Title (and date)*
ii. *Aim (Objective)*
iii. *Theory*
iv. *Material and chemical used*
v. *Data / Observation*
vi. *Result and Discussion*
vii. *and conclusion*

4.

- ✓ To protect the vulnerable group and other study participants
- ✓ To promote the aim of research such as knowledge, truth and avoidance of error etc.

Unit 2 Matter in Our Surrounding

Time allotted to the unit: 38 periods

Unit Overview

This unit gives emphasis to matters, their properties, type of changes they undergo, their classification and techniques of separation of mixture.

The first section of the unit (2.1) deals with characteristics and nature of matter. It begins with definition of matter and introduces the properties of matter. It gives emphasis on the interconversion of the three states of matter without changing the composition of the substance. It also gives information what is particulate matter and particle theory. In addition, it tells the students about diffusion.

The emphasis on section 2.2 is on physical and chemical properties of matter. It begins with substances are identified by their properties and explain what physical and chemical properties mean.

Section 2.3 give emphasis on classification of substances. It introduce the basis for the classification of matter as pure substance and mixtures. It also presents classification of pure substances as elements and compounds. Further classification of elements, compounds and mixtures are also included in this section. Section 2.3 also encourages students to perform experiment and to identify from the experiment whether a compound or mixture.

Section 2.4 gives emphasis to the changes around us. It introduce that substances around us can undergo either physical or chemical changes. The characteristics of both physical and chemical changes are also presented in this section. It also give information on useful and harmful physical and chemical changes. This section encourages students to perform experiment and realize whether a change in a substance is physical or chemical.

The last section of the unit 2.5 focuses on separation of mixtures. This section introduces the techniques of separation of mixture and how these techniques of separation are practically applied in our daily life. It gives chance to students to know the names of some apparatus used in laboratories for the separation process and also to perform activities in separating mixtures.

The methodology suggested teaching this unit as lecture, brain storming, group discussion, experiment, mind map or concept map, oral presentation, demonstration, questions and answers and role-play.

Unit Outcome

At the end of this unit, learners will be able to:

- ✓ use particles theory's postulates to explain properties and behaviour of materials;
- ✓ classify matter as an element, compound, homogeneous mixture, or heterogeneous mixture with regard to its physical properties;
- ✓ describe the structure of solids, liquids and gases in terms of particle separation, arrangement and types of motion;
- ✓ differentiate between physical and chemical properties and changes of matter;
- ✓ Distinguish between chemical and physical of matter.
- ✓ appreciate that matter can be classified based on physical or chemical properties;
- ✓ use properties of matter to identify substances and to separate them;
- ✓ Access information, using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, Internet
- ✓ demonstrate scientific inquiry skills along this unit: observing, classifying, comparing and contrasting, making mode, inferring, communicating, asking questions, designing experiments, drawing conclusions, applying concepts.

Contents of the unit

2.1. Characteristics and nature of matter

- Meaning and Properties of matter
- Particulate nature of matter
- Particle theory of matter (Particle model of matter)
- Diffusion
- Properties of solids, liquids and gases
- Changes in state

2.2. Physical and chemical properties of matter

- Physical Properties of matter
- Chemical Properties of Matter

2.3. Classification of substances

- A pure substance
- Elements and compounds
- Mixtures

2.4. Physical and Chemical Changes of Substances

- Physical change
- Chemical changes
- Characteristics of physical and chemical changes
- Useful and Harmful physical and Chemical Change

2.5. Separation of Mixtures and its Application

- Separation Techniques of Mixtures
- Application of separation techniques.

Suggested teaching methods;

- Discussion
- Explanation
- Questioning and answering

- Individual work based on the activities.
- Group work based the activities given
- brain storming
- experiment
- Demonstration
- Role-play.

Teaching Aids

- Periodic table ,chart
- Different laboratory tools: Beakers, flasks, boiling tubes, tong, test tubes, separatory funnel, balances, magnet, thermometers and Bunsen burner etc.
- Different chemicals: sulfur, Iron nails, sand, salts, sugar

2 .1.Characteristics and nature of matter

Proposed number of periods = 11 periods

At the end of this lesson the students should be able to**:**

- Define matter with examples from day today life.
- Demonstrate that matter is made up of tiny particles.
- State the postulates of the particle theory of matter.
- Infer the particulate nature of matter from demonstration.
- Apply particle nature of matter in explaining diffusion and every day effect of diffusion.
- Describe and/or make a representation of the arrangement, relative spacing, and relative motion of the particles in each of the three states of matter.
- Explain compression in terms of distance between particles.
- Use the terms melting, evaporating, condensing, and solidification to describe changes of state.
- Use the particulate nature of matter to explain: Melting, Solidification, Evaporation, Condensation.

Forward planning

Read the contents in section 2.1 thoroughly from the students' text and from this teacher's guide make a plan of your own that shows the contents and activities you are going to deal with during each period. Your plan needs to be designed in such a way that the whole contents of the section can be covered within 10 periods. In your plan, indicates the duration of time you will allot for group discussion, presentation, in harmonizing concepts, gapped lecture, stabilization and other activities you will perform in each period. You also need to plan how to manage students during group discussion.

Teaching Aids

- Particle model diagram
- Ink, perfume, beaker, water and etc.
- Chart that shows the diagrammatic representation of the microscopic views of solids, liquids and gases.

Subject matter presentation

To teach the contents in this topic, you better use group discussion, role play, gapped lecture and question and answers.

Before you start dealing with the details meaning and properties of matter, you may begin the lesson using the activity 2.1. First, allow students to discuss the activity for a few minutes in groups. Then, each group write something on a piece of paper about activity 2.1. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation and harmonize concepts as follows.

1. Matter is anything that has mass and occupies space. It includes both living and non- living things.
2. • Air, soil, plant, water and table are matters
   • Light, sound and heat are non-matters.

   Then give Exercise 2. 1 as class work or home work

Before you start dealing with particulate nature of matter, you may begin the lesson using the activity 2.2. First, allow students to discuss the activity for a few minutes in groups. Then, each group writes something on their exercise book about activity 2.2. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation, harmonize concepts as follows.

1. When you inflate a balloon its shape changes due to the presence of particles in the balloon. Everything around us is made up of tiny pieces or particles. The particles which make up matter are atoms or molecules.
2. The evidence of the existence of particles in matter and their motion comes from the experiments on diffusion i.e. mixing of different substances on their own. For example, when we burn an incense stick say agarbatti in one corner of the room, its fragrance or the pleasant smell of it spreads in the whole room quickly. This can be explained as follows: The burning of incense stick produces gases or vapors having pleasant smell. The particles of gases produced by the burning of incense stick move rapidly in all directions, mix with the moving particles of air in the room and reach every part of the room quickly along with the air. In short from the effect of wind blowing leaves or dust it is possible to understand the particle matter is in continuous motion. After you finish particulate nature of matter, go to activity 2.3 before on dealing with particulate theory of matter. So let the students discuss activity 2.3 in groups for a few minutes. . Invite some students to present the ideas of their groups to the rest of the class. After their presentations, harmonize the concepts as follows.

1. Everything is made of particles

2. Particles are always moving.

3. An increase in energy makes particles move faster.

4. An increase in temperature is the same thing as an Increase in energy.

5. The particles in hot water have more energy than cold water.

6. The particles in ice move less than particles in water.

It is advisable also describe the thoughts of ancient Greek philosophers, Democritus on particulate nature of matter and the postulates of particle theory. The followings are main ideas (postulate) in the particle model of matter:

1. All matter is made up of tiny particles.
2. The particles of matter move continuously.
3. The particles have spaces between them.
4. Adding heat to matter makes the particles move faster.
5. There are forces between the particles.
6. Particles of one substance differ from the particles of other substance.

Then give exercise 2.2 as class work or homework.

After the discussion, let the students perform Experiment 2.1 in groups. The experiment helps students to understand how particles spread into other substances. The experiment consists of two parts.

Part I Shows how long it takes to reach to different students at different distances to smell, when a bottle of perfume open in one corner of the room.

Part II indicates how the inks diffuse to the color of water, when add 2 or 3 drop ink into a beaker of water using a pipette.

Thus assist the students in a need of help. After they finish the experiment, let students write a group report and inform them that in their report, they should give the answers for all the questions and observations and analysis part of the experiment. Let some students from different group present their observation to the class. Be sure that their laboratory report matches with the following point:

Part I

1. When someone opens a bottle of perfume in one corner of room, its smell spreads in the whole room quickly but the time to reach the odor is depend on distance.

Part II

2. If a drop of ink is dropped into a beaker of water, then the color of ink spreads into the whole water of the beaker. This is an example of diffusion.

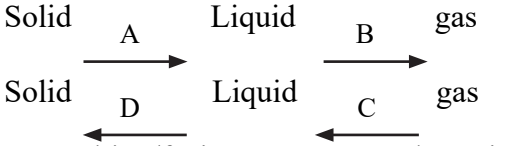
Continue your discussion on diffusion and diffusion in daily life. Then give exercise 2.3 as a class work or homework.

Here you are also advised to give activity 2.4 before dealing properties of solids, liquid and gases. This activity helps students to understand the properties of solids, liquids and gases. Let them do this activity in groups. After their presentations, harmonize concepts as follows:

Substance	solids, liquids and gases	I know this is because….
Water	Liquid	I can pour it.
Air	Gas	It is easily compressed
Stone	Solid	It is difficult to compress
Benzene	Liquid	I can pour it.
Chalk	Solid	It is not fluid.

Then give exercise 2.4 as class work or homework.

After you complete the discussion on properties of solids, liquids and gases, continue with activity 2.5. First, allow students to discuss the activity for a few minutes in groups. Then, each group write something on their exercise book about activity 2.5. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation, harmonize concepts as follows.



A= melting/fusion C= condensation

B= evaporation D= freezing

Additional notes

The three states of matter are interconvertible.

They can be interconnected by the following process:

i. Freezing (Liquid to solid change)
ii. Melting (Solid to liquid change)
iii. Condensation (Gas to liquid change)
iv. Vaporization (Liquid to gas exchange)
v. Sublimation (Solid to gas change).
vi. Deposition (gas to solid change).

Assessment

Assess each students work throughout subunit 2.1. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing activities 2.1-2.5
- Presenting ideas of the group after group discussion.
- performing experiments 2.1
- writing a laboratory report and presenting it to the class
- answering questions during mini-lecture
- answering the question in exercise 2.1-2.4
- Answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time.

Additional Questions

I. **Write True for correct statements and False for wrong statements.**

1. Air does not occupy space and has no mass. So it is not a matter
2. The particles in a liquid have more kinetic energy than the particles in a gas.
3. The temperature at which a solid melts is the same as the temperature at which its liquid form solidifies.
4. Diffusion in a liquid is faster than diffusion in a gas.
5. The opposite of sublimation is deposition

Answers to Additional Questions

1. False 2. False 3. True 4. False 5. True

Answers to Exercise 2.1

1. • a, b, e, f, h, i,j k and l are matters.
   • c, d and g are non-matter.

Answers to Exercise 2.2

I. answers for give short answers

1.

a. All matter is made up of tiny particles.
b. The particles of matter move continuously.
c. The particles have spaces between them.
d. Adding heat to matter makes the particles move faster.
e. There are forces between the particles.
f. Particles of one substance differ from the particles of other substance

2. The idea that matter is made up of tiny particles is called the Particulate nature of matter.

Answers to Exercise 2.3

1. Scent, high, low, diffusion

2. solid, liquid and gas or gas > liquid > solid

Answers to Exercise 2.4

1. Solids, liquids and gases
2. Solids have the following properties
   - Solids have definite shape and definite volume.
   - Solids generally have higher densities than gases and liquids.
   - Solids are very difficult to compress.
   - Solids are not fluids.
   - Solids do not diffuse .
   - The motion of particles are highly restricted.
3. The physical characteristic that distinguishes solid from liquid is that solids have a fixed volume and fixed shape while liquids only have a fixed volume but no fixed shape.
4. Liquid are close together with no regular arrangement. It have definite volume but its shape determine by its container. Gas are well separated with no regular arrangement. Gas has neither a definite shape nor a definite volume.
5. **Liquids and solids**
   - ✓ Both are matter made up of small particles(atoms)
   - ✓ Can be referred to as condensed phased because their particles are close together.
   - ✓ are not easily compressible; meaning they have little space between the particles
6. **Gas and liquids**
   - ✓ Both are matter made up of small particles(atoms)
   - ✓ They are fluid
   - ✓ Both have not shape
7. Solid
8. gas

II. Answers for multiple choice questions.

1. D. 2. A

2.2. Physical and Chemical Properties of Matter

Proposed number of periods = 6 periods

After completing this section, students will be able to:

- Identify and describe physical Properties.
- Use physical properties of matter to identify substance.
- Conduct experiments to identify properties of substances and make group report.
- Identify chemical property
- Distinguish between physical and chemical properties and give examples.

Forward planning

Read the contents on physical and chemical properties from the students' text and other reference material. Make a plan so that you can cover the whole contents in this section with 6 periods. Your plan shows the contents, activities and experiments you are going to do during each period. In your plan indicates the duration of time you will allot for group discussion, presentation and to harmonize. Design a plan on how to manage students during discussion, presentation and when they perform experiments.

Teaching Aids

Different materials such as aluminum, lead, gold, that show the physical and chemical properties.

Subject matter presentation

Physical Properties of Matter

It is advisable to use group discussion, brain storming, gapped lecture and experimentation to present the contents of this lesson.

You may start teaching the contents in this lesson by asking students what it mean physical properties. Encourage some students to suggest their opinion. Following their response, inform them the definition and examples of physical properties

i.e. a physical property can be measured and observed without changing the composition or identity of a substance. Color, melting point, boiling point, density, physical state, and electrical conductivity are physical properties.

After you complete the introduction part, continue with activity 2.6.The activity is designed to assist students to identify the physical properties. So let them discuss in groups for a few minutes. . Invite two students from two groups' one male and one female to present the answers to the class. Next, harmonize ideas by telling to them the following information.

1. Melting point, boiling point and density have constant value under specific conditions.
2. Odor, color, taste are properties that can be perceived by the sense organs.
3. Melting point, boiling point and density are measured using instruments.
4. The ice will melt if it is kept in a cup at room temperature
5. To detect color, we use eye odor we use nose and taste we use tongue
6. The taste of lemon is sour

After you complete the introduction part, continue with activity 2.7.The activity is designed to assist students identify the physical properties as well as the hazard of chemicals during tasting. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the class. Next, harmonize ideas by telling to them the following information

1. The acids that are found in lemon and vinegar is organic acids that are very weak or harmless but the acids in laboratory many of them is mineral acids that are corrosive, even they cause death so it is forbidden to taste chemicals in laboratory.

Next, introduce some physical properties of substances. These include measurable physical properties and physical states. Explain to them what it mean melting Pont, boiling point and density. Give them one or two questions to practices calculating the densities of a substances based on the formula

$$\text{Density} = \frac{\text{Mass of substance}}{\text{Volume of substance}} \quad \text{or} \quad \rho = \frac{m}{V}$$

Check their work and give corrections.

Next to that, continue with electrical conductivity.

Chemical Properties of Matter

For this subtopic, questions and answers gapped lecture and demonstration can be used as active learning methods. You may start teaching the contents in this lesson by asking students what it mean chemical properties. Encourage some students to suggest their opinion. Following their response, inform them the definition and examples of chemical properties.

Additional notes

A chemical property is a characteristic of a substance that describes the way the substance undergoes or resists change to form a new substance. Examples: flammability and rusting.

Finally give exercise 2.5 as a class work or homework.

Assessment

Assess each student's work throughout section 2.2. Watch carefully how every student is involved in answer questions raised during the gapped lecture and answer exercise 2.5.

Additional Questions

I. Write True for correct statements and False for wrong statements.

1. The ability of copper to conduct electricity is a chemical property of copper.
2. Chemical reaction is a physical property.

II. Give short answers

3. The density of mercury is 13.6g/cm^3.What volume of mercury has a mass of 1.36 kg
4. Which sense organs is used to identify
   a. Water from alcohol

b. Yellow from red
c. Common salt from sugar
d. Roughness or smoothness of a rock

Answers to Additional Questions

1. False 2. False

3. Using the formula $\rho = \frac{m}{V}$

$v = 100cm^3$

4. a Both water and alcohol are colorless liquids. Water is odorless while alcohol has odor. Therefore, alcohol from water identified by our nose.

b. Common salt has salty taste while sugar is sweet. As a result, tongue is responsible for this identification.

c. colors are recognized by our eyes.

d. skin

Answers to exercise 2.5

1.
- b, d, e, f, and I are physical properties.
- a , c, g, h and j are chemical properties

2.
- a, d, e and g are intensive properties.
- b, c and f are extensive properties.
- b, c and e are properties recognized by sense organs.
- a, d and f are measurable physical properties

2.3 Classification of substances

Proposed number of periods = 8periods

After completing this section, students will be able to:

- Use the particle theory to describe the difference between pure substance and mixture
- Differentiate between elements and compounds.
- Classify common elements into metals and non-metals.
- Investigate the properties of metals and non-metals and compile a list of general properties.

- Investigate the properties of non-metals and compile a list of general properties.
- Describe and classify mixtures as homogeneous and heterogeneous mixtures with examples from daily lives.
- Describe the relationship among elements, compounds, mixtures, homogenous mixture and heterogeneous mixture.

Forward planning

Dear teacher, read the contents on classification of substances (in terms of composition and observable properties) from the students' text and other reference material. Make a plan so that you can cover the whole contents in this section with 8 periods. Your plan shows the contents, activities and experiments you are going to do during each period. In your plan indicates the duration of time you will allot for group discussion, presentation and to harmonize. Design a plan on how to manage students during discussion, presentation and when they perform experiments.

You are advised to read this teacher's guide to get more information about the activities and methodology you can implement to teach the contents in this section.

Teaching Aids

- ✓ Charts that show the classification of matter
- ✓ Refer to the students' students text book for the materials and chemicals required to perform experiments 2.2

Subject matter presentation

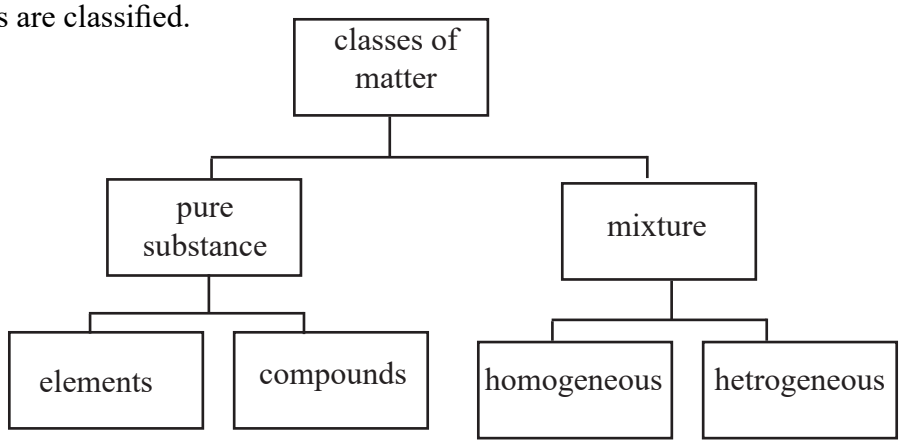
Pure substance

It is advisable to use group discussion, brain storming, experiment and gapped lecture to present the contents of this lesson.

You may start teaching the contents in this lesson by asking students to sugest the importance of classification of matter. Encourage some students to suggest their opinion. After getting feedbacks, inform the students classification of matters

enable scientists to systematically arrange the information (knowledge) about matters in a simpler and easier way to remember and understand.

After you complete the introduction part, continue with activity 2.8.The activity is designed to assist students identify the substances as pure substances and mixture they encounter in their daily lives. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the class. During the presentation, record the names of the substances suggested by students as pure substance and mixtures on the blackboard. This is may help you to apply brain storming methodology. Make sure that students have realized the difference between pure substances and mixtures. The schematic chart for the classification of matter is also given, which may help students to visualize how matters are classified.



Classification of matter

Activity 2.8

Pure substances: chalk, iron, water, oxygen, copper, gold, sulfur, carbon, hydrogen, chlorine and mercury, chalk, water, sugar, table salt and carbon dioxide

Mixtures: bronze, sugar solution, milk, cooking oil, air, ink and soil

Among the substances given in the activities

1 a. iron, oxygen, copper, gold, sulfur, carbon, hydrogen, chlorine and mercury are elements.

b. chalk, water, sugar, table salt and carbon dioxide are compounds

Elements and compounds

You may use group discussion and gapped lecture as methodology to teach contents in this topic.

You can start the topic by inform them that pure substances are classified as elements and compounds. First, define an element and give some examples. Explain the presence of 118 elements, 92 of them occur naturally on earth while the rest are man-made or artificial elements. Introduce the students to the three classes of elements; metal, non-metal and metalloids. Let them be familiar with the properties of metallic and nonmetals and mention some common metal and nonmetals.

i. Some examples of metals are iron, gold, silver, lead, sodium, zinc ,copper and calcium
ii. Some examples of non- metals are sulfur, carbon, oxygen, iodine, phosphorus, fluorine

Then go to activity 2.9. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows.

Oxygen is a non-metal essential for our life and all living things inhale it during breathing.
Oxygen gas in air is essential for breathing to survive. It is also necessary for the combustion i.e. burning of fuels which give us energy for different purposes.

After that, discuss on compounds. First, define a compound and ask students to suggest the difference between elements and compounds. After the discussion, let the students perform Experiment 2.2 in groups. The experiment helps students to distinguish compounds from mixture. The experiment consists of two parts. Part I shows how sulfur and iron are simply mixed to give a mixture. Part II is combination of part I and it indicates how sulfur and iron are combined to give a new compound, iron sulfide. In part II of

the experiment the students may face difficulty during heating and breaking the test tube by plunging the hot end of it. Thus assist the students in a need of help. After they finish the experiment, let students write a group report and inform them that in their report, they should give the answers for all the questions and observations and analysis part of the experiment. Let some students from different group present their observation to the class. Be sure that their laboratory report matches with the following point:

Part I

i. The iron filings are attracted to the magnet.
ii. A gray, color, mixture of iron filings and sulfur, is observed. These iron filings and sulfur are seen separately.

Part II

3. The iron filings and sulfur are not seen separately.
4. Since a new product (Iron sulfide) is formed, the individual components of iron and sulfur, cannot be attracted by a magnet.

Observation and analysis

1. Part II of the experiment indicates a compound. This is because a new substance, Known as iron sulfide is formed.
2. Part I of the experiment shows that it is a mixture

Inform the students that different elements are combining chemically to form binary compounds.

Then continue with activity 2.10 before dealing mixtures. So let them discuss in groups for a few minutes. The activity is designed to assist students identify compound and mixture they encounter in daily life. So let them discuss in groups for a few minutes. Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1. Magnesium filings and powdered sulfur can be seen separately under magnifying glass. No chemical change takes place. Therefore it is mixture. But when magnesium filings and sulfur are heated so they react with each other, anew substance magnesium sulfide formed. This is a compound.

2. Pure water is a compound composed of two or more elements that are combined chemically in a definite proportion by mass while a solution of sodium chloride in water is a homogenous mixture its combination is physically.
3. Air is a mixture of nitrogen, oxygen, hydrogen and other gases.

Then continue your discussion by defining the mixture .Explain the characteristics of the mixtures.

After that continue with the classification of mixtures and begin with activity 2.11. The activity is designed to assist students identify homogeneous mixture from the given substances they encounter in daily life. So let them discuss in groups for a few minutes. The activity is designed to assist students identify compound and mixture they encounter in daily life. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

- Air, salt solution, brass, sugar solution and Pepsi are homogeneous mixture.

Tell them that can be classified into homogeneous and heterogeneous. Also describe them how the properties of homogeneous mixture are different from heterogeneous mixture. Next, begin with activity 2.12. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

- Milk, cooking oil, ink and soil are heterogeneous mixture.

Then continue your discussion by comparing and contrast homogeneous and heterogeneous mixture using table 2.5.

Finally give exercise 2.6 as a class work or homework

Assessment

Assess each students work throughout subunit 2.3. You can assess students' performance based on your record about each student's performance during the

teaching learning process. Your records can be based on the participation of each student in:

- discussing activities 2.8 – 2.12
- Presenting ideas of the group after group discussion.
- performing experiments 2.2
- writing a laboratory report and presenting it to the class
- answering questions during mini-lecture
- answering the question in exercise 2.6
- Answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students who are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time.

Additional questions

1. How are elements and compounds similar? How they are different?
2. Classify the following as homogeneous and heterogeneous mixture.

a. Coca-Cola f. sea water
b. Dust air g. mixture of sand and iron filings
c. Soil h. blood i. sugar solution
d. milk of magnesium
e. bronze

Answers to Additional questions

1. • Elements and compounds are similar because both of them are pure substance.

• An element is composed of only one kind of atom and cannot be broken into simpler substances. On the other hand, a compound is composed of two or

more elements that are combined chemically and it can be broken into simple substances.

2.

a. homogeneous f. homogeneous

b. heterogeneous g. heterogeneous

c. heterogeneous h. heterogeneous

d. heterogeneous i. homogeneous

e homogeneous

Answers to exercise 2.6

1. • a, b ,d, f, g ,i, j, k and n i.e. Water, uranium, alcohol ,iron table salt ,hydrogen, gold, sugar and benzene are pure substances
   - ✓ The rest c, e, h, l and m are mixtures.
   - ✓ From pure substances b, f, i and j are elements while a, d, g, and k and n are compounds.
2. a. An **element** is a pure substance that cannot be broken down into simpler substances by ordinary chemical means. An element is composed of only one kind of matter (atoms).E.g. Sodium, sulfur, Iron, Gold. Oxygen, etc.
   b. A compound is a pure substance composed of two or more elements that are combined chemically in a definite proportion by mass. Examples Sodium chloride, calcium oxide (lime), Carbon dioxide, water, sugar etc.
   c. Homogeneous mixture also known as solution in which the composition is uniform throughout and the components cannot be seen by our naked eyes or using a microscope or a magnifying glass. Examples salt solution. Sugar solution, brass, bronze. Air, etc.
   d. Heterogeneous mixture is a mixture that does not have a uniform composition throughout and its components can be identified by

our naked eyes or with the help of a microscope or a magnifying glass. Examples: milk, blood, mixture of oil and water and soil.

Answers for multiple choice questions

1. B 2. C 3. C 4. C

2.4. **Changes around us: Physical and Chemical Changes of Substances**

Proposed number of periods = 6periods

After completing this section, students will be able to

- Define physical Change and Chemical Change
- Distinguish the physical and chemical changes using their characteristic
- Conduct some simple activities to show physical and chemical changes and write group report.
- Observe and describe physical chemical changes that are important in everyday life.

Forward planning

Read the contents in section 2.4 from the student's text, reference books and other sources to fully understand and to get more information about the physical and chemical changes around us. Design a plan to cover the content of the section within a given periods. Make a plan of your own on how to manage students during discussion, presentation, and assessment. In your plan, show the time allotted for group discussion on activities, presentation, for harmonizing concepts, for experiments and other activities. Try out the experiment before the lesson by yourself. Prepare yourself on the activities and exercise before the class.

Two experiments are suggested in this section. Before each experiments, make ready the required materials and chemicals. You are also advised to conduct each of these experiment by yourself before the students are supposed to perform the experiments.

Teaching Aids

- Refer to the students' text book for the materials and chemicals required to perform experiments 2.3.

Subject matter presentation

It is advisable to use group discussion, gapped lecture, questions and answer and Experimentation as methodology to teach this section.

You can begin the lesson using activity 2.13. It is designed to enable students analyzing the physical and chemical changes. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

Name of activities	Physical changes	Chemical changes	Reasons
Burning of charcoal		√	b/s change its identity
Melts of ice	√		No new substance is formed
Dissolving sugar in water	√		No new substance is formed
Fermentation		√	New substance is formed
Rusting of nail		√	new substance is formed
Evaporation of water	√		No new substance is formed
Spoilage of food		√	change its identity

Then continue your discussion by introducing some common changes that occur in our environment. Tell them that changes can be classified as physical and chemical. After that continue to deal with physical changes and explain them how the physical changes are occurred during the changes of state(phase).Inform them also Melting of ice, evaporation of water, dissolving sugar in water, dissolving salt in water and breaking a stick are common examples of physical changes.

Next, define the chemical changes and give some common examples.

After you complete the physical and chemical changes, Let the students do experiment 2.3 in groups. This experiment is designed to enable students to investigate whether the change of state of substance is physical or a chemical change. After they finish the experiment, let students write a group report and inform them that in their report, they should give the answers for all the questions and observations and analysis part of the experiment. Let some students from

different group present their observation to the class. Be sure that their laboratory report matches with the following point.

Observation and analysis for experiment 2.3

The iron nails will be covered with the familiar red rust. It is a chemical change. Because iron is changed to a new substance which is called rust.

Next go to activity 2.14 before explain them the characteristics of a physical and chemical change. These characteristic may help students to distinguish the physical and chemical changes, by observing the changes that occur on substance. So let them discuss in groups for a few minutes. Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

Students may mention some Characteristics of physical change

- No new substance is formed
- The composition of substance not altered
- It is easily reversed by physical means
- Energy changes are not neccerily
- It is a change in physical property

Students may mention some Characteristics of chemical change

- New substances with new properties are formed
- The composition of substance altered
- It is accompanied by Energy changes
- The change is not easily reversed
- It is a change in physical property

2. Changes in which the original substance remains unaltered are called physical changes whereas a chemical change is a process in which a substance undergoes a change in chemical composition.

Useful and harmful physical and chemical Changes

You can start this lesson with activity 2.15 as brainstorming. So let the students discuss activity 2.15 in groups for a few minutes. . Invite some groups to present their opinion to the rest of the class. Following their presentations, harmonize concepts as follows

a. importance of physical changes:

- ✓ Freezing preserves food, medicine, and other materials
- ✓ Melting, cutting, bending and mould different tools and accessories

b. importance of chemical changes

- ✓ Photosynthesis, Energy production, Food digestion**,** Fermentation, food cooking, etc.

c. Harmful physical changes: cutting tree, bad weather condition, oil spills, etc.

d. Harmful chemical changes: Rusting, souring food, burning of fuel, etc.

Finally give exercise 2.7 as a class work or homework.

Assessment

Assess each students work throughout section 2.4. You can assess students' performance based on your record about each student's performance during the teaching learning process. You may record their performance continuously on student's performance list. Your records can be on the basis of each student participation in:

- discussing activities 2.13-2.15
- Presenting ideas of the group after group discussion.
- performing experiments 2.3
- writing a laboratory report and presenting it to the class
- answering questions during gapped lecture
- answering the question in exercise 2.7
- Answering questions given as quiz or test.

Check their work and record their performance. Evaluate whether they achieved or not the suggested competencies for section 2.4 is achieved by most of the students. Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time so that they can cope up with the rest of the class.

Additional questions

1. Classify the following changes as physical or chemical changes.

a. Magnetizing a bar of iron

b. A mirror is broken.

c. An iron nail corroded in moist air

d. Copper metal is melted.

e. tearing of paper

f. Melting of ice

g. fermentation of tella

h. Alcohol evaporates

i. Table salt (NaCl) is crushed into powder

J. Glucose ($C_6H_{12}O_6$) and oxygen produce CO_2 and water

k. Explosion of gun powder

l. Burning of wood

Answers to additional questions

a. Physical changes changes	e. Physical changes	i. physical
b. Physical changes changes.	f. physical changes	j. chemical
c. Chemical changes. changes.	g. chemical changes.	K. chemical
d. physical changes changes	h. physical changes	l. chemical

Answers to exercise 2.7

1.

- ✓ **a, d, h and i are physical changes.**
- ✓ **b, c, e, f and g are chemical change.**

Answers to multiple choice questions

1. **B** **2. B** **3. C**

2.5. Separation of Mixtures and its Application

Proposed number of periods = 7periods

After completing this section, you will be able to

- List methods of separation of mixtures
- Give some specific examples of mixtures that can be separated by filtration, decantation, simple distillation, magnetic separation and using separator funnel
- Name apparatuses used in decantation, filtration, simple distillation, using separator funnel.
- Assemble apparatuses used in decantation, filtration, simple distillation, separator funnel
- Conduct and report on an investigation that uses physical means such as particle size, density, boiling point, solubility and magnetism to separation.
- Perform simple activities in group, to carry out the separation of mixtures using local materials and write a group report.
- Compare and evaluate the different ways of separating mixtures from products in community.

Forward planning

Read the contents in section 2.5 from the student's text, reference books and other reference book to get more information separation of mixtures and its application. Design a plan to cover the content of the section within a given periods. Make a plan of your own on how to manage students during discussion, presen-

tation, and assessment. In your plan, show the duration of time you allotted for introducing the topic, for group discussion on activities, harmonizing concepts, presentation of the lesson, and stabilization of the lesson. .

Three experiments are suggested in this section. Before each experiments, make ready the required materials and chemicals. You are also advised to conduct each of these experiment by yourself before the students are supposed to perform the experiments.

Teaching Aids

Refer to the students' text book for the materials and chemicals required to perform experiments 2.4

Subject matter presentation

It is advisable to use group discussion, gapped lecture, experiment and questions and answer as methodology to teach in this section.

Before you deal the topic, you can begin with activity 2.16.The activity is designed to remind the students about the separation techniques they familiar in day to day activities. Let the students discuss activity 2.16 in groups for a few minutes. . Invite some students to present the ideas of their groups to the rest of the class. After their presentations, harmonize the concepts by informing them

1.

A. Sieving
B. Magnetic separation
C. Filtration
D. Decantation by separatory funnel
E. Evaporation
F. Distillation
G. dissolution, filtration followed by evaporation

After harmonizing the concepts on the activity, introduce the magnetic separation method. That used to separate magnetic substance from nonmagnetic substance. Then let the students perform experiment 2.4 in groups. This experiment is designed to help students develop their skills in separating of a mixture of magnetic and nonmagnetic substance using magnet. After they finish the experiment, let students write a group report and inform them that in their report, they should give the answers for all the questions and observations and analysis part of the experiment. Let some students from different group present their observation to the class. Be sure that their laboratory report matches with the following point.

Observations and Analysis:

i. The iron filings are attracted to the magnet
ii. From the experiment we conclude that iron is magnetic substance and sand is nonmagnetic. Therefore it is possible separating iron from a mixture of iron and sand by magnetic separation technique.

Before you continue dealing the decantation ask some students the in text questions about the decantation process. After their response, inform them that during the local coffee ceremony, the boiled coffee is allowed to stay within the Jebena for a few minutes. This will result in settling of some insoluble solid particles at the bottom of the Jebena which is known as sedimentation. Then by, carefully pouring the coffee from the Jebena a clean coffee can be obtained. This process is known as decantation. Then continue your discussion by explaining how the decantation method helps in separation of a mixture of a liquid and insoluble solid and also tell them that it helps to separate two immiscible liquids like water and oil using separating funnel.

After that continue, introduce the filtration process. But, before you deal with the filtration process, you are advised to bring a filter paper is used as filtering medium and show them how the filter paper is folded in order to fit the filter funnel.

Additional notes

Difference between Filtration and Decantation:

While both filtration and decantation can be used to separate impurities from liquids, there are differences between them. Filtration is the direct separation of the entire solution through a filter, where the solid is trapped by the filter allowing the liquid to pass through. It cannot be used to separate two liquids.

Decantation is pouring away a liquid from solid impurities which have settled at the bottom of the container. Two liquids with a different density which have separated into two layers can similarly be separated by pouring the less dense liquid out.

Before you are dealing with the evaporation process, start with activity 2.17. The activity is designed to assist students analyze the evaporation separation method to recover the salt.. Let the students do activity 2.17 in groups. Encourage some group representative to present the ideas of their groups to the rest of the class. After their presentations, harmonize the concepts by informing them:

1. Evaporation is the process of escaping of water in the form of vapor. In this activity by evaporating the water you can recover the sodium chloride.

After explaining the evaporation process, continue your discussion by explaining the simple distillation process. Then as you finish your discussion, introduce to the students that mixtures can also be separated into their components by the combination of two or more techinques.Then, let the students do activities 2.18 in groups. The activity is designed to assist students analyzing some of the common mixture using different separation technique. Invite some students to present the ideas of their groups to the rest of the class. After their presentation, harmonize concepts.

i. Sand and salt is separated by dissolution, filtration followed by evaporation
ii. Magnetic separation, dissolution, filtration followed by evaporation
iii. Mixture of oil, water and sand is separated also by filtration and decantation (using separatory funnel) or filtration followed by simple distillation.

iv. Mixture of sugar and clay is separated also by dissolution, filtration followed by evaporation.

After that, before you are dealing application of separation techniques, start with activity 2.19. So let the students discuss activity 2.19 in groups for a few minutes. . Invite some groups to present their opinion to the rest of the class. Following their presentations, harmonize concepts as follows:

Activities	Separation technique
To obtain clean coffee	decantation
To obtain clean Tella	filtration
To separate Teff from rice	sieving

Continue your discussion by mention some industrial application of physical separation techniques. Then give the project to separate the mixture of table salt, sulfur powder and iron filing using local material.

Finally give exercise 2.8 as a class work or homework

Assessment

Assess each students work throughout section 2.5. You can assess students' performance based on your record about each student's performance during the teaching learning process. You may record their performance continuously on student's performance list. Your records can be on the basis of each student participation in:

- discussing activities 2.16-2.19
- Presenting ideas of the group after group discussion.
- performing experiments 2.4
- writing a laboratory report and presenting it to the class
- answering questions during gapped lecture
- answering the question in exercise 2.8
- Answering questions given as quiz or test.

Check their work and record their performance. Evaluate whether or not the suggested competencies for section 2.5 is achieved by most of the students. Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time so that they can cope up with the rest of the class.

Additional questions

1. Which separation technique can you use to separate mixtures of?

i. a liquid and insoluble solid

ii. A soluble solid and insoluble solids

iii. two miscible liquids
iv. two immiscible liquids

Answers to Additional questions

1. i. decantation or filtration

ii. Dissolution, filtration and then evaporation

iii. distillation
iv. Decantation (separatory funnel) or distillation.

Answers to exercise 2.8

1. a. Evaporation b. dissolution, filtration followed by evaporation

c. magnetic separation d. Filtration and decantation (using separatory funnel) or filtration followed by simple distillation.

E fractional distillation

2. a. evaporation
   b. magnetic separation
   c. decantation (using separatory funnel).
   d. sieving
   e filtration
   f. separation by hand

Answers to Review Exercise

Part I

1. True 2. True 3. True 4.False 5.False

Part II

1. D
2. A
3. C
4. D
5. B
6. C
7. B
8. C
9. B
10. C
11. C
12.D
13.B
14.B
15.C
16.D
17.C
18.A

Part III

1.F
2. A
3.C
4. B
5.D
6.E

Part IV

1. Decantation(Using separatory funnel)
2. Crystallization
3. Evaporation
4. Water
5. Filtration

Part V

1. **Diffusion** is the mixing and spreading out of a substance with another substance due to the movement or motion of its particles. It is also defined as the net movement of particles from an area of high concentration to an area of low concentration.
2. Because the solid state, the individual particles of a substance are in fixed positions with respect to each other because there is not enough thermal energy to overcome the intermolecular interactions between the particles. As a result, solids have a definite shape and volume.
3. Extensive properties depend on the amount of matter present on the sample. Example mass, length, area, volume etc.

Intensive physical properties do not depend on the amount of matter present e.g. density, melting point and color.

Unit 3 Elements,compound and Chemical Reaction

Time allotted to the unit: 17 periods

Unit Overview

This unit gives emphasis on language of science by discussing about chemical symbols, formulas and equations. The unit consists of four sections.

The first section of the unit (3.1) deals with Elements and their representation. It begins with definition of elements and deals with chemical symbols of elements and how to write symbols of elements.

The emphasis on section 3.2 is on Compounds and their representation. This section starts on definition of compounds and describes the chemical formula, introduces about valence number and polyatomic ions, and discusses naming and writing binary compounds and other simple chemical compounds. It also describes how to interpreting formula in terms of qualitatively and quantitatively.

Section 3.3 describes simple chemical reactions and equations. First, it presents simple chemical reaction and the law of conservation of mass.Next, it describes writing and balancing of simple chemical equations using inspection and least common multiple (LCM) methods. In this section, one experiment is also conducted to show simple chemical reaction.

The last section of the unit 3.4 focuses on uses of chemical reactions in every day situation.

The methodology suggested to teach this unit are lecture, brain storming, group discussion, experiment, mind map or concept map, oral presentation, demonstration, questions and answers and role-play.

Unit Outcome

At the end of this unit, learners will be able to:

- Compare elements to compounds and how they are represented by symbols and formulae.
- Identify and write symbols of common elements or compounds.
- Name compounds given their formula and write formula given the name of the compound.
- Use symbols and chemical formulae as a way of communicating information about elements and compounds.
- State and apply the Law of Mass conservation to writing balanced equations.
- Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms.

- Write equations describing chemical reactions using appropriate symbols;
- Investigate to determine how characteristics and properties of substances may change during chemical reaction
- describe scientific enquiry skills along this unit: classifying, comparing and contrasting, communicating, asking questions, designing experiment, drawing conclusions and applying concepts.

Contents of the unit

3.1. Elements and their representation

- Common elements
- Chemical symbols

3.2. Compounds and their representation

- Compounds
- Chemical formulas
- Valence number
- Formulas of Binary Compounds

- Naming Binary Compounds
- Polyatomic Ions
- Interpreting formula

3.3. Simple chemical reactions and equations

- Simple chemical Reaction
- Evidences that show chemical reaction has occurred
- Law of Conservation of mass
- Investigating Chemical Reaction
- Writing and balancing simple chemical equation
- Balancing Chemical equation

3.4. Uses Of Chemical Reactions in Every Day Situation

- Uses of chemical reaction

Suggested teaching methods;

- Discussion
- Explanation
- Questioning and answering
- Individual work based on the activities.
- Group work based the activities given
- brain storming
- experiment
- mind map or concept map oral
- Demonstration
- Role-play.

Teaching Aids

- Periodic table ,chart
- Different laboratory tools: Beakers, flask, tong, test tub, balances, Bunsen burner etc.
- Different chemicals: magnesium ribbon

3.1. Elements and their representation

Proposed number of periods = 2 periods

At the end of this lesson the students should be able to:

- Define element.
- Identify symbols of some common elements.
- Write chemical symbols for common elements symbols

Forward planning

Read the contents in section 3.1 thoroughly from the students' text and from this teacher's guide make a plan of your own that shows the contents and activities you are going to deal with during each period. Your plan needs to be designed in such a way that the whole contents of the section can be covered within 2 periods. In your plan indicates the duration of time you will allot for group discussion, presentation, in harmonizing concepts, gapped lecture, stabilization and other activities you will perform in each period. You also need to plan how to manage students during group discussion.

Teaching Aids

- Chart that shows the symbol of the elements

Subject matter presentation

To teach the contents in this topic, you better use group discussion, gapped lecture and question and answers.

Before you start dealing with the elements, you may begin the lesson using the activity 3.1. First, allow students to discuss the activity for a few minutes in groups. Then, each group write something on a piece of paper about activity 3.1. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation, harmonize concepts as follows.

1. An element is a pure substance that cannot be broken down into simpler substances by ordinary chemical means.
2. Oxygen, aluminum, iron, calcium, sodium, potassium, magnesium, hydrogen, nitrogen, gold, silver, copper, helium, sulfur, zinc, phosphorus and chlorine. etc.
   a. Aluminum, iron, calcium, sodium, potassium, magnesium, gold, silver, copper, etc. are metals.
   b. Oxygen, hydrogen, nitrogen, helium, sulfur, phosphorus, chlorine, etc. are nonmetals.

After define elements and mention some common examples of elements, let them to give activity 3.2.This activity helps students' understanding on the use of symbols of elements and how to denoted the symbol of the elements that have similar letter at the beginning. After they discuss for a few minutes invite some of the groups to present their opinions to the classmate. Then harmonize concepts as follows:

1. **An atomic symbol** is defined as shorthand way of representing elements or atoms of an element.
2. The names of some elements such as hydrogen and helium, carbon and calcium, silicon and sulfur begin with the same letter "H", "C" and "S" respectively. Therefore we cannot use the letter "H", "C" and "S" as a symbol for both elements respectively. Hence two letters are used for other elements except one. The first letter "H", "C" and "S" is assigned as a symbol for Hydrogen, carbon and sulfur respectively. The other elements Helium, Calcium and silicon are represented by two letter symbols He, Ca and Si respectively.

   After activity 3.2, continue with the definition of symbol. Define symbol as shorthand way of representing elements or atoms of an element. Explain how the elements are symbolized. In most cases, the first one or two letters of the name are used as the element's symbol. The first letter of a symbol is always capital and the other letter is small. Explain also symbols of element derived from their Latin names.

   Finally give exercise 3.1 as classwork and homework.

Assessment

Assess each student's work throughout section 3.1. Watch carefully how every student is involved in discussing the activity 3.1 and 3.2 in her or his groups, present ideas after discussion, answer questions raised during the gapped lecture and answer exercise 3.1.

Additional notes

Chemical symbols

A symbol is a short hand notation for the name of an element.

The names of elements are derived from various sources. Some are derived from Greek, Latin or German words that generally describe part of the properties of the elements. For example, the word 'iodine' is taken from the Greek word 'iodes', meaning violet like. Few elements are named after the place of their discovery; For example, americium is named after America, and polonium after Poland. Still others named in commemoration of famous scientist, such as Einsteinium for Albert Einstein, Symbol Es, Curium for Madam Merie Curie, Symbol, Cm. A few elements are named after the name of planets. For example

Uranium after Uranus, symbol U

Plutonium after Pluto, Pu

Symbols of some elements derived from Latin names

Some examples

Antimony—stabium-Sb

Tungsten-Wolfram-W. The others are given in students' text book.

Additional Questions

1. Write the symbol of the following elements

A. Chromium C. Cobalt E. Gold

B. Aluminum D. Argon F. Iron

2. Write the name of the elements represented by the following symbols

A. Na	E. Cl
B. Ga	F. Ag
C. I	G. W
D. F	H. Sn

Answers to Additional Questions

1. A. Cr B. Al C. Co D. Ar E.Au F . Fe
2. A. Sodium B. gallium C. iodine D. Fluorine
E. Chlorine F. Silver G. tungsten H. Tin

Answers to exercise 3.1

1. False 4.B

2. True 5. C

3. True

III

Name of element	Symbol		Name of element	Symbol
Potassium	K		Iodine	I
Helium	He		Boron	B
Chlorine	Cl		calcium	Ca
Copper	Cu		Nikel	Ni
Gold	Au		Hydrogen	H
Lithium	Li		silver	Ag

3.2. Compounds and their representation

Proposed number of periods = 6 periods

After completing this section, the students will be able to:

- Define compound as a substance formed when two or more elements chemically combined together.
- Define valence numbers as the combining power of an atom
- Write the formulae of simple binary compounds using symbols and valences
- Name binary compounds
- Describe polyatomic ion
- Write the chemical formulas of common compounds that contain polyatomic ions
- Deduce the formula of a simple compound from a model or a diagrammatic representation.
- Name compounds containing polyatomic ions.
- Identify the elements and number of atoms, given a chemical formula
- Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms.
- Identify the elements and compounds in common household products (e.g., hydrogen peroxide, lye, sodium chloride).

Forward planning

Dear teacher, read the contents on Compounds and their representation from the students' text and other reference material. Make a plan so that you can cover the whole contents in this section with 6 periods. Your plan shows the contents, activities and experiments you are going to do during each period. In your plan indicates the duration of time you will allot for group discussion, presentation and to harmonize. Design a plan on how to manage students during discussion, presentation and when they perform experiments.

You are advised to read this teacher's guide to get more information about the activities and methodology you can implement to teach the contents in this section.

Teaching Aids

- ✓ tables that show the monoatomic and diatomic molecules and the valence number

Subject matter presentation

Compounds and Chemical formulas

It is advisable to use group discussion, brain storming and gapped lecture to present the contents of this lesson.

Before you start dealing with compounds and Chemical formulas, you may begin the lesson using the activity 3.3. First, allow students to discuss the activity for a few minutes in groups. Then, each group writes something on their exercise book about activity 3.3. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation, harmonize concepts as follows.

1. a compound is a pure substance consists of two or more elements which have been chemically combined.
2.

Substance	Elements	Compounds
Sodium chloride(table salt)		√
Water		√
Gold	√	
Iron	√	
Carbon dioxide		√
Silver	√	
Calcium carbonate		√
Oxygen	√	
Potassium iodide		√

After activity 3.3, continue with the definition of compound, it is a pure substance consists of two or more elements which have been chemically combined.

A compound is represented by using the symbols for the elements of which it is composed. This is called the formula of the compound or elements.

Formulas of elements

Ask orally whether students know elements which exist as monoatomic, diatomic and homopolyatomic molecules.

After their response, deal with formulas of elements.

Formulas of compound

Define **as** a short hand representation of a compound.

It contains three or more different atoms. Examples

Water-H_2O

Ammonia-NH_3

A chemical formula shows the kind of elements and the number of each kind of atoms in a compound. For example

.Glucose ($C_6H_{12}O_6$)-has 6 carbon atoms.12 hydrogen atoms and 6 oxygen atoms.

Then give exercise 3.2 as classwork and homework.

Valence Number

Before you deal the topic valence number, you can begin with activity 3.4.The activity is designed to remind the importance of valence number in writing compounds. So let the students discuss activity 3.4 in groups for a few minutes. . Invite some students to present the ideas of their groups to the rest of the class. After their presentations, harmonize the concepts by informing them 1.The combining power of an element is called **valence.**

Formulas of Binary Compounds

You can start this lesson by asking students what is binary compounds and how

to write formulas of binary compounds. After their response, inform them as follows

Binary compounds are compounds formed from two different types of elements. To write formulas of binary compounds, follow the following simple rule

i. Write the symbol of the elements
ii. Write the valence number above the symbol
iii. Criss-cross the valence numbers to conserve charge or to become the compound electrically neutral and write below the symbols. If the valence number is one omit the subscript.

Then give Exercise 3.3 as classwork and homework

Naming Binary Compounds

You can start this lesson with activity 3.5 as brainstorming. So let the students discuss activity 3.5 in groups for a few minutes. . Invite some groups to present their opinion to the rest of the class. Following their presentations, harmonize concepts as follows:

1. If the binary compounds consists of metal and non -metal, the name of the metal named by its elemental name while the letters of the non-metal is replaced by the suffix-ide. So the correct name for a compound made of calcium and sulfur is calcium sulfide.

After the activity, discuss and describe the rule in naming binary compounds using examples. During explaining how to name binary compounds involve students to answer by themselves first for those examples given in their text books.

Polyatomic Ions

Define poly atomic ion and give examples. **A polyatomic ion,** also called compound ion which is positively or negatively charged group of atoms.
E.g. NH_4^+, OH^-,NO_3^-,SO_4^{2-}And PO_4^{3-}

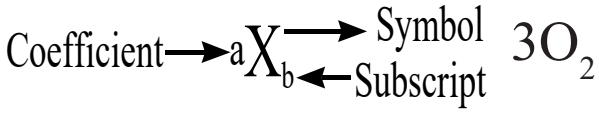
Finally give exercise 3.1 as classwork and homework.

Interpreting formula

You can start this lesson with activity 3.6.This activity is designed for students to understand the qualitative and quantitative meaning of symbols and formula. So let the students discuss activity 3.6 in groups for a few minutes. . Invite some groups to present their opinion to the rest of the class. Following their presentations, harmonize concepts as follows:

- Coefficient shows the number of atoms, molecules or formula units of the substance.
- Subscript in a formula stands for the number of atoms present in a given substance.

Then, continue on dealing with qualitative and quantitative meaning of symbols and formula. Draw a figure in a chart that shows the symbol, subscript and coefficient as follows



You can use the following additional examples (other than those mentioned in students' text book

For qualitative significance of a symbol

- ✓ The symbol N represents an element of nitrogen
- ✓ The symbol Al represents an element of aluminum

For qualitative significance of a formula

- ✓ An ammonia molecule,NH_3,contain nitrogen and hydrogen elements
- ✓ Glucose ($C_6H_{12}O_6$) contain carbon, hydrogen and oxygen elements

For quantitative significance of a symbol

Br quantitatively stands for one bromine

3Br quantitatively stands for three bromine

For quantitative significance of a formula

$3Br_2$ quantitatively stands for three bromine molecule

P_4 quantitatively stands for one molecule of phosphorus.

You can also order the students to do the project by using reference materials, such as a Science books and/or the Internet, try to discover the formulae of common compounds, after they finished their work, invite some groups to present their finding to the rest of the class.

Finally give exercise 3.5 as classwork and homework.

Assessment

Assess each students work throughout subunit 3.2. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing activities 3.3-3.6
- Presenting ideas of the group after group discussion.
- answering questions during mini-lecture
- answering the question in exercise 3.2-3.5
- Answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time.

Additional questions

1. Are O_3 and 3O the same? If they are different, explain their difference
2. The valence number of a metallic element X is 3. What is the formula of its oxide?
3. Name the following compounds a. $(NH_4)_3 PO_4$ b. $Fe(NO_3)_2$ c. $CuNO_3$
4. Describe the qualitative and quantitative meaning and composition of $4CO_2$ in terms of the number of atoms and molecules.

Answers to Additional questions

1. O_3 indicates one molecule of oxygen that contain 3 atoms of oxygen

   3O indicate 3 atoms of oxygen that are not combine.

2. X_2O_3
3. a. ammonium phosphate b.Iron (II) nitrate c. Copper(I) nitrate
4. qualitative meaning
   - carbon dioxide molecule

   quantitative meaning
   - 4 molecules of CO_2
   - CO_2 consists of 4 atoms of carbon and 8 atoms of oxygen.

Answers to Exercises

Exercise 3.2

1. D
2. C

Exercise 3.3

Part I

1.

A. CuO **B.Mg_3N_2** **C. NaCl** **D.Al_2O_3**

E.Fe_2O_3 **F. $FeBr_2$** **G. Ag_2O** **H. CaF_2**

2. a magnesium oxide b. Iron (II) sulfide

C. silver chloride

Part II

3. D

4. C

Exercise 3.4

1.

Ions	Nitrate	Sulfate	Carbonate	Phosphate
Na^+	$NaNO_3$	Na_2SO_4	Na_2CO_3	Na_3PO_4
Ca^{2+}	$Ca(NO_3)_2$	$CaSO_4$	$CaCO_3$	$Ca_3(PO_4)_2$
Al^{3+}	$Al(NO_3)_3$	$Al_2(SO_4)_3$	$Al_2(CO_3)_3$	$AlPO_4$
NH_4^+	NH_4NO_3	$(NH_4)_2\ SO_4$	$(NH_4)_2CO_3$	$(NH_4)_3\ PO_4$
Fe^{3+}	$Fe(NO)_3$	$Fe_2(SO_4)_3$	$Fe_2(CO_3)_3$	$FePO_4$

2. a. ammonium chloride b. copper (II) nitrate
   c. sodium hydrogen carbonate/ sodium bicarbonate
   d. Iron (III) phosphate
3. Mg, C and O
4. N, H, S and O

Exercise 3.5

1. C
2. a. Iron atom
   c. Carbon dioxide molecule
   d. Oxygen molecule
3. a. 3 molecule of H_2
   b. 4 molecule of H_2O
   c. 2 formula unit of sodium chloride

3.3. Simple chemical reactions and equations

Proposed number of periods = 7periods

After completing this section, you will be able to

- Define chemical reaction and give examples
- Describe evidences that show chemical reaction has occurred.

- State the law of conservation of mass
- Conduct an experiment in group to show simple chemical reaction.
- Write a chemical equation
- Balance simple chemical equation by inspection
- Create and use models of particles to demonstrate balanced equations.

Forward planning

Prior reading about simple chemical reactions and equations from the students' text and other reference material is very useful. Make a plan so that you can cover the whole contents in this section with 7 periods. Your plan shows the contents, activities and experiments you are going to do during each period. In your plan indicates the duration of time you will allot for group discussion, presentation and to harmonize. Design a plan on how to manage students during discussion, presentation and when they perform experiments.

- You are advised to read this teacher's guide to get more information about the activities and methodology you can implement to teach the contents in this section

Teaching Aids

- ✓ Charts that show the reactants and products.
- ✓ Refer to the students' students text book for the materials and chemicals required to perform experiments 3.1

Subject matter presentation

It is advisable to use group discussion, brain storming questions and answers, experiment and gapped lecture to present the contents of this lesson.

You can start this lesson with activity 3.7 as brainstorming. It is designed to enable students analyzing the physical and chemical changes. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

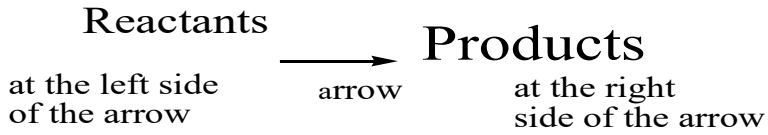
1. Students may list burning of candle, rusting of iron, cooking food, digestion of food, burning of charcoal, etc.

2. Cook food is a chemical change because when the food is cooked it change its identity.

3. a. NO

b. When the **glass beaker breaks no new substance is formed. Therefore, it is a physical change.**

Then continue your discussion by introducing simple chemical reaction. You can start this lesson by revising about chemical changes that they already learnt in unit 2.Next define define chemical reaction as **it is** a process in which one or more substances, the reactants, are converted to one or more different substances, the products. And ask students to list chemical reactions they experience in their daily life. Encourage also them to tell the raw materials (starting substances and new substances formed, after their trial give some chemical reaction and describe the reactants and products. Hang on the chart you brought to the class o as to show the reactants and products.



After this, continue on activity 3.8. It is designed to enable students analyzing the evidence that the chemical reaction occurs. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1. There are signs that indicate a chemical reaction has occurred. These are:

- A colour changes
- Evolution of a gas (formation of bubbles)
- Change of temperature (heat change
- Precipitate (formation of a solid)

Law of Conservation of mass

Begin this lesson with activity 3.9. It is designed to enable students analyzing during ordinary chemical reaction there is no mass loss or gain. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1. Of course burning paper turns it to smoke and ashes and from our everyday experience. When we burn something it gets lighter or, in other words, it loses mass. But this is not true in general! For example, when paper is burned oxygen from the air combines with carbon and hydrogen in the paper turning some of it into carbon dioxide and water vapor, which waft away with carbon particulates in the smoke. This, not surprisingly, leaves the solid ash left over lighter than the original paper.
   After activity 3.9 states the law of conservation of mass.

It states that matter is neither created nor destroyed during a chemical reaction. It means that the mass of reactants is exactly equal to the mass of the products.

After that, continue to demonstrate experiment 3.1.The experiment enables them to develop skills on how to show simple chemical reactions. Here the simple reaction is burning of magnesium in air. Tell them to watch carefully and record their obsevations.When the demonstration is complete, allow them to write reports in groups and submit it.When you check their reports make sure that they respond to the questions in the observation

1. The reactants substances are magnesium and oxygen.
2. Magnesium metal is silverfish lustrous metal and oxygen is colorless, whereas the product magnesium oxide is white powder. The MgO is not bend, not shinny. So it is not resemble to the original reactants.
3. Since new substance is formed it is a chemical change (chemical reactions).

Simple chemical equation

You can start this lesson by asking students what is chemical equation. After their response, inform them as follow.

A chemical equation is shorthand expression of a chemical changes (chemical reaction) through symbols and formulas. In general, to write a chemical equation for a given reaction one can follow the following three steps.

Step 1: Write a word equation for the reaction.

Step 2: Change the word equation to a chemical equation i.e., write the correct symbol or formula for each reactant and product.

Step 3: Balance the equation so that it obeys the law of conservation of mass

Then, before you are dealing with the balancing chemical equation, start with activity 3.10. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1. A chemical equation is shorthand expression of a chemical changes (chemical reaction) through symbols and formulas.

Then begin the lesson with activity 3.11. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1. The chemical equation be balanced to obey the law of conservation of mass.
   Tell them also there are methods to balance chemical equation such as inspection method and least common multiple (LCM) method and mention with examples.
   Finally give exercise 3.6 as classwork and homework.

Assessment

Assess each students work throughout section 3.3. You can assess students' performance based on your record about each student's performance during the teaching learning process. You may record their performance continuously on student's performance list. Your records can be on the basis of each student participation in:

- discussing activity 3.10 and 3.11
- Presenting ideas of the group after group discussion.
- answering questions during gapped lecture
- answering the question in exercise 3.6
- Answering questions given as quiz or test.

Check their work and record their performance. Evaluate whether or not the suggested competencies for section 3.3 is achieved by most of the students. Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time so that they can cope up with the rest of the class.

Additional questions

1. State the law of conservation of mass

2. Balance the following either by inspection or LCM method

a. $Al(OH)_3 \longrightarrow Al_2O_3 + H_2O$

b. $C_6H_6 + O_2 \longrightarrow CO_2 + H_2O$

c. $Mg + HCl \longrightarrow MgCl_2 + H_2$

Answers to Additional questions

1. The law of conservation of mass states that matter is neither created nor destroyed during a chemical reaction. It means that the mass of reactants is exactly equal to the mass of the products

2. a. $4Al(OH)_3 \longrightarrow 2Al_2O_3 + 6H_2O$

   b. $2\ C_6H_6 + 15O_2 \longrightarrow 12\ CO_2 + 6\ H_2O$

   c. $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

Answers to exercise 3.6

1. Balance by inspection

a. $2CaCO_3\ (s) \longrightarrow 2\ CaO(s) + 2\ CO_2(g)$

b. $H_2 + I_2 \longrightarrow 2HI$

c. $2C_2H_2(g) + 5O_2\ (g) \longrightarrow 4\ CO_2(g) + 2H_2O(l)$

d. $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$

e. $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

2

a. $Fe + O_2 \longrightarrow Fe_2O_3$

3 4 12 6 6

$Fe + O_2 \longrightarrow Fe_2O_3$

$4Fe + 3O_2 \longrightarrow 2Fe_2O_3$

b. $Mg + O_2 \longrightarrow MgO$

2 4 4 2 2

$Mg + O_2 \longrightarrow MgO$

$2Mg + O_2 \longrightarrow 2MgO$

3.4. Uses of Chemical Reactions in Every Day Situation

Proposed number of periods = 2periods

After completing this section, you will be able to

- Describe the uses of chemical reactions in everyday situations

Forward planning

Read about the use of simple chemical reactions from the students' text and other reference material is very useful. Make a plan so that you can cover the whole contents in this section with 2 periods. Your plan shows the contents, activities you are going to do during each period. In your plan indicates the duration of time you will allot for group discussion, presentation and to harmonize. Design a plan on how to manage students during discussion and presentation.

You are advised to read this teacher's guide to get more information about the activities and methodology you can implement to teach the contents in this section.

Subject matter presentation

It is advisable to use group discussion, questions and answers and gapped lecture to present the contents of this lesson.

Begin this lesson with activity 3.12. So let them discuss in groups for a few minutes. . Invite students from some groups to present the answers to the rest of class. After their presentations, harmonize concepts as follows:

1.The tella making process starts by soaking the barley in water for about 24 hour at room temperature to produce a malt,locally called "Bikil" Then the germinated barely grain is sun-dried and grounded to produce malt fiour.At the same time" gesho' leaves and stems are sun derided and grounded. Then ,bekil flour and gesho powder are mixed with an adequate amount of water in clean andsmoked traditional bioreactor known as insera.this mixture is left to ferment for two days to form Tejet.subsquntly,millet,sorghum and teff flours of equal proportion are mixed with water to form a dough.The dough is then baked to produce unleavened bread locally known as ye tella kita,which is sliced into pieces and added to the earlier produced Tejet.The mixture is then sealed tightly to ferment anaer-

obically for a few days to turned intoTenses.While the tenses is fermenting mail grain is soaked in water for about 3 day and thenit is dried,roasted and ground to make a dark maize fiour called asharo. Asharo is the main ingredient that determine the colour of tella.Asharois then added to the previous produced Tenses and fermented anaerobically for a period of a few days.After this period of fermentation, a thick mixture locally called "Difidif "is formed.Water isaddedto difidif and lefet to ferment for an additional 5 to 6 hour.Finally solid residues are removed by filtration and served to consumers as Tella.

The raw materials for tella is Barely,wheat,maize,millet,sorghum,teff and gesho. Obviously,the tella making process (fermentation) is a chemical change.

2. Combustion, metathesis, electroplating, Digestion, Acid-Base Reactions, Soap and Detergent reactions and Cooking.Then describe some common examples in details.

Additional notes

Combustion

Every time you strike a match, burn a candle, build a fire, or light a grill, you see the combustion reaction. Combustion combines energetic molecules with oxygen to produce carbon dioxide and water.

For example, the equation for the combustion reaction of propane, found in gas grills and some fireplaces, is:

$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2 + \text{energy}$

Metathesis

If you combine vinegar and baking soda for a chemical volcano or milk with baking powder in a recipe, you experience a double displacement, or metathesis reaction (plus some others.) The ingredients recombine to produce carbon dioxide gas and water. The carbon dioxide forms bubbles in the volcano and helps baked goods rise.

Electrochemistry

Batteries use electrochemical or redox reactions to convert chemical energy into electrical energy. Spontaneous redox reactions occur in galvanic cells, while non-spontaneous chemical reactions take place in electrolytic cells

Digestion

Thousands of chemical reactions take place during digestion. As soon as you put food in your mouth, an enzyme in your saliva called amylase starts to break down sugars and other carbohydrates into simpler forms your body can absorb. Hydrochloric acid in your stomach reacts with food to further break it down, while enzymes cleave proteins and fats so they can be absorbed into your bloodstream through the walls of the intestines.

Acid-Base Reactions

Whenever you combine an acid (e.g., vinegar, lemon juice, sulfuric acid, or muriatic acid) with a base (e.g., baking soda, soap, ammonia, or acetone), you are performing an acid-base reaction. These reactions neutralize the acid and base to yield salt and water.

Soap and Detergent Reactions

Soaps and detergents clean by way of chemical reactions. Soap emulsifies grime, which means oily stains bind to the soap so they can be lifted away with water. Detergents act as surfactants, lowering the surface tension of water so it can interact with oils, isolate them, and rinse them away.

Cooking

Cooking uses heat to cause chemical changes in food. For example, when you hard boil an egg, the hydrogen sulfide produced by heating the egg white can react with iron from the egg yolk to form a grayish-green ring around the yolk.

Assessment

Assess each students work throughout section 3.4. You can assess students' performance based on your record about each student's performance during the teaching learning process. You may record their performance continuously on student's performance list. Your records can be on the basis of each student participation in

- discussing activity 3.12
- Presenting ideas of the group after group discussion.
- answering questions during gapped lecture

Check their work and record their performance. Evaluate whether or not the suggested competencies for section 3.4 is achieved by most of the students. Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercise by arranging extra lesson time so that they can cope up with the rest of the class.

Additional questions

I. Write 'True' for the Correct Statements and 'False' for the Wrong Statements

1. Combustion of candle is a chemical change.
2. Rusting is a useful chemical reaction**.**

   Answers to Additional questions

   1. True
   2. False

Answers to Review Exercise

Part I

1. True 2. True 3. False 4. False 5. False

6. True 7. True 8. False 9. True 10.True

Part II.

11. A 12.B 13.B 14.C 15.C 16.C 17.C

Part III.

18. a. Zn b. P c. Hg d.Ca e. Sn

19. a. $2Al(OH)_3 \longrightarrow Al_2O_3 + 3H_2O$

b. $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$

c. $3Ca(OH)_2 + 2H_3PO_4 \longrightarrow Ca_3(PO_4)_2 + 6H_2O$

20.

a. $2Al + 3Br_2 \longrightarrow 2AlBr_3$

b. $6Na + N_2 \longrightarrow 2\ Na_3N$

c. $2K + 2H_2O \longrightarrow 2KOH + H_2$

UNIT 4 Cells as the basis Of Life

i. **Time allotted to the unit: 23 period**

ii. **Unit over view(introduction)**

This unit gives emphasis to the microscope and cell. The first section (sub unit) of the unit deals about microscope. It begins with purpose and invention of microscope then types of microscope and the basic parts of microscope. It gives emphasis on the purpose, time line and developments of microscope then after it give consideration on the types of microscope as well as parts of light microscope and how to use.

The second subunit deals about cell, it begins with explaining discovery and definition of cell then turn to basic structures of cell, significances of cell shape and size, unicellular and multicellular organism, level of organizations of organism, and finally the role of mitochondria for cellular respiration and chloroplast for photosynthesis are discussed.

iii. **Learning Outcomes:** At the end of this unit, learners will able to:

- Define a microscope
- Explain the use of a microscope
- Distinguish the different types of microscopes
- Describe the basic parts and functions of a microscope
- Use a microscope to view objects
- Define a cell
- Explain how cell was discovered and who discovered it
- Draw a cell and label its major parts
- Describe the functions of the major structural parts of a cell
- Distinguish between unicellular and multicellular organisms
- Give examples of cell shape
- Explain why cell shape and structure vary
- Discuss the differences of cell, tissue, organ and organ system
- Define respiration and write its chemical equation
- Define photosynthesis and write its chemical equation

iv. Contents of the unit

4.1. Microscope (8 Periods)

4.1.1. Purpose and invention of Microscope

4.1.2. Types of microscope

4.1.3. Basic parts of light microscope

4.2. Cell (15 Periods)

4.2.1. The discovery and definition of a Cell

4.2.2. Structure of a cell

4.2.3. Cell shape and size

4.2.4. Unicellular organisms

4.2.5. Multicellular organisms

4.2.6. Cell, Tissue, Organ, and Organ system

4.2.7. Respiration and Mitochondria

4.2.8. Photosynthesis and Chloroplast

v. Planning for the unit

In this unit you are going to introduce the students about microscope and cell therefore you need to make prior arrangements ahead of time. Knowing and using of microscope are the two most important activities which enable the students to investigate the cellular world. Therefore, you need to carry out the following activities before you start dealing with the unit.

- ❖ Go to the school laboratory and do the following activities:
  - Make sure if any type of microscope (simple [hand lens] or/and compound) is/are available or not. If it is not available think of

Main contents and period allotted for unit four

4.1. Purpose and invention of Microscope

1. Sub unit over view

This sub units deals about purpose and invention of microscope, types of microscope and basic parts of light microscope so that the students should define and discuss the role of a microscope, identify the major parts and functions of a basic microscope, draw diagram of a microscope and label the major parts and finally build microscope from locally available materials.

4.1.1. Purpose and invention of Microscope

1. Sub unit over view

This sub units deals about purpose and invention of microscope, types of microscope and basic parts of light microscope so that the students should define and discuss the role of a microscope, identify the major parts and functions of a basic microscope, draw diagram of a microscope and label the major parts and finally build microscope from locally available materials.

2. Proposed number of periods = 8 periods

3. Competencies

At the end of this lesson the students should be able to:

- Identify the major parts and functions of a basic microscope
- Use a microscope to view objects
- Discuss the role of a microscope
- Differentiate between simple and compound microscope
- Draw diagram of a microscope and label the major parts
- Build microscope from locally available materials

4. Planning for sub unit

Go to the school laboratory and do the following activities:

Make sure if any type of microscope (simple [hand lens] or/and compound) is/are available or not. If it is not available think of what you need to do next and how you are going to show a microscope. If there is no microscope in your school laboratory; you may draw a picture or make a model of microscope to facilitate the teaching learning process.

5. Suggested teaching methods

- Brainstorming on what a microscope is.
- Reflections on the key parts of a compound microscope and the calculation of total magnification
- Discussions on the function of key parts of a compound microscope.
- Demonstration on types of microscopes and key parts of a compound microscope
- Practical activities on mounting and focusing
- Project work to build microscope from locally available materials

6. Teaching Aids

- As teaching resources use the real microscopes or you can make drawings or prepare a model of microscopes to cover this sub-unit. Use the textbook as well.

7. Facilitating the learning process

You can introduce the lesson by bringing into the class a picture or drawing of a compound microscope (without any labeling of its parts) and ask them what it is. You can still ask them whether they have had the chance to see or use a microscope (hand lens and/or compound) before or not. Then after, you can brainstorm the students what is the use of a microscope.

After discussing the parts of the microscope and their functions you can proceed to experiments 4.1 Teacher helps students how to mount the specimen for observation. Students draw what they observe through a microscope. At the end of Experiment 4.1 discuss with your students on the practice of mounting and

Main contents and period allotted for unit four

Units 4	Main topic	Sub topic	Periods allotted
Unit Four: Cell as the Basis of Life (25	4.1. Microscope (8 Periods)	4.1.1. Purpose and invention of Microscope	2
		4.1.2. Types of microscope	2
		4.1.3. Basic parts of light microscope	4
	4.2. Cell (16 Periods)	4.2.1. The discovery and definition of a Cell	2
		4.2.2. Structure of a cell	2
		4.2.3. Cell shape and size	2
		4.2.4. Unicellular organisms	2
		4.2.5. Multicellular organisms	2
		4.2.6. Cell, Tissue, Organ, and Organ system	2
		4.2.7. Respiration and Mitochondria	2
		4.2.8. Photosynthesis and Chloroplast	2

4.1 Purpose and invention of Microscope

1. Sub unit over view

This sub units deals about purpose and invention of microscope, types of microscope and basic parts of light microscope so that the students should define and discuss the role of a microscope, identify the major parts and functions of a basic microscope, draw diagram of a microscope and label the major parts and finally build microscope from locally available materials.

2. **Proposed number of periods = 8 periods**
3. **Competencies**
   - Give them feedbacks to their class work and home work activities.
   - Support students who failed to answer the checklist questions

9. Assessment and follow up

You can assess your students by asking them the following questions:

- ❖ When was cell discovered?
- ❖ What are the names of the major scientists who took the credit in the discovery of cells?
- ❖ Explain the relationship between the discovery of cells and the invention of microscope
- ❖ What is the purpose of hand lens?
- ❖ Give them a picture or drawing of a microscope indicating its main parts and ask them to label the parts of a compound light microscope (you can give them in groups or individually). You can correct labeling of parts of the microscope giving marks.
- ❖ Give them matching questions on the parts of microscope and their functions so that they can relate parts of the microscope with their functions

4.2 Cell

Proposed number of periods = 15periods

1. Sub unit over view

This sub units deals about cell, and organized into eight sub-sub topic, the discovery and definition cell, structure of cell, cell shape and size, unicellular and multicellular organism, level of organization of organism, respiration and mitochondria, and photosynthesis chloroplast. So that the students discuss how cell was discovered, draw and label the basic structures of cell, know why the cell shape and structure vary, distinguish between unicellular and multicellular organism, know the different level of cellular organization of organism, grasp the role cellular respiration and photosynthesis.

Competencies

At the end of this lesson the students should be able to:

- explain how cell was discovered;
- draw and label the basic structures and functions of a cell;
- explain why cell shape and structure vary;
- distinguish between unicellular and multicellular organisms;
- differentiate among cell, tissue, organ and organ system with examples;
- examine and weigh the importance of cellular respiration;
- examine and weigh the importance of photosynthesis.

2. Planning for the unit

Make the appropriate preparation about cell by reading the contents in the students' text. You also need to read the teacher's guide on this section to plan how to present the lesson you intend to deal with during each period and get detailed information about the suggested Activities and the methodologies you implement. Plan how to manage students during discussion, and also budget your time for every activity you perform.

More over this sub unit need certain materials or teaching aid like microscope, posters or figures; to view/show the structures of the cell, to identify the cell structure and size, to observe the unicellular organism, cell, tissue, organ so that you should arranges these materials before the lesson delivered.

3. Suggested teaching methods

- As teaching resources, use the posters or drawings of plant and animal cell to cover this sub-unit. Use the textbook as well.
- Brainstorming on what a cell is and comparison of plant and animal cell.
- Reflections on the structure of plant and animal cells observed through a compound microscope or from posters showing simplified typical cell, animal and plant cells.
- Discussions on the effect of plant and animal cells.
- Experimental investigation on unicellular organisms if prepared slides are there in the laboratory.

4. **Teaching Aids**
   - As teaching resources, use microscope, prepared slides of different cell, posters or drawings of plant and animal cell to cover this sub-unit. Use the textbook as well.
5. **Facilitating the learning process**

You can introduce the topic narrating the contribution microscope and of scientists in the discovery of cell. Then ask students from what microscopic possible units their bodies are made from? Then ask Students to define a cell and discuss cells as the smallest units of living things. Tell about their sizes and the need for a microscope. The students will also discuss parts of cells and will identify common parts of all cells. Then after, they will start examining structural parts and their functions of animal and plant cells. Finally, students will compare animal and plant cells (exercise 4.2) the students will identify the differences between unicellular and multicellular organisms on the basis of the number of cells they have. Then proceed to the experiment 4.2 Teacher helps students how to mount the specimen for observation. Students draw what they observe through a microscope.

6. **Stabilization**
   - Summarize the lesson by giving short notes and key points of the sub units.
   - Ask them to do selected questions from exercise and end unit questions as a class work and home works and further reading assignment,
   - Give them feedbacks to their class work and home work activities.
   - Support students who failed to answer the checklist questions
7. **Assessment and follow up**

   You can assess your students by asking them the following questions
   - What are cells?
   - What are the parts of cells?
   - What are the common features of animal and plant cells?
   - What is the shape of plant cells?
   - What is the shape of animal cells?
   - What is the reason that animal cells look irregular in their shapes under the microscope?

- What are the unique structural parts of plant cells?
- Are cells of plants varying in shape?
- Are cells in our body varying?
- Why do cells vary in function?

ANSWERS FOR ACTIVITIES AND EXERCISES

Activity4.1

1. Bacteria, viruses, protozoa, yeast and etc.

2. By using microscope

Activity 4.2

1. Objective lens and eyepiece lens,

2. The total magnification of an object is calculated by multiplying the magnification of the objective lens by the magnification of the ocular lens.

Activity 4.3

Total magnification power of microscope is = magnification power of eyepiece lens X Particular objective lens used

10 X 40=400X

Exercise 4.1

1. B 2.B 3.A 4.A 5.C 6.A 7. B 8. C

Exercise 4.2

1. D 2. A 3. C 4. D

1. Similarity:

- They both contain membrane-bound organelles such as the nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, and peroxisomes.
- Both also contain similar membranes, cytosol, and cytoskeletal elements.

Differences

- Animal cells are mostly round and irregular in shape while plant cells have fixed rectangular shapes.
- Plant ell contains cell wall, chloroplast, large central vacuole (In plant cells, the function of vacuoles is to store water and maintain turgidity of the cell. Vacuoles in animal cells store water, ions and waste)
- All animal cells have centrioles whereas only some lower plant forms have centrioles in their cells (e.g. the male gametes of charophytes, bryophytes, seedless vascular plants, cycads, and ginkgo).

2. cell membrane ,cytoplasm, DNA and ribosomes

Answer for the experiment questions

1.Methylen blue

2. Because the air bubbles distort the formation of clear image.

3. It stains particular parts of the cell to be clearly observed.

Answer for exercise 4.3

1. Cell shape and size determines their function they perform.

2. A. Long and fibrous to conduct nerve impulse

   B. has tail to swim towards the egg cell

   C. have irregular shape to capture antigen

Activity 4.6

1. Animals can move plats cannot move

   Plants can make their own food animals cannot

2. Because of differences in their cellular structure.

Answer for exercise 4.4

1. Similarity:

They both contain membrane-bound organelles such as the nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, and peroxisomes.

Both also contain similar membranes, cytosol, and cytoskeletal elements.

Differences

Animal cells are mostly round and irregular in shape while plant cells have fixed rectangular shapes.

Plant ell contains cell wall, chloroplast, large central vacuole (In plant cells, the function of vacuoles is to store water and maintain turgidity of the cell. Vacuoles in animal cells store water, ions and waste)

All animal cells have centrioles whereas only some lower plant forms have centrioles in their cells (e.g. the male gametes of charophytes, bryophytes, seedless vascular plants, cycads, and ginkgo).

2. cell membrane ,cytoplasm, DNA and ribosome

Answer for exercise 4.4

1. C

2. C

Answer for exercise 4.5

1. C

2. B

3. C

Answer for exercise 4.6

1. Aerobic

2. Ethanol, CO_2, ATP

3. Cytoplasm

4. ATP

Activity 4.7

1. By means of cellular respiration
2. To carry out aerobic respiration

Answer for exercise 4.7

1. Photosynthesis takes place in the chloroplast and respiration in mitochondria.

2. Carbon dioxide + Water $\xrightarrow[\text{chlorophyll}]{\text{light}}$ Glucose (sugar) + Oxygen

Glucose + Oxygen $\rightarrow$ Carbon dioxide + Water + Energy

3. Aerobic respiration uses oxygen while anaerobic does not.
Aerobic respiration produces much energy than an aerobic.
Aerobic respiration takes place in mitochondria while an aerobic respiration in the cytoplasm,

Review Exercise

Instruction

i. 1.B 2.D 3.A 4.A 5.A 6.B 7.D 8.D 9.D 10.A

ii. 1.B 2.C 3.G 4.E 5.F 6.A 7.D

iii.

1. Microscope

2. Magnification

3. Lower power objective, middle power objective, high power objectives, oil immersion lenses

4. Mounting

iv.

1. It doesn't show any characteristics of life i'e functional and structural

2. Multiplying the magnification of the objective lens by the magnification of the ocular lens.

3. Organism, organ system, organ, tissue, cell organelle, molecules atom

4. Magnification is increasing the size of an object to be viewed whereas; Resolution is ability of the microscope to show the detailed or the scattered part of an object. It helps us to distinguish between two separate points.

Unit 5 Living things and their diversity

i. Time allotted to the unit: 23 period

ii. Unit over view

This unit will be organized by two sub units, the first introduce students to Characteristics of living things, classification and scientific names of organisms, hierarchy in the classification of organisms and the seconds sub units deals about kingdoms of life presenting the five kingdom of life, with their major characteristics and groups of each kingdom.

So that students should achieve the learning outcomes by implementing the desired contents and learning strategies.

iii. Learning Outcomes:

At the end of this unit, students will able to:

- distinguish between living and non-living things by describing the features that characterize living organisms;
- discuss if movement i.e. locomotion can characterize all living things or not ;
- define classification and its purpose ;
- explain the purpose of scientific name;
- list down the hierarchical levels in the classification of organisms;
- describe the distinguishing characteristics of kingdom Animalia, Plantae, Protista, Monera and Fungi;
- list common examples of animals, Plantae, Protista, Monera and Fungi;
- describe the body plan of a common animals, Plantae, Protista, Monera and Fungi;
- describe habitats of animals, Plantae, Protista, Monera and Fungi.

iv. Planning for the unit

As you are going to teach the students the, diversity of life and classification like animals, plants, microorganisms, like bacteria algae, fungi you need to organize materials, identify models, collect samples ahead of time to facilitates the learning process. Additionally group and orient the students to collect the different typical representative of each kingdom before the lesson will be delivered. Hence it is advisable to organize the essential material used during specimen collection.

i. **Suggested teaching methods**

- Discussion
- Experiment
- Demonstration
- Explanation
- Questioning and answering
- Individual work based on the activities.
- Group work based the activities given

ii. **Teaching Aids**

- ❖ As teaching resources use prepared diagrams or photos and charts for same organisms that grouped under each kingdom of classification
- ❖ Use the collected specimens of organisms from the school environments
- ❖ Use models of same organisms from the schools pedagogical center.

Main contents and period allotted for unit five

5.1. Living Things

1. Sub units over view

The students will start the unit by differentiate between living and non-living things by Organize and describe what the characteristics of life and living things are. Then after listing some of living organisms from their surrounding they

realize diversity of life and need for classification. Then after they will define classification and understand ways scientific naming of organism. Finally they will justify the importance of scientific name or binomial nomenclature; and know classification is not random but hierarchical nature based on evolutionary relationship.

2. **Proposed number of periods = 9 periods**
3. **Competencies**

At the end of this lesson students should be able to;

- ❖ Differentiate between living and non-living things
- ❖ Organize and describe characteristics of living things
- ❖ Justify why movement or locomotion from one place to another cannot be a defining characteristic of all organisms
- ❖ Relate diversity with classification of organisms
- ❖ Justify why scientific names of organisms should be used in science than the local names
- ❖ Analyze and describe the relationships of the hierarchical levels (Kingdom to Species) in the classification of organisms

4. **Forward planning**

Recommend students to read about the topic before coming to lesson**.**

Cheek and organize the essential materials like short notes, charts diagrams.

5. **Suggested teaching methods**

- ➢ Brief lecture
- ➢ Question and answers
- ➢ Brainstorming listing names of as many living organisms as possible. Group discussion and presentation hierarchy of classification
- ➢ Class activity on making or creating mnemonic on hierarchical steps of classification
- ➢ Assignments

6. **Teaching Aids**

   Diagram, illustration charts

7. **Facilitating the learning process**

   Begin the lesson brainstorming students on the diversity of life encourages students to name as many possible organisms in the surroundings to realizes the diversity, group them to discuss on the characteristic of life and monitory students involvements and record results students presentation. Provide constructive comments on the gaps observed.

   Record the results of the student's presentations on the relationships of the administrative structures and encourages correlating with biological levels of classification. Let the students do activity 5.4 creating mnemonic so they develop simple methods of memorization so in order to achieve, you should assist them and show the ways.

8. **Stabilization**

   - Summarize the lessons by reviewing on the key points of the sub unity.
   - Give them different work sheet that enhancing students understanding.
   - Ask them to do questions from exercise as a class work and home works and further reading assignment.
   - Give them feedbacks to their class work and home work activities.
   - Support students who failed to answer the checklist questions

9. **Assessment and follow up**

   You can assess your students by asking them the following questions

   What is the need classification?

   Why scientific name is advantageous over the local names.

   Who discovers the scientific naming of organism?

   Ask them to writes the correct scientific names of some organisms and human being containing all levels of hierarchy from general to specific

   Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

5.2. Kingdoms of Life

1. **Sub units over view**
2. **Proposed number of periods = 14 periods**
3. **Competencies**

At the end of this lesson students should be able to;

- ❖ Compare the five Kingdoms of living things by describing their distinguishing characteristics
- ❖ Summarize the commonest examples of organisms belonging to each Kingdom
- ❖ Describe the body plans of insects such as butterfly, amphibians such as frogs, mosses, liverworts, ferns, conifers such as junipers, flowering plants, Paramecium, Algae, and Mushroom
- ❖ Relate each Kingdom of organisms to their major habitat types as aquatic, terrestrial or moist.

4. **Forward planning**

This section deals about main kingdoms of the living organism and some of their divisions. There are a number of different activities/ field work proposed, which all involve students examining examples of the kingdom/phylum they are studying. In many cases you will be able to collect living specimens locally. The following are activities you are expected to carry out before starting to deal with the sub-unit. Check for moss, fern, gymnosperms and flowering plants in your school compound.

Each description of a kingdom/phylum is accompanied by a photo or drawing of examples of the organisms involved. If you do not have living, dead or preserved specimens available for your students, these images can be used to help you point out some of the features by which the organisms are classified.

5. **Suggested teaching methods**

Lecture

Brain storming

Group discussion about the classification system, familiar with the terms

kingdom, phylum, class, order, family genus, and species

Experiment investigation: students perform activity 5.14 the hay infusion experiments to observe the typical examples of protozoan.

Demonstration: student identifies and demonstrates the body plan or structures of organism they collected.

Field work: Students carry out activity 5.8upto 5.16 take students out to collect organisms. If possible, students bring in organisms to identify.

Practical activity; students make their mnemonic on hierarchy of classification

Assignments further reading and written assignment should be given on each topic

6. **Teaching Aids**

   Diagram, descriptive charts, model, photograph, microscope magnifying lens, collected specimens of the actual body of organism

7. **Facilitating the learning process**

   Introduce the topic by brainstorming students on the multitude diversity of living things on the planet Earth; Observe students while they are discussing about classifying organisms from the provided charts and make sure that all students are engaged in the group discussion and activities. Provide constructive comments on the gaps observed in the students 'presentation. Present and discuss the five kingdoms of classification and the students to differentiate among the five Kingdoms of living things by describing their distinguishing characteristics. Then students perform activity 5.6and 5.7

   Justify the criteria they used to classify.

   Then after present major characteristics and groups of the kingdoms animal, plant, Protista, monera, fungi, will be delivered respectively. Each sub section will be supported by different activities to make the teaching learning practical and tangibles so that the teacher encourages, supervise and guide the students in all of the suggested practical activities; make sure active participation of each student.

8. **Stabilization**
   - Summarize the lessons by giving them short notes and reviewing on the key points of the sub unity.
   - Give them different work sheet and assignments that enhancing students understanding.
   - Ask them to do questions from exercise as a class work and home works and further reading assignment.
   - Give them feedbacks to their class work and home work activities
9. **Assessment and follow up**

You can assess your students by asking them the following questions:

- What are the characteristics of life
- Why classification is important
- What is the difference between natural and artificial classification system?
- What is the use Classification hierarchy
- What are the distinctive/major characteristics of kingdom animalia, plantae monera, Protista and fungi?
- What are the major groups of kingdom animalia, plantia, monera, Protista and fungi?
- What is the difference of vascular and non-vascular plant
- List typical examples of vertebrates and invertebrates and bryophytes, pteridiophytes, gymnosperms and angiosperms etc.

Answers for activities and exercises

Activity 5.1 (1) an individual living thing, such as an animal or a plant, is called an organism. The term 'living organism' is usually used to describe something which displays all the characteristics of living things**.** There are seven activities which make organisms different from on-living things. These are the seven characteristics of living organisms: Movements, respiration, sensitivity, growth, reproduction and excretion.

Activity 5.2 These administrative structure are arranged hierarchically from general to specific that mean Country, Region, Zone, Wereda and they are also integrated an d co- related. Similarly the hierarchy in classification of organism are inter related/ integrated each other by certain common ancestor or relationship rather randomly.

Activity 5.3 A way to remember it is "King Philip came over for Good Spaghetti" By learning this mnemonic you are going to remember the sequence in the classification system:

•Kingdom - King

•Phylum - Philip

•Class - Come

•Order - Over

•Family - From

•Genus - Good

•Species – Spaghetti.

Activity: 5. 4 the answer incudes various organism from the smallest living or microorganism to the very complex human being**.**

Activity: 5. 5 students may include the following criteria to classify structural or anatomical similarity, plant and animals, microscopic creature, movement activity, habitat natures, edible and non-edible etc.

Activity: 5. 6: students know the five kingdom classification system and try to re -classify the organisms based structural similarities. This means that organisms that share similar features are placed in one group.

These organisms are classified in to the following kingdom.

1.Kingdom animalia;- tiger, lizared ,fish, crocodile, human,insects, birds,

2.Kinkdom plantae;- flowering plants, fern, gymnosperms

3.Kinkdom fungi;- mould, yeast, mushroom

4.Kingdom protistae;-paramicium, depending on their general characterstics.

Activity: 5.7: Collecting and examining insects (arthropods)

Material you require: suitable containers, nets, hand lenses and, alcohol solution (70 or 90%)

Procedure: You may need to use nets to catch some of the organisms. Take care handling any organisms which may sting or bite. Keep different types of specimen you collected (butterfly, grasshopper, spider, Bees, mosquitoes) in appropriate container and examine

1. They may need to use nets to catch some of the organisms. Take care handling any organisms which may sting or bite, or may carry disease.

2. Ask students what features their specimens have in common.

3. Ask them to examine their characteristic features, i.e. number of limbs, presence and number of antennae and number of body parts, presence and number of wings.

4. They should then make a table of characteristic features like in the following tables

5. They should make large well-labeled drawings of each of their specimens.

Characteristic features of arthropods (insects)

Specimen	Number of body parts	Number of limbs	Antenna	wings
Butterfly				
Grasshopper				
Spider				
Bees				
houseflies,				

B. collecting and examining Platyhelminthes (flatworms)

Material you require: preserved or fresh specimens of Platyhelminthes (flat worm) hand lenses.

Ask students to observe, draw and label specimens of these invertebrate phyla.

Activity: 5.8 Collecting and examining amphibian (frog)

Material you require: transparent container or /cage/, pairs of forceps, pairs of gloves.

Procedure: collect live or freshly killed toads or frogs and keep in transparent container or cage 1. Ask students to examine the head and trunk regions of the toad. They should note and identify the following characteristic features:

• Mouth – has a wide gape. With the help of forceps, they can open the mouth and note the long sticky tongue which is used to capture insects, and homodont teeth, i.e. same-sized teeth (dead specimen only).

• Nostrils – two small holes situated above the mouth to enable breathing while partly submerged in water.

• Eyes – large and bulging; they can move the eyelids with their forceps – are both eyelids movable and opaque?

• Ears – are dark, round patches behind the eyes; there is no external ear.

• Trunk – in toad note the dark, rough and dry skin on the dorsal side and lighter and less rough skin on the ventral side of the trunk; in frog smooth moist skin.

• Limbs – these are found on the trunk; note that the hind limbs are longer and thicker than the forelimbs. The hind limbs are used for leaping while the short stout forelimbs help to absorb the shock on landing. The webbed digits give additional thrust during swimming. Which of these limbs are webbed?

• Does their toad/frog have a tail?

Ask students make a large well-labelled drawing of the toad/frog as seen from the slide

Activity: 5. 9 Collecting and looking at mosses

Material you require: microscopes, hand lenses, scalpel blades, forceps, microscope slides and cover slips.

Procedures

1. In groups, students should search around the school for moss plants around damp walls, rocks, tree barks or damp verandas. They should then carry their collected specimen into the laboratory for detailed study.

2. Ask them, with the help of a hand lens, to examine the specimen carefully and identify the parts.

3. They should draw and label their specimen.

Activity: 5. 10 Collecting and examining a fern

Material you require: common ferns, hand lenses, scalpels, clean slides, cover slips, and microscopes.

Procedure:

1. In groups, students should search for a fern along rivers/stream banks, shady areas beneath trees and along fences.

2. They should examine their specimens and identify as many structures as they can.

Then ask students to:

3. Draw and label their specimen.

4. Observe the lower surface of the leaves (fronds).

5. Draw the lower surface of the specimen showing the arrangement of the spore-forming bodies if there are any there.

Activity: 5. 11 (A) Collecting and examining conifers

Material you require: saw, container, conifer leaves and cones.

Procedure: In groups, you should search and collect a conifer tree in you school compound.

Ask students to:

1. Obtain some conifer leaves and cones.

2. Observe them carefully.

3. Make large well-libeled drawings of the leaves of conifer.

4. Examine some conifer cones. Note the seeds attached to the cone. Carefully remove one seed from the cone of conifer and draw it.

(B) Collecting and examining angiosperm

Material you require: bean plants with flowers and bean seed, maize plants with flowers and maize grain (or teff plants), hand lenses.

Procedure: Make a collection of flowering plants around your school. Identify them and then classify them according to whether they are monocotyledons or dicotyledons.

Ask students to:

1. Obtain a bean plant and a maize plant.

2. Compare their roots, stems, leaves, flowers and seeds.

3. Make a table of differences between the bean plant and the maize plant.

4. Draw well-labelled diagrams of the bean plant and the maize plant.

Activity 5.12

Ask students to develop a table that simplifies and summarizes the kingdoms from mosses to flowering plants as follows. They should copy the example shown here and fill it in.

Division	Characteristics	Examples
Bryophyta		
Pteridophyta		
Gymnosperm		
Angiosperm		

Activity: 5. 13 Making hay infusion and observing protozoan (paramecium)

Materials: A hand full of hay, a large beaker, pond water, some milk

Method:

1. Take a hand full of dried grass or hay (free from pesticides or herbicides) and cut the grass into smaller pieces
2. Place the cut grass into the beaker and about 0.5-1 liter of water.
3. Add 1-2 drops of milk. The water will turn slightly turbid. The milk is food for the bacteria and they will start to reproduce. The ciliates feed on the bacteria and will also reproduce.
4. Let the beaker stand open for several days, protected from direct sunlight as this may result in overheating and the heat will reduce the oxygen concentration. Do make sure that the beaker receives sufficient light, though. Photosynthetic algae present in the pond water will produce oxygen.
5. Keep adding 1-2 drops of milk when the turbidity disappears. Bubble some air through the water at regular intervals (using an air-pump from an aquarium) or agitate the water a bit to enrich it with oxygen.
6. Replace the evaporated water.

7. Take some sample from the surface of the water (where there is oxygen) for microscopic investigation. If the water is agitated, then the microorganisms are (of course) not able to collect beneath the water surface.

8. Observe paramecium using microscope and draw the structure.

Activity: 5.14 Collecting and looking at fungi

Material you require:

Procedures: search around the school for mushroom in the school compound or If necessary they can grow their own fungi (mould) on a little damp injera or by letting a piece of fruit go rotten.

Ask students to look at the structures of fungi (fruiting body or mycelium) and draw several different types of fungus.

ANSWER FOR EXERSICES

EXERCISE: 5.1

1. Characteristics of living things

There are seven activities which make organisms different from non-living things. These are the seven characteristics of living organisms.

1. Nutrition

Living things take in materials from their surroundings that they use for growth or to provide energy. Nutrition is the process by which organisms obtain energy and raw materials from nutrients such as proteins, carbohydrates and fats.

2. Respiration

Respiration is the release of energy from food substances in all living cells. Living things break down food within their cells to release energy for carrying out the following processes.

3. Movement

All living things move. It is very obvious that a leopard moves but what about the thorn tree it sits in? Plants too move in various different ways. The movement may be so slow that it is very difficult to see.

4. Excretion

All living things excrete. As a result of the many chemical reactions occurring in cells, they have to get rid of waste products which might poison the cells. Excretion is defined as the removal of toxic materials, the waste products of metabolism and substances in excess from the body of an organism.

5. Growth

Growth is seen in all living things. It involves using food to produce new cells. The permanent increase in cell number and size is called growth.

6. Reproduction

All living organisms have the ability to produce offspring.

7. Sensitivity

All living things are able to sense and respond to stimuli around them such as light, temperature, water, gravity and chemical substances**.**

2. Because certain organisms are not move place to place. Examples plant cannot move from one place to another (not Cause change in position/place) but they can move by their body parts

EXERCISE5.2

1. Scientific names are universal because, for instance, every biologist will understand that *Felis catus* means 'house cat' without resorting to the dictionary, no matter what language they speak.
2. The smallest natural group of organisms is the species. A species can be defined as a group of organisms that can reproduce to produce fertile offspring.

EXERCISE.5.3

kingdom	animalia	all animals, same as zebra
phylum	chordata	all animals with a backbone
class	mammalian	animals with abackbone, which have have hair
order	primate	mammals with hands and feet
family	hominidae	apes, primitive humans and modern humans
genus	homo	primitive humans and modern humans only
species	sapiens	modern humans only
scientific name	homo sapiens	

EXERCISE 5.4

I. 1.B 2.B 3.A 4.D 5.C

II. A. Organisms E. Growth

B. Respiration F. Reproduction

C. Movements G. Excretion

D. Nutrition H. Sensitivity / irritability

EXERCISE: 5.5

i. Choose the correct answer 1.D 2.C

ii.Give short answer

3.Mammal;- produce living young, female have mammary gland to produce milk and have for types of teeth,

Birds ;- feather with scale, live in water and on land.

EXERCISE: 5.6

1. Bryophytes are non-vascular plants that lack true leaves, stem, and roots whereas pteridophytes are vascular plant have well-developed xylem and phloem that can help them to transport water and nutrients fluids through their body, like mosses they reproduce by spore.

2. Play an important role in minimizing erosion along bodies of water, carrying out water and nutrient cycling and also produces oxygen to the atmosphere.

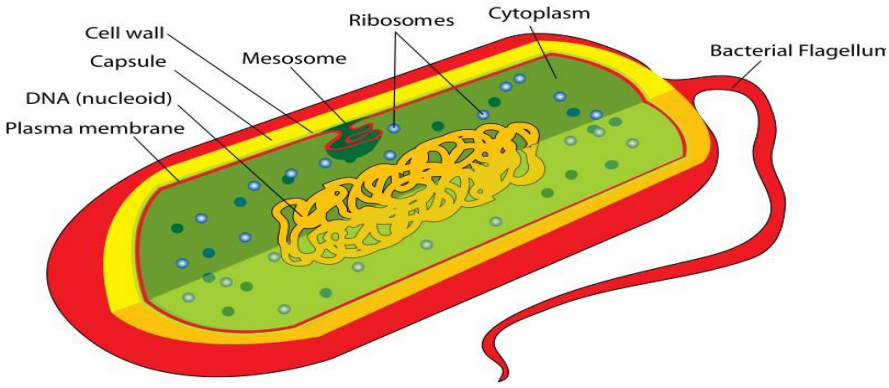
EXERCISE: 5.7 1.D 2.A 3.C 4.D 5.C

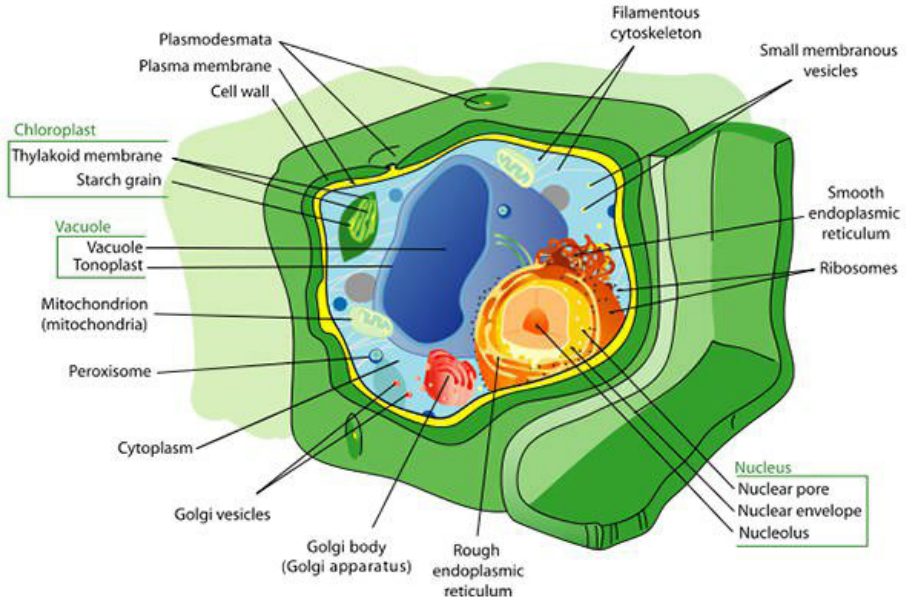
EXERCISE: 5.8

1.A **prokaryotic cell** is a simple, single-celled (unicellular) organism that lacks a nucleus, or any other membrane-bound organelle.

A **eukaryotic cell** is a cell that has a membrane-bound nucleus and other membrane-bound compartments or sacs, called **organelles**, which have specialized functions. The word eukaryotic means "true kernel" or "true nucleus," alluding to the presence of the membrane-bound nucleus in these cells. The word "organelle" means "little organ," and, as already mentioned, organelles have specialized cellular functions, just as the organs of your body have specialized functions.2. **Table: Differences between prokaryotes and eukaryotes.**

Prokaryotes	**Eukaryotes**
Small cells	Large cells
Unicellular	Often (but not always) multicellular
Genetic material is not contained within a nucleus	Genetic material is contained in a membrane-bound nucleus
Cells have a simple membrane internal system but no organelles Example: no chloroplast, no mitochondria	Cells have a distinct membrane system with organelles Examples: Chloroplast, mitochondria, golgi bodies





Typical structures of prokaryotic and eukaryotic cell

Answer for Review Exercise

I. **1.**False 6.true

2. True 7.False

3. False 8.False

4. True 9.False

5. True

II. 1. B 2.A 3.D 4.C 5.E

III.

1. Binomial naming
2. Species
3. Homo sapiens
4. Binary fission
5. Kingdom

IV. 1.C 2.B 3.B 4.A 5.C 6.C 7.D 8.C 9.B 10.D 11.B 12.D

V. 1. Classification hierarchy has many uses. First, it helps scientists to sort organisms in order. Second, it helps them to identify new organisms by finding out which group they fit. Third, it is easier to study organisms when they are sorted in groups.

2. The classification scheme provides a mechanism for bringing together various species into progressively larger groups. Taxonomists classify two species together in the same **genus** (the plural is *genera*). For example, the horse *Equus caballus* and the donkey *Equus assinus* are both placed in the genus *Equus.* Similar genera are brought together to form a **family.** Similar families are classified within an **order.** Orders with similar characteristics are grouped in a **class.** Related classes

are grouped together as **divisions** or **phyla** (the singular is *phylum*). Divisions are used for plants and fungi, while phyla are used for animals and animal-like organisms. The largest and broadest category used to be the **kingdom.**

3. The kingdom, **Animalia,** includes animals. Animals without backbones (invertebrates) and with backbones (vertebrates) are included here. The cells are eukaryotic; the organisms are heterotrophic. All animals are multicellular, and none has cell walls. In the kingdom Animalia, biologists classify such organisms as sponges, hydras, worms, insects, starfish, reptiles, amphibians, birds, and mammals. The feeding form is one in which large molecules from the external environment are consumed and then broken down to usable parts in the animal body.

The kingdom **Fungi** includes the yeasts, molds, mildews, mushrooms, and other similar organisms. The cells of this kingdom are eukaryotic and heterotrophic. Yeasts are unicellular, whereas other species form long chains of cells and are called *filamentous* fungi. A cell wall strengthened by chitin is found in most members. Food is taken in by the absorption of small molecules from the external environment; thus, fungi are deemed absorptive heterotrophs.

4. The protists include protozoa, algae, and slime molds. The cells of these organisms are eukaryotic. They can be either unicellular or multicellular, and they may be autotrophic or heterotrophic. Eukaryotic organisms have a nucleus and membrane-bound organelles in their cytoplasm, possess multiple chromosomes, have large ribosomes, and reproduce by mitosis.

All plant cells are eukaryotic and autotrophic. The organisms synthesize their own foods by photosynthesis, and their cell walls contain cellulose. All the organisms are multicellular. Classified here are the mosses, ferns, and seed-producing and flowering plants.

5 .

Kingdom				
Animalia	**Plantia**	**Fungi**	**Monera**	**Protista**
Lizard	Papaya	mushroom	bacteria	amoeba
Rat	Sunflower	Yeast	blue green algae	paramecium
pigeon	Maize	Mold		euglena
spider	Pae			plasmodium
termites	Sorghum			trypanosomes

ADITIONAL NOTES ON CERTAIN TOPICS

How Cells Are Studied

A cell is the smallest unit of life. Most cells are so small that they cannot be viewed with the naked eye. Therefore, scientists must use microscopes to study cells. Electron microscopes provide higher magnification, higher resolution, and more detail than light microscopes. The unified cell theory states that all organisms are composed of one or more cells, the cell is the basic unit of life, and new cells arise from existing cells.

Comparing Prokaryotic and Eukaryotic Cells

Prokaryotes are predominantly single-celled organisms of the domains Bacteria and Archaea. All prokaryotes have plasma membranes, cytoplasm, ribosomes, a cell wall, DNA, and lack membrane-bound organelles. May also have polysaccharide capsules. Prokaryotic cells range in diameter from 0.1–5.0 μm.

Like a prokaryotic cell, a eukaryotic cell has a plasma membrane, cytoplasm, and ribosomes, but a eukaryotic cell is typically larger than a prokaryotic cell, has a true nucleus (meaning its DNA is surrounded by a membrane), and has other membrane-bound organelles that allow for compartmentalization of functions. Eukaryotic cells tend to be 10 to 100 times the size of prokaryotic cells.

The plasma membrane is a phospholipid bilayer embedded with proteins. The nucleolus within the nucleus is the site for ribosome assembly. Ribosomes are found in the cytoplasm or are attached to the cytoplasmic side of the

plasma membrane or endoplasmic reticulum. They perform protein synthesis. Mitochondria perform cellular respiration and produce ATP. Peroxisomes break down fatty acids, amino acids, and some toxins. Vesicles and vacuoles are storage and transport compartments. In plant cells, vacuoles also help break down macromolecules.

Animal cells also have a centrosome and lysosomes. The centrosome has two bodies, the centrioles, with an unknown role in cell division. Lysosomes are the digestive organelles of animal cells.

Plant cells have a cell wall, chloroplasts, and a central vacuole. The plant cell wall, whose primary component is cellulose, protects the cell, provides structural support, and gives shape to the cell. Photosynthesis takes place in chloroplasts. The central vacuole expands, enlarging the cell without the need to produce more cytoplasm.

The endomembrane system includes the nuclear envelope, the endoplasmic reticulum, Golgi apparatus, lysosomes, vesicles, as well as the plasma membrane. These cellular components work together to modify, package, tag, and transport membrane lipids and proteins.

The cytoskeleton has three different types of protein elements. Microfilaments provide rigidity and shape to the cell, and facilitate cellular movements. Intermediate filaments bear tension and anchor the nucleus and other organelles in place.

Microtubules help the cell resist compression, serve as tracks for motor proteins that move vesicles through the cell, and pull replicated chromosomes to opposite ends of a dividing cell. They are also the structural elements of centrioles, flagella, and cilia.

Animal cells communicate through their extracellular matrices and are connected to each other by tight junctions, desmosomes, and gap junctions. Plant cells are connected and communicate with each other by plasmodesmata.

Additional notes on certain topic of chapter five

History of classification

Aristotle (384-322 BC) was a 4th century Greek philosopher. He divided organisms into two main groups, namely plants and animals. His system was used into the 1600's. People who wrote about animals and plants either used their common names in various languages or adopted more-or-less standardized descriptions.

Caspar Bauhin (1560–1624) took some important steps towards the binomial system currently used by modifying many of the Latin descriptions to two words.

Carolus Linnaeus (Carl Von Linne) (1707–1778) was an 18th century Swedish botanist and physician. He classified plants and animals according to similarities in form and divided living things into two main kingdoms namely — plant and animal kingdoms. He named the plants and animals in Latin or used latinised names in his books *Species Plantarum* (1753) and *Systema Naturae* (1758). The two-kingdom classification system devised by Linnaeus is not used today. As scientists discovered more and more about different organisms, they expanded the system to include many more kingdoms and groupings. However, one of Linnaeus more enduring systems was the system of naming organisms- called **binomial nomenclature**. We will learn more about binomial nomenclature in the next section.

Figure 9.3: Carl Linnaeus developed a more advanced classification scheme and the system of naming organisms called binomial nomenclature.

Ernst Haeckel (1834-1919) was able to observe microscopic single-celled organisms and he proposed a third kingdom of life, the Protista, in 1866. Protista were single celled organisms that were neither plant nor animal, but could have characteristics of either

Herbert Faulkner Copeland (1902–1968) recognised the important difference between the single-celled eukaryotes and single-celled prokaryotes. He proposed a four-kingdom classification, and placed the bacteria and blue-green algae (prokaryotes) in a fourth kingdom- Monera.

Binomial Nomenclature

Robert Harding Whittaker (1920-1980) devised a five kingdom system in 1969. He recognised that fungi belonged to their own kingdom. However, even today the five-kingdom system is under dispute. It is the nature of science that as more discoveries come to light, theories will continue to be improved upon and revised.

One of Linnaeus' greatest contributions was that he designed a scientific system of naming organisms called **binomial nomenclature** (bi - 'two', nomial - 'names'). He gave each organism a two part scientific name - **genus** (plural - 'genera') and **species** (plural - 'species') names. The genus and species names would be similar to your first name and surname. **Genus name** is always written with a capital letter whereas **species name** is written with a small letter. The scientific name must always be either written underlined or printed in italics. Since Latin was once the universal language of science among western scholars in medieval Europe, these names were typically in Latin.

An organism will always have only one scientific name even though they might have more than one common name. For example Blue crane, indwe (for amaXhosa) and mogolori (for Batswana) are all common names for South Africa's national bird (shown below). However, it has got only one scientific name which is *Anthropoides paradiseus*.

Classification

This section introduces learners to the concept of taxonomy, which is the classification of living organisms. The activity below allows learners to practice classification.The practice of classifying organisms is referred to as **taxonomy**. Classification is usually a hierarchical process. One begins with general and broad differences, and then one systematically introduces more and more detailed and specific criteria.

Artificial classification systems, such as the grouping of vehicles into those that provide transport on land, water or air, are based on arbitrary groupings and have little meaning. The biological classification system, however, is based on research in anatomy, physiology, chemistry, genetics and many other branches of science. It is a scientific method of classification that groups organisms that share common features.

This classification is not random, but rather it describes evolutionary relationships. As a consequence, it is always necessarily hierarchical, where the important features inherited from a common ancestor determine the group in which the organisms are placed. For example, humans and whales both feed their young on milk, which is a characteristic inherited from a common ancestor. This similarity places them under the same class, **mammals**, even though their habitats are completely different.

Each organism is grouped into one of five large groups or **kingdoms**, which are subdivided into smaller groups called **phyla** (singular: phylum) and then smaller and smaller groups with other names.

- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

Unit 6 Earth in Space

Time allotted to the unit: 16 periods

Unit Overview

This Unit has three sections. The first Section 6.1(Shape and dimensions of earth), the second Section 6.2(Parts of the Earth (Body & Atmosphere)) and the last Section 6.3 (Movements of the Earth).

The first section of the unit is (6.1) deals with Shape & dimensions of the earth. It begins with definition of Earth science and definition of earth. It presents the Shape and dimensions of earth, local and global ideas about the shape of the Earth and their evidences.

Section 6.2 presents the Parts of the Earth (Body & Atmosphere). It includes detailed information about External structure (Outer zone) and internal Structure (Inner zone) of the earth.

The last section 6.3 presents the movements of the Earth. It covers revolution, rotation and the effects of motions of the Earth.

Please encourage your students to interact and give them time to grasp the topics. Also, be sure that they give full attention to the introductory activity in each section. This activity prepares them for the topic they are about to study. All sections include exercise and activities that give your students many chances to practice what they learn.

The methodologies to be implemented for teaching the contents in this unit are gapped lecture, answer and question, group discussion, visual-based active learning, drawing a map (picture), brain storming and role- play. etc.

Unit Outcomes

After completing this unit, students will be able to:

- Describe the shape, dimensions and motionof the earth.
- Construct the model of earth and use it to explain phenomena related to its motion
- Describe the measuring techniques for too big (Earth) and to small (continental drift) quantities measurement and estimation

6.1 Shape and dimensions of the earth

Proposed number of periods: 6 periods

After completing this section, students should be able to:

-describe the shape of the Earth;

- dentify evidences supporting the shape of the Earth;

-list local and global ideas about the shape of the Earth;

-name dimensions (circumferences, diameters, and angular distances) of the earth'

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning, drawing a
- Map (picture), and role- play

Warm up

Ask the students if they know what Earth is?

What is the shape of the earth? Is it flat or round or sphere or other shape?

Forward planning

Read the contents in section 6.1 (shape and dimensions of earth) thoroughly from the students' text and from this teacher's guide make a plan of your own that shows the contents and activities you are going to deal with during each period.

Your plan needs to be designed in such a way that the whole contents of the section can be covered within 6 periods. In your plan indicates the duration of time you will allot for group discussion, presentation, in harmonizing concepts, gapped lecture, stabilization and other activities you will perform in each period. You also need to plan how to manage students during group discussion.

Teaching Aids

- Picture of the Earth.
- Practical model of the Earth

Subject Matter Presentation

It is advisable to use group discussion, question and answer and visual-based methodologies to deal with the contents in the lesson.

You are advised to begin the unit with the warm up questions. Based on the background of the students prepare a discussion on the shape of the earth. You may begin the lesson using the activity 6.1. First, allow students to discuss activity what they gather information about the shape of the earth from internet or other reference materials for a few minutes in groups. Guide to discuss the local assumptions about the shape of the earth. Then, each group writes common idea on a piece of paper about activity 6.1. Invite students from some groups to present the point of their discussion to the rest of the class. Following their presentation, harmonize concepts and after that harmonize concepts.

Project work 6.1 designed to contract or Build model of the earth including its body parts. Asking students to create models helps make their thinking visible, giving your insight into their current understanding and misconceptions and encourages them to think deeply and imaginatively about scientific ideas. Your assistance is important in constructing the model. After they construct the model of the earth they share and compare their models with their classmates. Based on their own experiences explain why they think their models are accurate. You share a spherical model of the earth to compare to their own models.

Before starting next section about dimensions of the earth, give an assignment for the students to read the topic and attempt activity 6.2. In the class, raise the questions which were asked in the activities, so that, students can share their understanding. (The teacher needs to ask more questions to make the class interactive and live.) While discussing on activity 6.2 make sure that students have got clear idea of dimension of the earth.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Answers to Exercise 6.1

Part I: Answer to multiple Choose questions

1. C. an oblate sphere
2. A. a Ping-Pong ball
3. B. spherical

Part II: Answer to fill the blank questions

1. equatorial bulge

   Latitude

Part III: Answer to Short answer questions

1. Circumnavigation of the earth, Earth's curved horizon, Ship's visibility, Sun rise and sun set, the lunar eclipse

   driving poles on level ground on a curved earth, Space photographs and the changing altitude of the sun.

2. The local assumptions about the shape of the earth were the early ancient Greeks, Sumerians, Babylonians, Egyptians and Vikings all believed that the Earth was a flat disc or plane surrounded by water

- The ancient Chinese believed that the Earth was a flat square shape surrounded by heavens that were a round egg shape.
- The local evidence for the shape of the earth are ships disappear hull first when they sail over the horizon, Earth casts a round shadow on the moon during a lunar eclipse, and different constellations are visible at different latitudes.

3

- ✓ Polar diameter – is shorter than equatorial diameter (12,714 km)
- ✓ Polar circumference – is shorter than equatorial circumference (40,008) km
- ✓ Equatorial diameter – is longer than polar diameter (12,756 km)
- ✓ Equatorial circumference – is longer than polar circumference (40,075 km)

6.2 Parts of the Earth (Body & Atmosphere)

Proposed number of periods: 5 periods

After completing this section, students should be able to:

- recognize all parts of the Earth;
- describe the organization and contents of the different parts of the Earth;
- explain different observations about the Earth in terms of the nature and behaviors of the different parts of the Earth.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning, drawing a
- Map (picture), and role- play

Warm up

Ask the students if they know what structure of the earth?

What are the internal and external structures of the earth?

Forward planning

Make the appropriate preparation on Parts of the Earth (Body & Atmosphere) by reading the contents in the students' text book. You also need to read the teacher's guide on this section to plan how to present the lesson you intend to deal with during each period and get detailed information about the suggested Activities and the methodologies you implement. Plan how to manage students during discussion, and also budget your time for every activity you perform. The time you allot for students to discuss activities, presentation after discussion, harmonizing concepts and other activities during each period should be indicated in detail.

Teaching Aids

- Models of the atmosphere.
- Practical model for layers of the Earth

Subject matter presentation

We advise to use group discussion, question and answer methodologies for this topic.

After introducing the topic of the section, start the lesson using Activity 6.3. The activity is designed to help students realize that the Parts of the Earth (Body & Atmosphere) and it clearly distinguishes External structure (Outer zone) and internal structure (Inner zone). Also the activity helps the students that *to identify the layers of the atmosphere, In which layer we live on and In which layer do planes fly in*. So, let the students discuss Activity 6.3 in groups for a few

minutes. After they complete the discussion, invite some groups to present their conclusions to the rest of the class. After the presentations, harmonize concepts suggested by students with the truth.

- Tell them the facts that the structure of the earth consists of External structure (Outer zone) and internal structure (Inner zone). External structure of the earth consists of layers such as Atmosphere. It composed by abiotic (non-living matter) and biotic (living organism).
- Help them understand that Characteristics of atmosphere categorized into two groups

A. According to its composition: atmosphere of Earth is composed of nitrogen (about 78%), oxygen (about 21%), argon (0.009%) and carbon dioxide (0.03%) and other gases include neon, helium, Krypton, xenon.

B. According to its vertical structure from the ground level into interplanetary space: Earth's atmosphere has five major and several secondary layers according to contrasting temperature conditions in it with Altitude.

After harmonizing concepts, you can continue teaching the lesson by asking students to state the five major layers according to contrasting temperature conditions in it with Altitude. After their responses, tell them what the layers are.

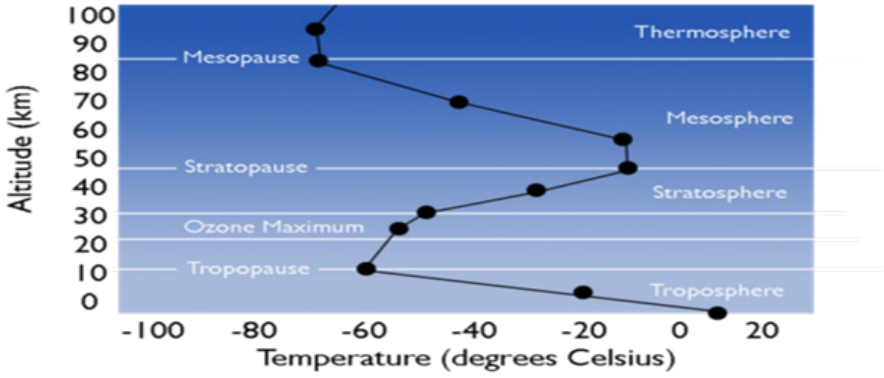
To proceed further, ask them what the orders of atmosphere from are lowest to highest in contrasting temperature conditions in it with Altitude. After appreciating the attempts of your students, give the appropriate answers to your questions.

Answers to exercise 6.2

Part I: Answer to fill the blank space questions

1. the mesopause

Temperature decreases with height throughout the mesosphere. The coldest temperatures in Earth's atmosphere, about -90° C (-130° F), are found near the top of this layer. The boundary between the mesosphere and the thermosphere above it is called the mesopause.



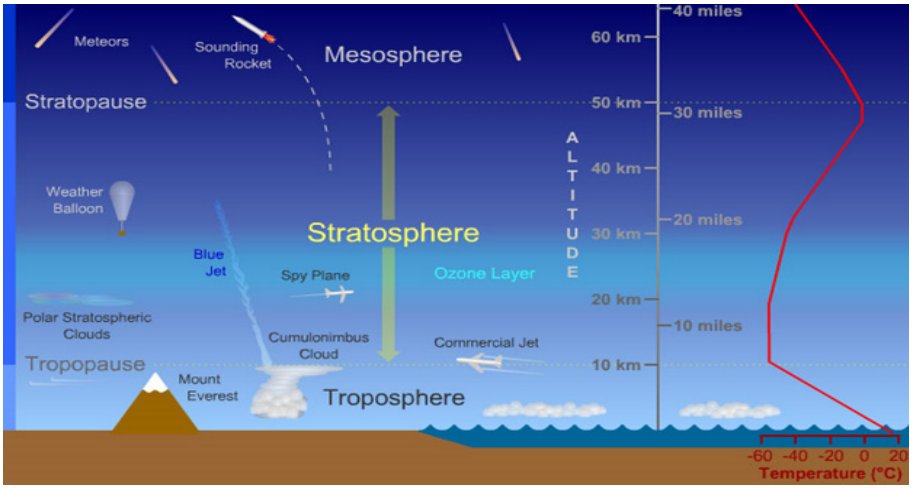
2. the stratopause

At the bottom of the mesosphere is the stratopause, the boundary between the mesosphere and the stratosphere below. The mesosphere is difficult to study, so less is known about this layer of the atmosphere than other layers.

3. the tropopause

The troposphere, the lowest layer, is right below the stratosphere. The lower boundary of the stratosphere is called the tropopause; the upper boundary is called the stratopause.

The lower boundary of the stratosphere is called the tropopause; the upper boundary is called the stratopause.



Part II: Answer to multiple Choose questions

1. C 2. A 3.C 4. B 5. B 6. D 7. D 8. B 9. B 10. C 11. D

Internal Structure of the earth (Inner zone)

It is advisable if you use group discussion, question and answer methodologies.

You better start the lesson using project work 6.2. Project work 6.2 is designed to help students to have a clear understanding about Internal Structure of the earth.

After they construct the model of Internal Structure of the earth they share and compare their models with their classmates. Based on their own experiences explain why they think their models are accurate. You share Internal Structure model of the earth to compare to their own models and then present their work. Following the presentations, harmonize concepts. Check their models and select the best one to use as a teaching aid. Tell them Internal Structure model of the earth have three major parts. These are

I. Core II. Mantle III. Crust

At the end of this section, introduce the difference between the three major parts of the earth. Let the students compare and contrast the properties of core, mantle and crust.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

Assess each student's work throughout section 6.2. You can use students' performance list to record how every student

- Participates in discussing Activities.
- Takes part in presentations after discussions.
- Answers questions you ask during mini-lecture, harmonizing concepts or stabilization.
- Answers questions given as class work, homework and quiz accordingly after checking the work of every student. You can use Exercise, class work and home works.

Check whether or not the suggested competencies for section 6.2 are achieved by the students. Appreciate students working above the minimum requirement level and encourage them to continue to work hard. Give extra attention to students working below the minimum requirement level in class or arrange extra lesson time. Give them questions recommended to them from the additional questions in this section or others of your own so that they will catch up with the rest of the class.

6.3 Earth's movements

Proposed number of periods: 5 periods

After completing this section, students should be able to:

- demonstrate movements of the Earth (revolution and rotation);
- explain the effects of motions of the Earth;
- construct the model of Earth and use it to explain phenomena related to its motion.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning.
- Map (picture), and role- play

Forward planning

Make the necessary preparation by reading this section thoroughly and plan how to cover the contents of the section within five periods. Download videos that show the motion of the earth.

Teaching Aids

- Picture of the Earth.
- Practical model of the Earth and the sun
- Video that shows the motion of the earth

Subject matter presentation

Ask students to discuss Activity 6.4 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Invite your students to report their discussion motion of the earth (rotation and revolution). Ask them to explain the difference between rotation and revolution of the earth. Also do not forget to mention the evidences that prove that the Earth rotates. Explain what happen if the earth does not move. If the earth stops spinning suddenly, the atmosphere will continue to spin. The winds will also cause erosion to the earth's crust.

Mention the effects of the Earth rotation and revolution. The **spinning of the Earth causes day to turn in to night**, while the full rotation/the revolution of the Earth causes summer to become winter. Combined, the spinning and the revolution of the Earth causes our daily weather and global climate by affecting wind direction, temperature, ocean currents and precipitation.

Throughout the lessons assess students learning using exercise 6.3. Make sure that all students have attained the set minimum learning competencies in this section.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

Assess each student's work throughout the section.

Give class work or homework (you can use questions from the suggested exercise or your own). Correct the works of students and record their performances. Follow strictly how every student participates in discussion, presentation, and answering questions.

Correct the research done by the students and make a record in the students' performance list. From your record, see whether the competencies suggested for the section are achieved or not.

Answers to Exercise 6.3

Part I: Answer to fill the blank space questions

1. Revolves
2. rotating on its axis
3. Season changes due to the change in the position of the earth around the sun.
4. 366
5. In winter season

Part II: Answer to choose the best answer questions.

1.C 2. A 3.B 4. D 5.A

Part III: Answer for short answer Questions.

1. The spinning of the Earth around its axis is called 'rotation'. The axis has an angle of $23\frac{1}{2}^{0}$ and is perpendicular to the plane of Earth's orbit. This means the Earth is tilted on its axis, and because of this tilt, the northern and southern hemispheres lean in a direction away from the Sun While the movement of the Earth around the Sun in a fixed path is called a revolution. The Earth revolves from west to east, i.e., in the anticlockwise direction. The one revolution of the Earth around the Sun takes around one year or precisely $365\frac{1}{4}$ days.

2. The summer solstice is the longest day of the year and it occurs when the Earth's rotational axis is most inclined toward the sun. The winter solstice is the year's shortest day, occurring when the Earth's rotational axis is at its most inclined to the sun.

3. An equinox occurs when the position of the Sun is exactly over the Equator. When this happens, the hours of daylight and the hours of darkness are about equal almost everywhere on Earth. Equinoxes take place twice a year when day and night are of approximately equal length (about 22 September and 20 March).

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning, drawing a
- Map (picture), and role- play

Forward planning

Read the contents of this section thoroughly and plan how to cover the contents within six periods. Your plan may include the contents and activities you should treat during each period, the time to give activity 6.5 for students as an assignment. Also work out a plan on: how much time you need to allot for students to discuss activities, make presentations, harmonizing concepts, stabilization and evaluation during each period.

Teaching Aids

- Picture of the Earth cycle and systems.
- Practical model of the Earth

Subject matter presentation

This section is interesting because it deals about what makes us to live on Earth. It is better to use question and answer and discussion methods to teach this section.

You are advised to begin the class with the activity given in the student's text-book. The activity is designed to assist students know the Earth's systems and their effect. Help the students to form groups and let them discuss the activity. Next, invite a student to present the idea of his or her group to the class. Finally, organize a whole-class discussion. After the discussion, harmonize it by present-ing each factor that makes Earth suitable for life and the four main components of the earth system may be described briefly. In addition to what is given in the textbook, you can add your own and you can also ask students to contribute on the integration of the four components of the earth system for life.

Project work 6.3 is designed students to know Changes to **Earth's cycles can cause changes in the climates of our planet**. The more we know about these cycles, the more we will understand how humans are affecting them and how that might change the planet.

The spinning of the Earth causes day to turn to night, while the full rotation/ the revolution of the Earth causes summer to become winter. Combined, the spinning and the revolution of the Earth causes our daily weather and global climate by affecting wind direction, temperature, ocean currents and precipitation.

Assessment

Assess the students' work throughout the section. Record how each student is doing on your students' performance list. You may make a record of the students' participation in discussions, during explanations, in performing project works, in presentations, and in doing class and homework. From your records of what students have done; see how many of them achieved the suggested competencies for the section. Encourage students working above the minimum requirement level and give them additional work.

Assist students working below the minimum requirement level either by arranging extra lesson time or giving them additional activities.

Answers to Review Exercise

Part I: Answer to True/false Items

1. ***True 2. False 3. True 4.False***

Part II: Answer to matching Items

1. ***C 2. E 3. D 4. A 5. B***

Part III: Answer to fill the blank space question

Part a:

1. 24 hours	***2.*** Rotation	3. 365.25 days
4. Revolution	5. Axis	6. Season

Part b:

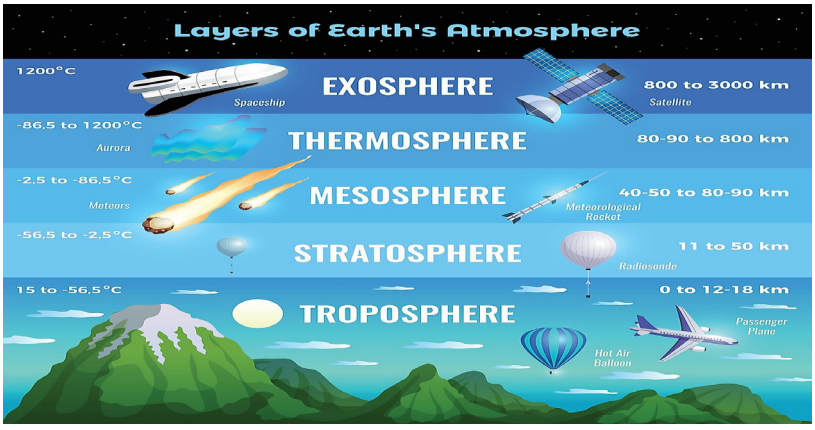
1. crust 2. mantle 3. outer core 4. inner core

Part IV: Answer to multiple choose questions

1. C	***5. B***	***9. B***	***13. D***
2. A	***6. C***	***10. B***	
3. C	***7. A***	***11. D***	
4. D	***8. C***	***12. A***	

Part V: Answer to short answer questions

1. Earth's atmosphere has five major and several secondary layers. From lowest to highest, the major layers are the **troposphere, stratosphere, mesosphere, thermosphere and exosphere**.



2. The earth is made up of three different layers: the crust, the mantle and the core

The crust

This is the outside layer of the earth and is made of solid rock, mostly basalt and granite. There are two types of crust; oceanic and continental. Oceanic crust is denser and thinner and mainly composed of basalt. Continental crust is less dense, thicker, and mainly composed of granite.

The mantle

The mantle lies below the crust and is up to 2900 km thick. It consists of hot, dense, iron and magnesium-rich solid rock. The crust and the upper part of the mantle make up the lithosphere, which is broken into plates, both large and small. To learn more about these plates see the Plate Tectonics page.

The core

The core is the center of the earth and is made up of two parts: the liquid outer core and solid inner core. The outer core is made of nickel, iron and molten rock. Temperatures here can reach up to 50,000 C.

3. The earth moves two ways. It spins and it moves around the sun. The spinning of the earth is called rotation. It takes the earth about 24 hours, or one day, to make one complete rotation. At the same time, the earth is moving around the sun. This is called a revolution. It takes a little over 3651/4 days, or one year, for the earth to make one full revolution around the sun.

4. Some of the effects of the Earth's rotation are:

   - Rotation creates a diurnal cycle of light and darkness, i.e. day and night.
   - Rotation causes tides, i.e. rise and fall of the sea level twice a day.
   - Rotation causes sunrise in the east and sunset in the west.

5. Due to the revolution:

   ✓ the length of days and nights varies at a place at different times of the year.

   ✓ causes a change of seasons.

   ✓ It helps in the location of Tropic of Cancer and Tropic of Capricorn due to the fact that Sun rays fall vertical here.

   ✓ The altitude of the mid-day Sun changes.

Unit 7 Motion, Force, Energy and Energy Resources

Time allotted to the unit: 28 periods

Unit Overview

In this unit, students will learn the concept motion, force and its effects, forms and sources of energy, conversion and conservation of energy, resource depletion and environmental degradation are emphasized in the unit. It has nine main parts.

Section 7.1 deals with the definition and types of motion. In this section the term motion and types of motion (motion on straight line, circular motion, rotary motion and curvilinear motion) briefly described. The emphasis of the next section (**7.2)** is on force and gravitational force is explained. It also explains the pulling/pushing activity of force and the effect and advantages of gravitational force.

The following section **7.3** presents effects of force and Related effects of force with their daily life experience. **Section 7.4** is the fourth section presents measuring device of force , measuring scales on measuring device of force and Explain parts of measuring device of force.

The emphasis of **Section 7.5 is** about energy as a property of matter that can be converted and explains the relationship between energy and matter

Section 7.6 introduces all forms of energy and Explain which energy converted to other forms of energy. **Section 7.7** gives information about the sources of energy and their classification as renewable and non-renewable. It also presents examples of renewable and non-renewable energy sources.

Section 7.8 describes how energy is used wisely and list the strategies of conservation of energy

The last part of the unit (section **7.9)** gives emphasis to Resource depletion and environmental degradation.

Since Resource depletion and environmental degradation is the major problem of the globe at present, this section will introduce types of depletion cause and methods of reducing Resource depletion and environmental degradation problems.

Dear colleague, from experience of teaching, it is observed that teaching this unit using lecture method is boring and cumbersome to students. So, different teaching methods are suggested for each section and sub-topic. The major methodologies suggested for this unit are peer teaching, gapped lecture, inquiry and group discussion.

Unit Outcomes

After completing this unit, students will be able to:

- Explaintypes of motion.
- Demonstrate the pulling/pushing activity of force.
- List some effects of force.
- Relate effects of force with their daily life experience
- Understandthe concept of energy.
- Distinguish between renewable and non-renewable forms of energy.
- List the strategies of conservation of energy
- Identify types of motion

These learning objectives have to be implemented. The minimum learning competencies have to be achieved by the majority of students. You have to sure this happened through continuous assessment techniques. Do not wait until the end of the lessons.

7.1 Definition and types of motion

Proposed number of periods: 2 periods

After completing this section, students should be able to:

- define motion as the change of position with time;
- describe the types of motion;
- give examples for each type of motion.

Suggested teaching methods

- Brain storming
- Group discussion
- Explanation
- Question and answer
- Practical activities Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning,

Warm up

Ask the students if they know what motion is? How they come to school? Ask if they were sit on the chair are they in motion?

Forward Planning

Read the contents on motion from the students' text and make the necessary preparation. You also need to read the contents in this guide to get clear information about the suggested activities. Plan how to manage students when they discuss the activity 7.1 and 7.2. Have a detailed time budget plan for all activities you perform during each period. Have a list of students in each section so that you can use it to record the performance of every student in the section.

Teaching aids

- Spring -mass system
- Different weights (blocks)
- Pendulum
- Rotating objects.
- Alternatives: Well illustrated diagrams on motion of objects.

Subject Matter Presentation

- ✓ Before starting this unit give a reading assignment for the students to read the first part of the unit.
- ✓ It is advisable if you use warm up questions to start the lesson because, it can motivate the students to participate in class activities, activate the students' background knowledge, and help the teachers introduce a new topic in interesting way or help get the students' attention.
- ✓ In the class, raise the question which is asked in activities part on student's text. (The teacher can also ask more questions for discussion).

- ✓ If the discussion leads to a conclusion that somebody simply sitting in a moving car is at rest relative to the car and at the same time he/she is in motion relative to the ground, then the teacher can arrive at the conclusion that a body is said to be in motion when it changes its position relative to other bodies or frame of references.
- ✓ Ask the questions in Activity 7.1 to identify different types of motion around them.
- ✓ Before explaining the different types of motion you have to do simple demonstrations to show different types of motion. After each demonstration ask the students to group the motion as rectilinear, curvilinear, rotary, and vibratory motion. Finally you should summarize the lesson by repeating each type of motion.
- ✓ You can demonstrate the following activities.
  - i. An object sliding down over an inclined plane. (Rectilinear motion)
  - ii. Rotate a ball which is tied to a string. (Curvilinear motion)
  - iii. A disk made from card bard rotating on an axis or nail. (Rotary motion)
  - iv. Simple pendulum made from locally available material (Vibratory motion)

So, to facilitating the learning process, it is advisable to refer to different books, to present the concept "motion" in a meaningful and simplified way. Design a situation in which students can observe clearly different types of motion. For example

- For motion in a straight line: a person walking in a straight Path.
- For curvilinear motion; a car taking a turn on a road (Round about).
- For vibratory motion; spring - mass system and pendulum.

Stabilization

- Summarize the lesson by giving them short notes. Ask them to do selected questions from unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the review exercise questions

Assessment

Assess each student's work throughout section 7.1. You can use students' performance list to record how every student:

- Participates in discussing Activities.
- Takes part in presentations after discussions.
- Answers questions you ask during mini-lecture, harmonizing concepts or stabilization.
- Answers questions given as class work, homework and quiz accordingly after checking the work of every student. You can use Exercise, class work and home works.

Check whether or not the suggested competencies for section 7.1 are achieved by the students. Appreciate students working above the minimum requirement level and encourage them to continue to work hard. Give extra attention to students working below the minimum requirement level in class or arrange extra lesson time. Give them questions recommended to them from the additional questions in this section or others of your own so that they will catch up with the rest of the class.

Answers to Exercises 7.1

Part I: Answers to multiple choice questions

1. D	3. A	5. B
2. B	4. D	6. C

Part II: Answers to short answer questions

1. Motion is **a change in position of an object with respect to time**. If the position of a body is not changing with respect to time, the body is said to be at rest, motionless, immobile or stationary. Any moving body is said to be in motion. Some types of motions are show below: Motion is based on Frame of Reference.
2. **Rotary Motion**: A special type of motion in which the object is on rotation around a fixed axis like, a figure skater rotating on an ice rink.

   Oscillatory Motion: A repeating motion in which an object continuously repeats in the same motion again and again like a swing.

   Example:

   - A swinging swing
   - The motion of a pendulum
   - A boat tossing up and down a river
   - The tuning fork

Rotational motion can be defined as when an object moves along its axis and all the parts of it move for a different distance in a given period of time. Thus, if an object is under rotational motion all of its parts will move different distances in the same interval of time.

For Example: The game merry-go-round, blades of a fan, blades of a windmill etc.

Rectilinear motion: An object moving in translation motion opts a straight-line path, then it is known as Rectilinear motion. Example: A train moving on a straight track or a car moving on a straight road.

When an object moving in translational motion follows a curved path it is known as ***curvilinear motion.*** Example: A stone thrown up in the air

7.2 Definition of force and gravitational force

Proposed No of periods = 4 periods

After completing this section students should be able to:-

- explain the term force;
- demonstrate the pulling/pushing activity of force;
- explain gravitational force.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning

Forward Planning

Read the contents of this section thoroughly and plan how to cover the contents within ***four periods***. Set a plan that shows the topics and activities you will treat during each period so that you can cover the entire content of the section within five periods. In addition read the teacher's guide to get information about the methodologies you need to implement and about the activities suggested in this section. In your plan, show the time allotted for every activity you perform during each period, such as group discussion, presentation, harmonizing concepts, and gapped lectures etc.

Teaching aids

- Force measuring devices
- springs
- Different masses and beam balances

Subject matter presentation

Ask students to discuss Activity 7.3 and 7.4 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

The suggested method of teaching is active learning method. Therefore, your basic role would be to lead the students to discuss on the given topic and guide the students on practical works.

Based on Activity 7.3, let students discuss about "what a force is?" and they mention different examples of force from their daily life activities.

Let every group, forward its summarized idea of force. Write down their ideas on the black board. It is important to be completely non-judgmental about their responses. Surely you will get different categories of force: such as, political force, military force, and many others. Do not discourage any of them.

After you put their responses on the board, let them discus on their categories (i.e. let them group the different forces as non-physical and physical. Finally guide them to focus and understand that 'force' in general science is a technical term that is not always directly related to common uses of the word "Force" That is a force is **a push or pull upon an object resulting from the object's interaction with another object**. When the interaction ceases, the two objects no longer experience the force. Forces only exist as a result of an interaction.

During the next period of this section, try to manage Activity 7.4. Based on Activity 7.4, students need to build knowledge of gravitational pull of the earth.

Have the students perform the activity and discuss it in groups for a few minutes. Then, ask some students to present their conclusions to the class. After their presentations, hold a whole-class discussion. Following the discussion, harmonize it by presenting these ideas:

Gravity of earth pulls the ball towards the ground and ball fall back to the ground.

Stabilization

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the check point and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the review exercise questions

Assessment

Assess the students' work throughout the section. Record how each student is doing on your students' performance list. You may make a record of the students' participation in discussions, during explanations, in performing project works, in presentations, and in doing class and homework. From your records of what students have done; see how many of them achieved the suggested competencies for the section. Encourage students working above the minimum requirement level and give them additional work.
Assist students working below the minimum requirement level either by arranging extra lesson time or giving them additional activities.

Answers to Exercises 7.2

Part I: Answers to fill the blank space questions.

1. Gravity
2. Force

Part II: Answers to multiple choice questions

1. C
2. B
3. B

Part III: Answers to short answer questions

1. A force is a push or pull upon an object resulting from the object's interaction with another object.

Example

– When goal keeper changes direction of motion of a ball

– When a wagon pushed

When a horse pulling a cart etc

2. The gravitational force is **a force that attracts any two objects with mass**. We call the gravitational force attractive because it always tries to pull masses together, it never pushes them apart. In fact, every object, including you, is pulling on every other object in the entire universe

7.3 Effects of force

Proposed number of periods: 4 periods

After completing this section, students should be able to:

- list all effects of force;
- demonstrate some effects of force;
- relate effects of force with their daily life experience.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning

Forward Planning

Make the appropriate preparation on effects of force by reading the contents in the students' text. You also need to read the teacher's guide on this section to plan how to present the lesson you intend to deal with during each period and get detailed information about the suggested Activities 7.5 and the methodologies you implement. Plan how to manage students during discussion, and also budget your time for activity you perform. The time you allot for students to discuss activities, presentation after discussion, harmonizing concepts and other activities during each period should be indicated in detail.

Teaching aids

- Force measuring devices
- springs
- Different masses and beam balances

Subject Matter Presentation

You better use group discussion, visual-based active learning and brainstorming methodologies. For this section, you are advised to use group discussion; brainstorming and visual based learning methodologies. After introducing the topic of the lesson, let the students discuss Activity 7.5 in groups for a few minutes.

With this activity, students should conclude their study of the effect of force by forming general ideas about the uses effects of force for daily life activities. Here apply brain storming methodology. Encourage some groups to present their opinions and to show the effects of force in the class if front of the students. Record all suggested ideas of the students on the blackboard. Then, continue harmonizing concepts by listing the all the effects of force.

Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the exercise questions.

Assessment

Check whether students participate actively in discussions. Don't forget to record students' performance in the performance list as you evaluate their homework.

Students working at the minimum requirement level will be able to:

- List some effects of force
- Demonstrate some effects of force.
- Relate effects of force with their daily life experience

Praise students working above the minimum requirement level and recognize their achievements. Encourage them to continue working hard and not become complacent. Help students working below the minimum requirement level by giving them extra activities so that they will catch up with the rest of the class.

Answers to Exercises 7.3

Part I: Answers to multiple choose questions.

1. D 2. D 3. C 4. A

Part II: Answers to short answer questions.

➢ The major Effects of force when a force is applied on an object
- Force can change the state of motion of an object
- Force can change the direction of moving objects
- Force can increase the speed of moving objects
- Force can decrease the speed of moving objects
- Force can change the shape of an object

7.4 Measuring forces

Proposed number of periods: 4 periods

After completing this section, students should be able to:

- name measuring device of force;
- identify different measuring scales on measuring device of force;
- explain parts of measuring device of force.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning

Forward Planning

Read the contents of this section thoroughly and plan how to cover the contents within ***four periods***. Set a plan that shows the topics and activities you will treat during each period so that you can cover the entire content of the section within five periods. In addition read the teacher's guide to get information about the methodologies you need to implement and about the activities suggested in this section. In your plan, show the time allotted for every activity you perform during each period, such as group discussion, presentation, harmonizing concepts, and gapped lectures etc.

Teaching aids

- Force measuring devices
- springs
- Different masses and beam balances

Subject Matter Presentation

It is advisable to use group discussion and gapped lecture for this topic.

You are advised to start the lesson with Activity 7.6, which is given in the student textbook. Let your students perform and discuss the activity in their groups. Next, invite some students to present their findings to the class. Then, hold a whole-class discussion and inform them of the following points:

You can say we use a device called a **force meter** to measure the size of a force. Most force meters have a hook that you can use to hang or pull on something. Find science kit in school pedagogical

centers and bring bar magnets to classroom and show the force meter and its parts. And also tell them how to calibrate the force meter. We measure forces using a unit called Newton's. They get this name from one of the most famous scientists of all time: Isaac Newton. He was the first person to describe the force that we know as gravity.

Spring balances provide a method of mass measurement that is both simple and cheap. The mass is hung on the end of a spring and the deflection of the spring due to the downwards gravitational force on the mass is measured against a scale.

Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Assessment

Assess each student's work throughout the section. You can do this by using student's performance list. Record how every student:

- Involves in group discussion.
- Participates in presenting opinions of the groups after discussion.
- Suggests ideas while you implement brain storming method.
- Gives comments on wrong views suggested by students.
- Answers questions raised during harmonizing concepts.

You can also prepare questions related to measuring forces and give them as class work or homework. Check their work and record their performances.

From the cumulative records, make sure whether or not the suggested competencies for this section are achieved. Appreciate students working above the minimum requirement level and help those working below the minimum requirement level. Let the students also attempt the review exercise on this section and end unit questions.

Answers to Exercises 7.4

Part I: Answers to fill the blank space questions.

1. Force meter (newton meter) also called spring balance.
2. Hook
3.

a. Ring	c. Scale	e. Object
b. Pointer	d. Hook	f. Spring

7.5 Definition of Energy

Proposed number of periods: 3 periods

After completing this section, students should be able to:

- define energy as a property of matter that can be converted from one form to another form.

Suggested teaching methods

- Brain storming

- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning

Forward Planning

Make the appropriate preparation on effects of force by reading the contents in the students' text. You also need to read the teacher's guide on this section to plan how to present the lesson you intend to deal with during each period and get detailed information about the suggested project work and the methodologies you implement. Plan how to manage students during project presentation, and also budget your time for activity you perform. The time you allot for students presentation after discussion, harmonizing concepts and other activities during each period should be indicated in detail.

Teaching aids

Subject Matter Presentation

Use group discussion and question and answer and project work to teach this topic. Begin the lesson with project work as given in the student's text book. The project work helps students define energy as a property of matter that can be converted and increasing opportunities for learning in and beyond the classroom. Let them present the ideas of their discussion to the class. Also, allow them to explain according to their understanding. Next, harmonize the students' discussion by giving the answer (s) as presented below, if needed.

In general science, energy is a property of matter. It can be transferred between objects, and converted in form. It cannot be created or destroyed. Everything in the Universe is made up of matter and energy.

Energy can be converted from one form to another. Examples: Gasoline (chemical)

is put into our cars, and with the help of electrical energy from a battery, provides mechanical (kinetic) energy. Similarly, purchased electricity goes into an electric bulb and is converted to visible light and heat energy.

Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the exercises.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the exercise questions.

Assessment

You are expected to assess each student's work throughout section 7.5. You can do this by using students' performance list and recording how every student:

- participates in project work
- presents ideas after discussion
- Answers questions raised during harmonizing concepts, stabilization and gapped lectures
- Does the activity suggested in this guide related to classification of elements.

Give them also Exercise7.5 as class work or homework, and quiz. Check their work and record their performances.

Based on the cumulative record, see whether or not the competencies suggested for this section are achieved by most of the students. Appreciate students working above the minimum requirement level. Give them the additional questions suggested for this section. With regard to students working below the minimum requirement level, give them the necessary assistance in class and arrange additional lesson time when over required.

You can also set questions of your own in accordance with the suggested competencies and give them additional exercise to help them catch up with the rest of the class. Use also question recommended to them from the additional questions.

Answers to Exercises 7.5

Part I: Answers to fill the blank space questions.

1. Energy
2. Matter
3. Heat and light

7.6 Forms and conversion of Energy

Proposed number of periods: 3 periods

After completing this section, students should be able to:

- list some forms of energy;
- explain which energy converted to other forms of energy.

Suggested teaching methods

- Brain storming
- Discussion
- Explanation
- Question and answer
- Using models
- Individual work based on the activities given
- Group work based on the activities given
- Visual-based active learning

Forward Planning

Read the contents of this section thoroughly and plan how to cover the contents within ***three periods***. Set a plan that shows the topics and activities you will treat during each period so that you can cover the entire content of the section within ***three periods.*** In addition read the teacher's guide to get information about the methodologies you need to implement and about the activities suggested in this section. In your plan, show the time allotted for every activity you perform during each period, such as group discussion, presentation, harmonizing concepts, and gapped lectures etc.

Teaching aids

Chart showing energy can be changed from one form to another.

Subject Matter Presentation

Implement group discussion and question and answer methodologies to teach this topic. Introduce the topic of the section. The section starts with Activity 7.7

Based on the discussion of Activity 7.7 students need to understand that there are different forms of energy and conversion of energy. After the discussions, have some groups present their opinions to the class. Then continue by harmonizing concepts suggested by students with the actual concept.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

Assess each student's work throughout section 7.6. You can use students' performance list to record how every student

- Participates in discussing Activities.
- Takes part in presentations after discussions.
- Answers questions you ask during mini-lecture, harmonizing concepts or stabilization.
- Answers questions given as class work, homework and quiz accordingly after checking the work of every student. You can use Exercise, class work and home works.

Check whether or not the suggested competencies for section 7.6 are achieved by the students. Appreciate students working above the minimum requirement level

and encourage them to continue to work hard. Give extra attention to students working below the minimum requirement level in class or arrange extra lesson time. Give them questions recommended to them from the additional questions in this section or others of your own so that they will catch up with the rest of the class.

Answers to Exercises 7.6

Part I: Answers to multiple choose Items

1. D 2. A 3. D

Part II: Answers to fill the blank space questions.

Original energy	Transducer	Energy transformed
Electrical energy	Earphone	Sound energy
Mechanical energy	Generator	Electrical energy
Chemical energy	Battery	Electrical energy

7.7 Energy Sources (sun, fuel, hydroelectric, wind, nuclear)

Proposed number of periods: 3 periods

After completing this section, students should be able to

- list sources of energy;
- distinguish between renewable and non-renewable forms of energy.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer

Forward Planning

Make the appropriate preparation on Energy Sources (sun, fuel, hydroelectric, wind, nuclear) by reading the contents in the students' text. You also need to read

the teacher's guide on this section to plan how to present the lesson you intend to deal with during each period and get detailed information about the suggested Activities and the methodologies you implement. Plan how to manage students during discussion, and also budget your time for every activity you perform. The time you allot for students to discuss activities, presentation after discussion, harmonizing concepts and other activities during each period should be indicated in detail.

Teaching Aids

Charts of different energy sources

Subject matter presentation

You are advised to begin the lesson with Activity 7.8. Let the students discuss the activity in groups for a few minutes and then ask them to share their ideas with the class. Next, hold a whole-class discussion. After that, harmonize the suggested ideas with the truth

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

Assess how every student is working throughout section 7.7. You can do this by recording the performance of each student. To make records, see how each student:

- Involves in discussing Activity7.8
- Takes part in presenting opinions of the group after discussion.
- Answers questions raised during mini-lectures.

You can also give Exercise 7.7 and other questions of your own as class work or

homework. Correct their work and record their achievements.

Based on the record you have, evaluated whether or not the students have achieved the competencies suggested to the section. Appreciate students working above the minimum requirement level and give them extra work. Assist those working below the minimum requirement level by arranging additional lesson time or giving them exercises on points they didn't understand. You can use the additional questions suggested to them and some other questions from reference materials.

Answers to Exercises 7.7

Part I: Answers to multiple choose questions

1. ***D*** 2. ***C*** 3. ***D***

Part I: Answers to Short answer questions

1.

- Solar Energy
- Wind Energy
- Geothermal Energy
- Hydrogen Energy
- Tidal Energy
- Wave Energy
- Hydroelectric Energy
- Biomass Energy
- Nuclear Power
- Fossil Fuels (Coal, Oil and Natural Gas)

2. A renewable energy source is any natural resource that can replace it quickly and dependably. These energy sources are plentiful, sustainable, naturally replenished and good to the environment.

   The major sources of renewable energy are:

   - Solar energy from the sun
   - Wind energy
   - Geothermal energy from the heat inside the earth
   - Hydropower from flowing water
   - Ocean energy in the form of wave, tidal, current energy and ocean **thermal energy.**
   - Biomass from plants

The major types or sources of non-renewable energy are:

- Petroleum
- Hydrocarbon gas liquids
- Natural gas
- Coal
- Nuclear energy

7.8 Wise use & Conservation of energy

Proposed number of periods: 2 periods

After completing this section, students should be able to

- describe how energy is used wisely;
- list the strategies of conservation of energy.

Forward planning

Read the contents in this section and make the necessary preparation. You can prepare a chart shows the strategies of conservation of energy as a teaching aid to help students understand concepts presented in this section.

Teaching Aids

Charts shows the strategies of conservation of energy

Subject Matter Presentation

Use peer teaching and group discussion methodologies for this section. This section begins with project work 7.2 is designed to help students get more information about Wise use & Conservation of energy. So, it is advisable if you implement peer teaching methodology for this part. Give them information about the points they should emphasize on. Give them a home work to make preparation on the section in groups before the period you plan to deal with it. Let all groups in each section make preparation then present their findings to the whole class.

Then Harmonize concepts suggested by the students in their presentation, about how energy is used wisely and List the strategies of conservation of energy.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

You can assess how every student is working on this section by asking oral questions, giving class work and checking their works. Make sure that the suggested competencies are achieved by the learners. For students working below the minimum requirement level, give additional exercises on points that are not clear to them.

Answers to Exercises 7.8

Part I: Answers to short answer questions

1. **Energy conservation** is the practice of using less energy in order to lower costs and reduce environmental impact
2.
   - Replace inefficient furnaces and water heaters with new high-efficiency models.
   - If buying a new furnace, do not get one larger than you need.
   - Wrap the hot water boiler in an insulating jacket.
   - Clean filters on forced-air furnaces.
3. **Strategies of conservation of energy**

The strategies that you can and should take for saving energy at home or in the office are:

- Switch off lights, fans and other appliances when not in use.
- Water taps should not be left open.
- While cooking vegetables the vessel should remain covered.
- For cooking, only the required quantity of water should be used.
- Soak pulses in water for some time before cooking,
- Use of more efficient appliances.
- Use public transport in place of your own vehicle to save fuel.
- Share automobiles rides to office, instead of driving alone to office.

7.9 Resource depletion & environmental degradation

Proposed number of periods: 3 periods

After completing this section, students should be able to

- explain resource depletion and environmental degradation.

Forward Planning

Read the contents of this section thoroughly. Plan how to manage students when they discuss activities and make presentations. Decide which groups should make presentations.

Teaching Aid

Prepare a chart that shows a list of some causes, effects and solutions of Resource depletion & environmental degradation.

Subject Matter Presentation

The suggested methodologies for this section are peer teaching, group discussion and visual based learning. This section starts with Activity 7.9. The activity helps students to visualize the way of life are difficult in degraded environment. During the period in which you treat the section, let students from two different groups make presentations to the rest of the class turn by turn. After each group completes the presentation, give chance to other students to ask the groups some questions, and also give the opportunity to the groups to answer questions raised by other members of the class. Then, harmonize the ideas of the students with

those which they are supposed to know.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Assessment

Assess each student's work throughout the section. You can do so either by giving class work or homework and checking the work of every student. Also record the effort that has been made by each group during presentation. Collect the written documents prepared by other groups who didn't involve in presentation. Check their works and make a record. See their achievements and make sure that the competencies suggested for the section are achieved or not.

Answer to Exercise 7.9

Part I: Answers to short answer questions

1. Resource Depletion: This refers to the situation where a resource is used at a rate faster than it can be replenished. This can lead to a reduction in the overall quantity of the resource available, which may eventually lead to its exhaustion. The depletion of resources often results in environmental degradation, as the extraction and processing of resources often lead to air, land, water, and noise pollution, as well as solid waste disposal problems.

2. Environmental Degradation: This term refers to the deterioration of the environment, often due to the depletion of natural resources. It can manifest as air, land, water, and noise pollution, as well as the problem of solid waste disposal. Moreover, environmental degradation can lead to changes or disturbances in the environment that are perceived as deleterious or undesirable.

The depletion of natural resources is primarily driven by a combination of factors, including :

- **Overpopulation:** The global population is more than seven billion people, and this population is consistently increasing, leading to an expansion in the demand for resources to sustain life.
- **Consumption Habits:** The way people live, transport themselves, and shop affects which natural resources are used.
- **Industrialization:** Industrial processes and activities deplete resources, often due to pollution.
- **Climate Change:** Climate change is closely linked to resource depletion, with both processes accelerating due to human activities.
- **Pollution:** Industrial pollution and the contamination of natural resources are significant contributors to resource depletion.
- **Mismanagement:** Poor environmental human practices and mismanagement of resources also play a significant role in resource depletion.
- **Deforestation**: The continued cutting down of forests leads to a decrease in the world's tree population, affecting the global oxygen supply and contributing to resource depletion.

3. Environmental degradation has a multitude of harmful effects on both the natural and the human environment.

- **Human Health:** Environmental degradation can lead to acute and chronic medical illnesses, war, and human rights abuses. It can also contribute to the extinction of wildlife, which in turn can affect human diets.
- **Biodiversity Loss:** Deforestation, one of the leading causes of environmental degradation, results in the loss of biodiversity. This loss can have devastating consequences, such as the extinction of species and disruption of the water cycle

- **Climate Change:** The effects of climate change are already widespread, including shrinking glaciers and ice sheets, earlier river and lake ice breakup, shifting plant and animal geographic ranges, and earlier blooming of plants. These changes can lead to famine, weather extremes, and species loss.

- **Water Quality:** Deforestation and other forms of environmental degradation can lead to poor air quality and undrinkable water.

- **Natural Disasters:** Over consumption of natural resources results in environmental degradation, reducing the capacity of the environment to meet social and ecological needs. This degradation can increase the frequency and intensity of natural disasters, such as floods and landslides.

Answer to Review Exercise

Part I: Answer to True or False question

1. False 2.True 3. True 4. False

Part II: Answer to Matching questions.

1.C 2.E 3.B 4.A

Part III: Complete the following sentences by choosing alternatives from the bracket and fill in the blank space.

Coal, natural gas and oil are all examples of ***non-renewable*** (renewable/non-renewable) energy resources. When they are burned, they release ***energy*** (energy/ electricity). Coal, natural gas and oil are also known as ***fossil fuels*** (nuclear fuels/ fossil fuels). Wind and solar energy are examples of ***renewable*** (renewable/ non-renewable) energy sources because they ***can*** (can/cannot) be replaced. ***Force*** has to be applied to change the ***direction*** of a ***moving*** object. (moving, direction, force)

Part IV: Answer to multiple choose questions

1. B	8. C	15. C
2. D	9. D	16. A
3. A	10. A	17. B
4. C	11. B	18. D
5. D	12. D	19. D
6. A	13. C	
7. B	14. C	

Part IV: Answer to short answer questions

1. Gravitational force is the force of attraction on a body by earth. Example - **Leaves and fruits fall from a tree downwards towards the ground due to** the gravitational pull.
2. An object thrown upwards comes down after reaching a point. This is because **of the Earth's gravitational pull**.
3. Weight is **the force exerted on a body due to the gravitational pull of Earth**.
4. Rotatory motion, rotatory motion, oscillatory motion, uniform circular and periodic motion, rectilinear motion, oscillatory motion and periodic motion respectively

General Science Syllabus Grade 7

Unit One: Basic Concepts of Science (11 periods)

Learning Outcomes: At the end of this unit, learners will able to:

• Define science as a body of knowledge and the processes and practices used to add to that body of knowledge and describe the main branches of science and explain their relationship.

• describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others, and the environment.

• appreciate the role and contribution of science and technology in the understanding of the world.

• Provide examples of Ethiopian scientists who have contributed to science and technology, and describe their contributions

• Discuss the importance of scientific values in decision making and problem solving.

• Select and use tools to observe, measure, and construct. Including: microscope, concave and convex mirrors and lenses, chemical apparatus

• Show concern for their own safety and that of others in carrying out activities and using materials

•work collaboratively while exploring and investigating

• Access information, using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, Internet

• Identify potential hazards and implement appropriate safety procedures when working in the laboratory

Competencies	Contents	Learning Strategies	Assessment
• Define science as a body of knowledge and the processes and practices used to add to that body of knowledge • Distinguish between the Indigenous Science and Conventional Science • Describe the main branches of science • explain the relationship among the branches of science • Explain how the development of science and technology affect one's beliefs, practices, and ways of thinking. • Identify the significant contributions of Ethiopian and International Scientists in science and technology. • Discuss the importance of scientific values in decision making and problem solving. • Discuss the importance of ethical disciplines in scientific investigations.	**1,1 The Nature of Science and its Branches (6 periods)** • Definition of science (Conventional Science and Indigenous Science) • Branches of natural science • Science and technology • Famous Scientists of the World and Ethiopia • Scientists and Ethical Discipline	• Students could be asked what they think science is. • Write their ideas on the blackboard. They are likely to suggest things like: – Way of knowing Body of knowledge – Natural world – Our environment • Use the students' ideas to filter a simple definition of science as: • Science is a study of the physical and natural world. Science provides an ordered way of learning about the nature of things, based on observation and evidence. Through science, we explore our environment, gather knowledge and develop ideas that help us interpret and explain what we see.	Pre-assessment of prior knowledge and students' experience Anticipatory set with questions Remedial or enrichment activities Teacher's observation

		• Students should be asked to provide examples of how science and technology have been used to solve problems around the world • Students could be asked to write one sentence about the branches natural sciences by searching from Internet or other sources such as library. For example, – **Biology -** study of living things – **Chemistry -** study of the chemical properties of materials – **Physics -** study of matter, motion, force and energy. • Students should appreciate that there are regions of overlap between the disciplines. Example, – Chemical reactions that take place in living things combine chemistry and biology. – The effects of forces result in the formation of mountains • Students could be asked to identify other topics where the different scientific areas overlap. • Students should appreciate the role and contribution of science and technology in their understanding of the world.	Quiz Performance assessment-report, presentation

		• Students could choose one of the scientists and create a role-play for the press release following the news of his/her discovery. – Various roles to consider would include: the scientist; media; fellow scientists; and the general public. Alternatively, they could choose an Ethiopian scientist and create a cartoon strip showing their discovery/ – . Values on focus: Imbibe good character traits of scientists. • Students could discuss the uses and benefits of science and technology to society and relate applications of science to some social and ethical issues. • Students could research on the contribution of Ethiopian scientist in science and technology	Ensure all students participate and contribute to class discussions Performance assessment-Report/Presentation Oral and written questions
		• Students could be shown some common pieces of apparatuses such as Balance, Beaker, Measuring cylinder, Tongs, Bunsen burner, Test tubes , Petridishes, etc.) • Students should practice the correct handling and use of these laboratory equipment and materials.	Questions Students work in pairs during the practical component

• Identify different laboratory tools • Demonstrate safe ways of using apparatus in the laboratory. • Practice precautionary measures in the laboratory • Exhibit knowledge of lab safety rules and procedures. • Identify potential hazards and implement appropriate safety procedures when conducting laboratory	**1.2 Common laboratory equipment, uses, safety rules and procedures in science laboratories** (5 periods) ▪ Common Laboratory equipment -Name and uses Making laboratory equipment/tools from locally available materials • Lab safety rules and procedures. • Personal protective • Hazard Signs (Symbols)	▪ Allow students in groups to prepare laboratory tools such as beaker, measuring cylinder, balance, tongs, etc. from locally available materials • The learner may be provided opportunities in pairs/groups/ and encouraged to: • discuss rules and regulations that should be followed in the science laboratory ▪ discuss hazard symbols on chemical bottles, electrical gadgets and other materials found in the laboratory and demonstrate how to handle those materials safely. ▪ The learner may be provided opportunities in pairs/groups/and encouraged to: • Discuss rules and regulations that should be followed in the science laboratory • Discuss hazard symbols on chemical bottles, electrical gadgets and other materials • found in the laboratory and demonstrate how to handle those materials safely.	Ensure all students participate and contribute to class discussions. Questions Ensure all students participate and contribute to class discussions. Questions

Unit Two: Matter in Our Surroundings (38 Periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Use particles theory's postulates to explain properties and behavior of materials.
- Classify matter as an element, compound, homogeneous mixture, or heterogeneous mixture with regard to its physical properties.
- Describe the structure of solids, liquids and gases in terms of particle separation, arrangement and types of motion.
- Differentiate between physical and chemical properties.
- Distinguish between chemical and physical of matter.
- Appreciate that matter can be classified based on physical or chemical properties.
- Use properties of matter to identify substances and to separate them.
- Access information, using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, , Internet
- Demonstrate scientific inquiry skills along this unit: observing, classifying, comparing and contrasting, making model, inferring, communicating, asking questions, designing experiments, drawing conclusions, applying concepts.

Competencies	Contents	Learning Strategies	Assessment
• Define matter with examples from day today life.	**2.1. Characteristics and nature of matter (11 periods)** • Meaning and Properties of matter	▪ Students should review the topic on matter learned in earlier classes using a KWL or mind map strategy. ▪ Students should define matter and give examples of both matter and non-matter. ▪ Students may believe that everything on Earth is matter. Teachers should probe students for examples that are not matter, such as all types of energy, including light, heat, and sound.	• Observe students during discussion -Mind Map • Oral and written question • Journal (students could write examples of the different types of matter they encounter at school and at home)
• Demonstrate that matteris made up of tiny particles.	• Particulate nature of matter • characteristics of the particles of matter	▪ Students could develop and use models to communicate the concept that matter is made of particles too small to be seen that move freely around in space (e.g., inflation and shape of a balloon, wind blowing leaves, or dust). Once students have come up with individual models, have them share their ideas with their group and record the group consensus on chalkboard/ large poster paper which they will share with the class.	▪ Models ▪ Observe students during activities ▪ Performance assessment-poster paper, activities on diffusion (using the quality criteria example: rubric, checklist in describing students‘ achievement).

• State the postulates of the particle theory of matter.	• Particle theory of matter (Particle model of matter)	❖ Students should outline the postulates of particle theory of matter as: • matter consists of particles, • there are spaces between the particles, • the particles move continuously, • there are forces between the particles, • particles of one substance differ from the particles of other substance.	• Written assessment • Oral questions
• Infer the particulate nature of matter from demonstration/investigation.	▪ Evidences for the particle theory of matter - Diffusion	▪ Students could carry out experiments, such as the diffusion of harmless chemicals such as perfumes with a distinctive odor, to show that even a small amount, such as one drop, spreads within a large room so it can be smelt in all places – therefore the particles responsible for the smell must be very small and there must be many of them in a single drop. ▪ Students could also Explore and explain the concept of diffusion through observation of dissolving of food coloring water.	• Performance assessment-Observe students during activity (using the quality criteria examples: rubric, checklist in describing students' achievement). • Report/presentation • Oral question

• Apply particle nature of matter in explaining diffusion and every day effect of diffusion. • Apply the knowledge of particle model of matter theory to explain the three states of matter. • ~~Describe and/or~~ Make a representation of the arrangement, relative spacing, and relative motion of the particles in each of the three states of matter. • Describe compression interms of distance between particles.	▪ Explaining Observations Using the Particulate nature of matter ▪ Diffusion and every day effects of diffusion, – Properties of solids, liquids and gases ✓ Particles in solids, liquids and gases • Compression	• Students could apply particle nature of matter in explaining diffusion and every day effect of diffusion (, e.g. the spread of perfumes and cooking aromas; tea and coffee grains in water). • Students could use particles model diagram to describe the differences in behaviour among particles in solids, liquids and gases. • Challenge a few students to role-play particles in different states of matter by acting out their properties. • Students should use model or particle model diagram to describe the structure of solids, liquids and gases in terms of particle separation, arrangement and types of motion of the particles using particles in boxes‘ and use this diagram to describe the compressibility of gaseous.	• Observe students during the activity • Observation collaborative and independent work • Performance Assessment Model or particle model diagram • Presentation/ reflection • Performance assessment role play • Observe students during activities

• Use the terms melting, condensing, and freezing/solidification to describe changes of state. • Use the particulate nature of matter to explain: Melting, Freezing/ solidification, Evaporation, Condensation.	– Changes in state • Explaining change of state processes using a simple particle model of matter.	▪ Students should define melting, evaporating, condensing, and freezing/ solidification and use them to describe the process of changes of state. ▪ Students could use particles model diagrams to explain changes of states in terms melting, evaporating, condensing, and freezing/ solidification. Here Students should be helped to visualize how much small the particles (atoms or molecules) are, and what actually happens when substances melt, dissolve or evaporate.	▪ Interactive Discussion ▪ Observe students during activities ▪ Oral questions
▪ Describe physical Properties	**2.2 Physical and chemical properties of matter (6 periods)** • Physical properties	▪ Students should be asked to brainstorm information that they need to know in order to identify an object/substance. As a class, students develop a list of properties that can help to identify an object/a substance. A class T-chart can be developed listing physical and chemical properties and ones that can be tested for in class.	▪ Diagnostic assessment ▪ Observe students during discussion

		They are likely to suggest things like: – Colour – Mass – Volume – State at room temperature – Melting/Boiling point. ▪ Students should understand that physical properties are those that can be observed or measured without attempting to change the substance into a different substance. ▪ Students should realize that some physical properties, such as mass and volume, depend on the amount of matter being measured while properties, such as melting, and colour, do not depend on the amount of the substance present.	▪ Written assessment

▪ Use physical properties of matter to identify substances.	▪ Identification of substances based on their physical properties	▪ Students should realize that each pure substance has characteristic physical properties (for any bulk quantity under given conditions) that can be used to identify it. They should also know that melting point, boiling point, solubility, and odor are characteristic physical properties that can be used to identify a pure substance. ▪ Students could be given an unknown substance and asked to identify it by comparing its properties with those given in data tables	▪ Quiz ▪ Remedial or enrichment activities ▪ Observes and records as students demonstrate their understanding of the concepts
▪ Conduct experiments to identify properties of substances and make group report.	▪ Observing physical properties	▪ Students could be given a substance and asked to find some of its physical properties by observation e.g. , for a metal block the student could observe: - State and the color - Conductivity - Density	▪ Performance assessment-presentation, report (using the quality criteria (example rubric, checklist) in describing students' achievement

		– The observation of conductivity and density should be done only qualitatively and descriptively • Students could identify metals by observing their physical properties e.g. – Copper – brown colour – Iron and steel – magnetic – Aluminum- low density • Lead- high density	▪ Report
▪ Identify chemical properties. ▪ Distinguish between physical and chemical properties.	▪ Chemical properties	▪ Students should know that chemical properties can only be studied while trying to change the substance into another substance e.g. flammability. ▪ Students should understand the difference between physical properties and chemical properties.	▪ Questions ▪ Performance assessment-presentation (using the quality criteria (example rubric, checklist) in describing students' achievement

• Use the particle theory to describe the difference between pure substances and mixtures	**2.3 Classification of substances (in terms of composition and observable properties) (8 periods)** • Pure substance and mixture	• Students are likely to have first-hand experience with pure substances and mixtures from prior learning or their daily life experience. They could be asked to take part in a brainstorming or KWL session to activate their prior knowledge about pure substances and mixture. • Students could make lists of common substances which are pure and those which are mixtures . Common mixtures could include:	▪ Diagnostic assessment ▪ Ensure all students participate and contribute to class discussion ▪ Observing

		- Soil – a mixture of different sized particlesand plant material – Cooking oil – a mixture of vegetable oils. – Ink—contains a mixture of dyes, dissolved in alcohol and water. – Milk— contains proteins, carbohydrates, fats, water, minerals. – Air— contain oxygen, nitrogen , carbon dioxide ▪ Common pure substances could include: – Gold Sulphur – Copper Silver – Water Sugar ▪ Students should be informed that: – pure substances have characteristic properties and are made from a single type of particle. – a mixture is a combination of two or more particles which have not bond together; each part in the mixture retains its own properties. 🕐 Students could be asked to use the particles model diagram to describe the difference between pure substances and mixtures. Paper clips with different size or colors or other local materials can be used to make physical models that can be used for this activity.	▪ Observe students during activities ▪ Oral questions ▪ Observe students during activities ▪ Ensure all students participate and contribute to class discussion

• Differentiate between elements and compounds. • Classify common elements into metals and non-metals	• Elements and Compounds - Classification of Elements	• Students should recognize that there are a number of substances that cannot be decomposed into simpler substances and these are called elements. There are 92 naturally-occurring elements. • Students could know that a chemical element is a pure substance that contains only one type of particle (atom), which is the smallest particle of an element.	▪ Oral question
		• Students should be asked to suggest how elements might be classified into groups. They may suggest solids, liquids and gases as the states of matter will be familiar to them. Explain to them that elements are classified in terms of metals and non-metals.	▪ Ensure all students participate and contribute to class discussions

• Investigate the properties of metals and compile a list of general properties. • Investigate the properties of non-metals and compile a list of general properties.		• Provide students with samples of different metals: iron, aluminum, copper and any others which are available. They should examine them and compile a list of general physical properties e.g. solid, hard, flexible, metallic appearance, can be polished. As a result of these activity students should deduce the common properties of metals. • Provide students with samples of different non- metals: carbon, sulphur and iodine. They should examine them and compile a list of general physical properties e.g. solid, rigid, can be crushed into a powder, dull appearance. Show students some examples of gaseous elements such as oxygen, nitrogen and chlorine. Point out that many non-metals are not solids but gases. • Students could also classify the non-metals into solids and gases at room temperature.	▪ Observe students during activities ▪ Make sure students are working together ▪ Observe students during activities ▪ Report

		- This work could be linked back to physicalproperties by referring students to the tables of melting points and boiling point of the elements to identify one metal and one non-metal which are liquids at room temperature. • Students should appreciate that elements combine chemically to form compounds. Give some examples of binary compounds and ask them from which elements they are formed e.g. – Sodium chloride – sodium and chlorine – calcium oxide (lime) – calcium oxide – Carbon dioxide – carbon and oxygen. • Emphasize that a compound is not a mixture of elements but elements which have undergone a chemical change. – Students should realize that the properties of a compound are completely different from the properties of the elements from which it is formed..	Performance assessment- Report, observing during they perform the investigation, presentation (using the quality criteria (example rubric, checklist) in describing students' achievement Inferring skill ▪ Observation ▪ Quiz

		• Students could carry out an experiment in which they heat a mixture of iron and sulphur in a soda glass tube and compare the properties of the iron sulphide with the original mixture. This will emphasize the differences between a mixture and a compound. • Students could be asked to show the differences between element and compounds using particles model diagram. • Students should be informed that: ▪ element is a substance that is made up of only one type of atom. ▪ a compound is a substance that is made up of more than one type of atom bonded together.	▪ Observe students during activities ▪ Lab report ▪ Presentation

• Describe mixture • Classify mixtures into homogenous and heterogeneous. - prepare mixtures • Use models/ particles diagram to show differences between homogenous and heterogeneous. • Describe the relationship among elements, compounds, mixtures, homogenous mixture and heterogeneous mixture.	• Mixture - Homogenous mixture - Heterogeneous mixture	• Students should describe the two types of mixtures, i.e., homogenous and heterogeneous and give examples for each. • They could also be given mixtures of different kinds and be asked to identify them as homogenous or heterogeneous. – Students could be asked to prepare beneficial and useful mixtures such as drinks, food, and herbal medicines • Students could use models/ particles diagram to show and describe the differences between homogenous and heterogeneous mixtures. • Students could create/make a mind map or concept map of types of matter as they progress through this topic/ subunit. One possible arrangement would be to have ―matter or substances‖ at the center. Six branches labelled	▪ Group quiz ▪ Observe students during activities ▪ Make sure students are working together ▪ Concept Map about the classification of Substances

		· properties‖, —mixture‖, -elements‖, - compounds‖ —homogenous mixtures‖ and - heterogeneous mixtures‖ could form the basis of creating a graphical representation of the main information in this sub-unit.	
• Describe physical and chemical change. • Distinguish the physical and chemical changes using their characteristics.	**2. 4 Changes Around Us:- Physical and chemical changes (6 periods)** • Importance of physical and chemical changes in our life	• Students could be asked to tell some of the changes they observe in their environment. • Students should observe and record typical –changes‖ in their home and identify whether they are physical or chemical changes .They should give reasons for their choice. These include:	▪ Asking questions

• Conduct some simple activities to show physical and chemical changes and write group report. • Observe and describe physical and chemical changes that are important in everyday life. • Identify useful and harmful changes.	• Physical chemical changes that are important in everyday life • Useful and Harmful Changes	– Burning of charcoal – Fermentation – Spoilage of food – Rusting of nail – Melting of ice – Evaporation of water – Dissolving sugar in water etc. • They should be asked to generalize – what are the characteristics of different changes – physical and chemical changes? The difference between these two types of change could include: – Physical change • easily reversed • no new substance formed – Chemical change • not easily reversed • new substance formed	▪ Presentation ▪ Use a scoring rubric to assess their ability to recognize and provide proof for the variousChanges. ▪ Make sure students are working together

		• Students could investigate some changes themselves and determine whether they are physical changes or chemical changes by using simple experiment. e.g. – Boiling water – Grinding salt – Tearing paper into small pieces – Melting an ice – Iron nail going rusty – Making an iron bar magnetic – Heating magnesium ribbon – Burning candle. – They may then present their findings to the class in the form of an oral presentation, a poster display, or multi-media presentation. – Students could be asked to identify evidence of chemical change through color, gas formation,solid formation, and temperature change .	▪ Observing during activity ▪ Report ▪ Presentation

		• Students could identify physical changes e. g dissolving etc.) and chemical changes (e.g. fermentation, food cooking, etc.) that are important in our live • Students could identify physical changes (e. g oil spills etc.) and chemical changes (rusting of car, souring of food etc.) that are harmful in our live • Students should allowed to evaluate whether changes in materials (for example burring of fire wood etc.) are useful or harmful to one's environment	Reflections
• List methods of separation of mixtures	**2.5 Separation of mixtures and its application periods(7 periods)** • Methods of separation of mixtures	▪ Students should be asked to list the methods of separation with which they are already familiar from their daily life experience. These could include: – Separation by hand – Sieving – Filtering – Decanting ▪ Students should appreciate that separation techniques are a method of obtaining pure substances.	▪ Diagnostic assessment- group activity, brain storming.

• Give some specific examples of mixtures that can be separated by filtration, decantation, simple distillation, magnetic separation and using separator funnel.		▪ Students could be asked to give examples of mixtures that can be separated by filtration, decantation, simple distillation, magnetic separation and using separator funnel including the following: – Magnetic separation: ▪ Iron filings and sulfur could be used to illustrate separation of magnetic and non- magnetic substances . Iron filings and sand could also be used . It is wise to place the magnet in a polyethene before doing this experiment as it can be difficult to remove all of the iron filings from the magnet – Filtration: ▪ A mixture of chalk particles (or some other insoluble solid particles) and water – Evaporation ▪ A mixture of sodium chloride (or any other soluble salt) and water forms a solution which can be separated by evaporation if the solution is left in an open dish on a window sill the water will evaporate the salt will be left behind. Evaporation is quicker if the solution is placed in a broad dish, such as an evaporating basin, which exposes a large surface area of the solution to the air. – Decantation ▪ Pouring boiled coffee from the pot (‘Jebena’) to the cup ▪ A mixture of cooking oil and water can be separated by decanting - the cooking oil and water form two layers. The top layer, the cooking oil, can be removed by careful pouring.	• Written assessment • Oral questions

		This is best done when the mixture is in anarrow tube such as a measuring cylinder. It can also be separated using separator funnel. – Simple Distillation – A mixture of two miscible liquids boiling points can be separated by simple distillation For example ι) Mixture of water (B.P.100^{0}c) and alcohol (ethanol B.P. 78^{0}c) ιι) Obtaining pure water from salt solution – Students should be made familiar with the use and care of the apparatuses used in these techniques.	
▪ Name apparatuses used in decantation, filtration, simple distillation, using separator funnel. ▪ Assemble apparatuses used in decantation, filtration, simple distillation, separator funnel.		▪ Students should practice assembling apparatuses used in decantation, filtration, simple distillation, separator funnel.	▪ Oral questions ▪ Performance assessment

▪ Conduct and report on an investigation that uses physical means such as particle size, density, boiling point, solubility and magnetism to separation	▪ Application	▪ Students could attempt the separation of different mixtures using a range of techniques including: ✓ A mixture of iron filings and sulphur powder ✓ A mixture of cooking oil and water ✓ A mixture of chalk particles in water ✓ A mixture of alcohol and water ✓ Salt solution ▪ Students could undertake separation using a combination of techniques. For example, a mixture of salt and sand can be separated by first adding water to dissolve the salt, filtering to remove the sand and finally evaporation of the filtrate to give the salt.	▪ Observing during activity ▪ Report ▪ Presentation/ Re-flections
▪ Perform simple activities in group to carry out the separation of mixtures using local materials and write a group report.	▪ Separating of mixtures using local materials	▪ In group, using local available materials students could plan and investigate how table salt is separated from a mixture of table salt, sulphurpowder and iron filings then report their finding.	▪ Observing during activity

		• Students could be asked to separate other mixture locally available using local materials	• Report • Observation collaborative and independent work
• Compare and evaluate the different ways of separating mixtures from products in community		▪ Student could discuss with the parents/ guardians /grandparents/elders in the neighborhood on the techniques separation used in daily live. Students should be asked to make/prepare a table of such activities of daily life in which sedimentation, decantation, filtration and evaporation are used/occurs. They may then present their findings to the class in the form of an oral presentation, a poster display, or multi-media presentation. ▪ Alternatively teachers may present examples of separation techniques used by local indigenous people. Students should be asked to identify and compare with modern separation techniques used to accomplish the same tasks. What are the positive and negative effects of using the modern separation techniques as opposed to the traditional indigenous techniques?	• Performance assessment poster display / multi media presentation, report (using the qualitycriteria (example rubric, checklist) in describing students' achievement • Report

		▪ Teachers may facilitate a cooperative jigsaw activity to research early historical uses of each separation techniques. Organize students into home groups of six. Assign each member of the home group a separation technique to be explored, ▪ Reorganize students according to separation techniques and ask them to research early use of their separation technique and trace how its use has changed over time. Once all research has been completed, students should return to their home group and share what was learned with other members ▪ Students could create a print or digital display to illustrate how separation techniques devices has changed over time.	• Observation collaborative and independent work

Unit 3: Elements, Compound and Chemical Reaction (17 Periods)

Learning Outcomes:

- Compare and contrast elements and compounds in terms of composition and their representations
- Identify and write symbols of common elements or compounds.
- Name compounds given their formula and write formula given the name of the compound.
- Use symbols and chemical formulae as a way of communicating information about elements and compounds.
- Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms.
- State and apply the Law of Mass conservation to writing balanced equations.
- Write equations describing chemical reactions using appropriate symbols;
- Investigate to determine how characteristics and properties of substances may change during chemical reaction
- describe scientific enquiry skills along this unit: classifying, comparing and contrasting, communicating, asking questions, designing experiment, drawing conclusions and applying concepts

Competency	Contents	Learning Strategies	Assessment
• Define element	**3.1. Elements and their representation(2 periods)**	• Students are likely to have first-hand experience with element. Thus they could be asked to take part in a brainstorming session to activate their prior knowledge about element and cite the definition of the term –element‖. • Students should define atomic symbols as shorthand way of representing elements or atoms of an element. Illustrate this by writing the names of several elements on the board with their symbols alongside. Students should be aware of that symbols stand for a specific element. No two elements can have the same symbol. • Students should appreciate that: • symbols are much easier and quicker to write • the same symbols are used throughout the world so chemists all over the world can understand them	▪ Oral questions

• Identify symbols of some common elements. • Write chemical symbols for common elements.	▪ Common elements ▪ Chemical symbols ▪ Writing symbols	• Symbols stand for a specific element. No two elements can have the same symbol. • Students could be given a periodic table and asked to point out the symbols for some elements they may be familiar with e.g. sulphur, carbon, gold, iron, oxygen etc. Do not attempt to explain the Periodic Table at this stage; this will be discussed and explained in detail in Grade 9 • Students should understand that the first letter is always written in upper case and, where there is a second letter, this is written in lower case. For example, the symbol for helium is He, and not HE, hE or he. • Students should know that, in general, the symbol of an element is the first letter of its name. Where there are two elements whose names start with the same letter, an additional letter is added.	▪ Quiz ▪ Observation

		For example, the symbol for carbon is C, while the symbol for calcium is Ca. • Teachers could ask students to consider why the letter symbols for some of the elements do not correspond to the element's name (e.g. Iron, number 26, has the symbol Fe).Students could research and find out why some common elements have symbols which appear to have little resemblance to their names e.g. iron, Fe; lead Pb; sodium, Na. • Students should practice writing symbols from names and names from symbols. They should focus on the symbols of the first 20 elements of the Periodic Table together with a small number of commonly encountered elements such as iron (Fe), copper (Cu), zinc (Zn),aluminum, gold (Au), silver (Ag), bromine (Br) and iodine (I). • Students should be guided to make a chart, poster, or multimedia presentation of common elements showing their names, symbols, and uses (They can refer to information sources such as books, internet etc, to get information required for this activity).	▪ Report/Reflection ▪ Quiz

• Define compound as a substance formed when two or more elements chemically combined together. • Define valence numbers as the combining power of an atom	**3.2 Compounds and their representation(6 periods)** • Compounds • Meaning of formula • Valence number	▪ Students should be reminded from their work in Unit 2 that a compound consists of two or more elements which have been chemically combined. It follows therefore, that in order to represent a compound we combine the symbols of the elements to make a chemical formula. ▪ Students should appreciate that atoms of different elements have different combining powers‘ which we call valence number. ▪ Give students a simple table to show the combining power of some common elements including: – 1 sodium, potassium, copper (I) – 2:magnesium, calcium, iron (II), copper (II) – 3: aluminum, iron (III) – 2: oxygen, sulphur – 1: chlorine, bromine, iodine	▪ Oral Questions ▪ Quiz

• Write the formulae of simple binary compounds using symbols and valences • Name binary compounds	• Formulas of Binary compounds • Naming binary compounds	▪ Students should practice writing the formulas of compounds in which the metal and non-metal have the same combining power e.g. potassium iodide, KI; copper (II) oxide, CuO. ▪ Ask students to suggest how we write the formulas of a compound in which the combining powers of the atoms are not the same e.g. Calcium chloride. Calcium has a combining power of 2 while chlorine has a combining power of 1 therefore we need two chlorines to go with one calcium. Here the students should understand the use of subscripts and coefficients in a chemical formula and describe using diagrams of molecules. ▪ Students could understand that the name of non-metal that is written at right side in the formula in binary compounds should have an "ide" ending. e.g. NaCl - Sodium chloride ▪ Students should be aware of that a small number of elements have more than one combining powers. For example, in some of its compounds iron shows a combining power of 2 and is written as iron(II) – while in others it shows a combining power of 3 and is written as iron (III) ▪ Students should understand that certain groups of atoms are found together in a number of different compounds. They should learn the names, formulas and combining powers of these groups including:	▪ Observing students during activities ▪ Oral questions

• Describe poly-atomic ion • Write the chemical formulas of common compounds that contain polyatomic ions • Deduce the formula of a simple compound from a model or a diagrammatic representation. • Name compounds containing polyatomic ions.	▪ Polyatomic ions ▪ Writing chemical formulas ▪ Naming simple chemical compounds	– 1 ammonium, NH^+_4 – 1 hydroxide OH^-, nitrate NO^-_3 • Students should practice writing the names and formulas of compounds which contain one of these groups and an atom with the same combining power e.g. ammonium chloride, NH_4Cl, potassium hydroxide, KOH • Finally, students should practice writing the names and formulas of compounds which contain one of these groups and an atom with a different combining power e.g. ammonium sulphate, $(NH4)_2SO_4$, iron (II) nitrate, $Fe(NO_3)_2$. • Students should practice writing the chemical formulas of common named chemicals and the names of chemicals from their formula.	• Quiz • Observing during activities

• Identify the elements and number of atoms, given a chemical formula • Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms. • Identify the elements and compounds in common household products (e.g., hydrogen peroxide, lye, sodium chloride).	▪ Interpreting formula	▪ Students should describe the significance of coefficients and subscripts in the formulas of elements and compounds ✓ e.g. Cl_2;the subscript 2 shows qualitatively chlorine is a molecule and quantitatively there are atoms of Cl inchlorine molecule. ✓ $3H_2O$; the coefficient 3 shows that there are 3 molecules of water. ▪ The subscript 2 shows that there are 2 atoms of hydrogen in a water molecule. There is also 1 atom of oxygen in a water molecule though not written as subscript under "O". ▪ Students should interpret some formulas in this way e.g.CaO, calcium and oxygen, one atom of calcium and one atom of oxygen; $Ca(NO_3)_2$, calcium and nitrate, one atom of calcium and two nitrate groups	▪ Observation ▪ Oral question ▪ Report ▪ Presentation

		▪ Students should be asked to search reference materials, such as a Science books and/or the Internet, to try to discover the formulae of common compounds such as baking soda, Vinegar (acetic acid), lime etc. and interpret them in terms of the elements present and theratios of their atoms.	
▪ Define chemical reaction and give examples.	**3.3. Simple chemical reactions and equations (7 periods)** ▪ Simple chemical Reactions	▪ Students should understand that a chemical reaction is a process in which some substances change into different/new substances. In chemical reaction one or more substances, called reactants, react alone or with each other to produce one or more new substances, called products.	▪ Oral questions

• Describe evidences that show chemical reaction has occurred. • State the law of conservation of mass.	▪ Evidences that show chemical reaction has occurred ▪ Low of Conservation of mass	• Students should give different examples of chemical reactions. The students could also discuss the examples of changes brought about by the chemical reactions. These could include: ✓ Rusting of iron ✓ Fermentation ✓ Digestion of food • Students could record and describe the various chemical changes that occur in their daily lives (e.g. cooking food, etc.) and describe the evidence they use to determine that a chemical reaction occurred. • Students should know that mass is conserved during a chemical reaction i.e. no atoms are lost or gained – they are simply rearranged.	• Quiz • Reflection • Question
▪ Conduct an experiment in group to show simple chemical reaction.	• Investigating chemical reaction	▪ Students should conduct an experiment on simple chemical reaction. This could be burning of magnesium in the air to produce magnesium oxide. ▪ Student should investigate to determine how characteristics of substances may change when they interact with one another Example backing soda in veanger produce gas ▪ In general, Students should be encouraged to Compare similarities and differences indata before and after reaction to determine whether a chemical reaction has taken place .	• Performance assessment- individual/ group lab report, reflection

• Write a chemical equation. • Balance simple chemical equation by inspection. • Create and use models of particles to demonstrate balanced equations.	• Writing and Balancing simple chemical equation • Writing Chemical equation • Balancing Chemical equation • Demonstrating balancing equation	▪ Using the board demonstrate how to write and balance chemical equations. ▪ Describe in words a simple reaction (such as the formation of water from hydrogen and oxygen), and then represent it with a chemical equation. Explain what each part of the equation represents. Be sure to distinguish the uses of coefficients and subscripts. ▪ Also, explain how and why the equation must be balanced. Work with the class to balance two or three of the equations. Then ask students to try to balance some equations. Students should actively participate in brief teacher-led discussion on how to represent chemical reactions with equations. ▪ Students should practice writing balanced chemical equations using the same technique. Initially they should be focused on simple equations. Once they have mastered the technique this should be extended to more difficult examples. ▪ Students should develop the habit of checking for balance each time they write and equation by counting the number of each atom on each side of the equation. ▪ In group, with a guidance, students could prepare a model from local available materials and use to demonstrate balanced equations. Alternatively they can use paper clips of different size or colours and other materials to demonstrate a balanced chemical equation.	▪ Oral questions ▪ Observation ▪ Quiz

• Describe the uses of chemical reactions in everyday situations. • Explain reactants and products through indigenous knowledge of fermentation process.	**3.4 Uses of Chemical Reactions in Every Day Situation (2 periods)** ▪ Uses of chemical reaction	▪ Student should observe and describe chemical reaction that are important in everyday life ▪ Students should describe the effect of chemical reaction in daily life and on the environment ▪ Student could discuss in group and give some examples of usfule and harmful examples. • Students could discuss in group and give some examples of useful chemical reactions such as fermentation in brewing which produces carbon dioxide and ethanol/ alcohol and other indigenous knowledge. • Students should be challenged and guided to come up with other examples of useful chemical reactions. These could include: • Chemical reactions that can be used as energy sources include: ✓ Burning methane natural gas ✓ Burning fuels ✓ The conversion of glucose into carbon dioxide and water. • Chemical reactions that are used to make new materials include:	• Observing during discussion

• Describe the effect of chemical reaction in daily life and on the environment.	▪ Effect of chemical reaction in daily life and on the environment	✓ water and carbon dioxide reacting to form glucose and oxygen. ✓ the conversion of glucose into carbon dioxide and water ✓ making iron from iron ore ▪ Students could discuss on effect of chemical reaction (example rusting, carbon monoxide formed during burning of charcoal) in daily life and on the environment. ▪ Students should be aware of that chemicals can enter the air, water, and soil when they are produced, used or disposed and during chemical reaction (example during the combustion of combustion of fosil fuels the carbon dioxide formed enter the air}	

Unit Four: Cell as the Basis of Life(23 periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Define a microscope
- Explain the use of a microscope
- Distinguish the different types of microscopes
- Describe the basic parts and functions of a microscope
- Use a microscope to view objects
- Define a cell
- Explain how cell was discovered and who discovered it
- Draw a cell and label its major parts
- Describe the functions of the major structural parts of a cell
- Distinguish between unicellular and multicellular organisms
- Give examples of cell shape
- Explain why cell shape and structure vary
- Discuss the differences of cell, tissue, organ and organ system
- Define respiration and write its chemical equation
- Define photosynthesis and write its chemical equation

Competencies	Contents	Learning Strategies	Assessment
• Identify the major parts and functions of a basic microscope • Use a microscope to view objects • Discuss the role of a microscope • Differentiate between simple and light microscope • Draw diagram of a microscope and label the major parts • Build microscope from locally available materials	4.1 Microscope (8 Periods) • Purpose and invention of Microscope • Types of microscope 4.1.1. Basic parts of light microscope and their function	• Ask students, in groups, to discuss and tell if they think are organisms around them that they cannot see with their naked eyes; finally, you reflect on their answers. • While students are still in groups, ask them to discuss what they could use to see the organisms that they cannot see with their naked eyes. • Bring a sample of light microscope to a classroom, and ask students if they have known these apparatus before. • Show a very fine fiber to students, and ask them to record its size. • Now, adjust this very fine fiber under a light microscope, and let each student see it through the microscope; ask them to explain what change they have observed. • Now, ask the students to explain the purpose or use of a microscope; finally, you reflect on the students answers.	• Observe students activities while they are discussing in groups • Record the results of the students' discussions. • Question and answer on the use, types and parts of a microscope. • Ask students to adjust a microscope to observe small piece of his/her own hair under a microscope and observe it. • Request students to individually draw a microscope on a sheet of paper, label its parts and submit • Ask students to list down any questions they have from the chapter. • Ultimately, ask students to construct (build) a light microscope from locally available materials in groups of five students and submit it to the teacher for evaluation. • Provide descriptive feedback on the students' responses to the questions, diagram of the microscope they have submitted,

		• Ask students, if they know who invented a microscope and when? Finally, you reflect on the students answers. • By providing samples of a simple microscope and a light microscope, ask students to compare and contrast the differences in structure of those two microscopes. • Provide students with a diagram of light microscope labelled with various major parts (such as eyepiece/ ocular, body tube, revolving nosepiece, objectives, stage and stage clips, condenser, course adjustment, fine adjustment knob, arm, lamp and base). • Then, provide a light microscope to students in groups and ask them to discuss and relate the labelled parts from a diagram to the actual parts on the microscope. • Ask students to discuss and tell what component a microscope uses to magnify an object, and in which part(s) a microscope it is located. • Ask students to discuss how what the roles of each part of a microscope are. • Ask students to reflect on how they have felt about a microscope • Ask students to individually draw a microscope on a sheet of paper and label its major parts, and submit for the teacher	and gaps observed indicating how they shall improve their learning.

• Explain how cell was discovered • Draw and label the basic structures and functions of a cell • Demonstrate the structure of onion epidermal cell and human cheek cell under a light microscope • Explain why cell shape and structure vary • Compare and contrast animal cell and plant cell • Distinguish between unicellular and multicellular organisms • Differentiate among cell, tissue, organ and organ system with examples • Examine and weigh the importance of cellular respiration • Examine and weigh the importance of photosynthesis	**4.2 Cell (15 Periods)** 4.2.1 The discovery and definition of a Cell 4..2.2 Structure and function of a cell 4.2.3 Looking plant cell and animal cell under light microscope. 4.2.4 Cell shape and size 4.2.5 Animal cell and plant cell-comparism 4.2.6 Unicellular organisms 4.2.7 Multicellular organisms 4.2.8 Cell, Tissue, Organ, and organ system 4.2.9 Respiration and Mitochondria 4.2.10 Photosynthesis and Chloroplast	• Ask students, in groups of five students, to discuss and list down the structural components of a house, which can be a wooden/ mud-walled or brick-walled. • Ask the students to individually think and list down the commonly known external and internal organs of human body • Make the students take a moment and think about how these various body organs are assembled together to form our body, by correlating it with a house structure. • Take a particular human body part, say liver, and ask the students to discuss and in groups if it is made up of further smaller parts or not; finally you reflect on the students answers. • Investigate the structure of plant cell and animal cell under the microscope • Briefly explain to the students the story of how the cell was discovered by Robert Hooke in 1665 and by A. V. Leeuwenhoek (pronounced as Lay-Van-Hook) in 1674, followed by an explanation that all living things are basically made up of units called cells. • Show charts of typical animal	• Observe students activities while they are discussing in groups • Record the results of the students‘ discussions. • Question and answer on the definition of a cell. • Question and answer on the examples and functions of major cell structure. • Give students group presentation on the story of cell discovery • Ask students to explain the purpose of respiration and photosynthesis • Request students to individually draw a typical animal cell and plant cell on a sheet of paper, label its parts and submit • Ask students to list down any questions they have from the chapter. • Provide descriptive feedback on the students‘ responses to the questions, diagram of the cell they have submitted, and gaps observed indicating how they shall improve their learning. • Question and answers on what structures are common to plant and animal cell, animal cell only and plant cell only • Observe students‘ activity while investigating plant and animal cells

		and plant cells to students, and ask students to identify and list down the various labelled structural parts of a cell from a chart ; students should focus on identifying cell membrane, cell wall, cytoplasm, nucleus, and, vacuole,) • Group students into five and let students compare and contrast the major structures common to both animal cells, plant cell only and animal cell and make inference • Ask students to individually identify and present to a class any differences in structure, shape, etc. they have observed between the animal and plant cells and ask students why the shape and structure of cells vary • Briefly explain to the students the functions of cell wall, cell membrane, nucleus, cytoplasm, mitochondria and chloroplast. • Show a chart of cells with different shape and size, and ask students why cells come with varied shape and size; finally, you reflect on their answers. • Ask students how many cells they think that their body is made of; also ask them if they know of organisms whose body is made up of just a single cell (e.g. amoeba, baker‘s yeast, paramecium, etc.) • Using a chart, show students	

		drawings of unicellular organisms such as paramecium, amoeba, and multicellular organisms such as human, elephant and a tree, and ask them which of these are made up of single cell (i.e. unicellular organisms), and which organisms in the chart are made up of many cells (multicellular organisms). • Let students discuss that the life function of a cell and organism is the same in unicellular organism while in multicellular organisms it is not. Hence, a single cell in multicellular organism is incapable of living independently. Here it is better or entry point to introduce the concept of specialization and division of labor in multicellular organisms • Ask students if they know the differences among cell, tissue, organ and organ system in their own body • Demonstrate these different levels of biological organization to students using students themselves as follows: ask one student to sit separately from the rest of the students (representing a cell), form two or three groups of five students each (each group representing tissue), then combine each group into one bigger group (representing organ), combine	

		two bigger groups to form much bigger group (Organ system) • Ask students how the energy in the food we eat is released to our body; ask them the role of oxygen we inhale; ask them the relationship between the food we eat and the oxygen we breathe in. • Explain briefly to students how energy in the food can be released in a cell without oxygen (anaerobic respiration) and with the use of oxygen (aerobic respiration), and where each occurs in a cell with the differences in the amount of energy released from the same amount of food during each process. • Tell students that mitochondria of the cell are termed as –power house‖ of a cell, and ask them to reason out why. • Ask students to write word chemical equation of aerobic respiration (refer to Unit 3 for learning on chemical equation) • Ask students, if respiration is a function of both animals and plants, and why? • Write down the word equation of photosynthesis (refer to Unit 3 for learning on chemical equation) for students, and ask them for any difference with that of respiration; then, ask them what this process maybe termed.	

		• Briefly explain to students what a photosynthesis is and its role. Tell them that it takes place in chloroplast, and then ask them if photosynthesis is a function of animals or plants, and to reason out why. • Use a chart to demonstrate to students that mitochondria and chloroplastare cell structures where aerobic respiration and photosynthesis take place, respectively.	

Unit Five: Living things and their diversity (23 periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Distinguish between living and non-living things by describing the features that characterize living organisms
- Discuss if movement i.e. locomotion can characterize all living things or not
- Define classification and its purpose
- Explain the purpose of scientific name
- List down the hierarchical levels in the classification of organisms
- Describe the distinguishing characteristics of kingdom Animalia, Plantae, Protista, Monera and Fungi.
- List common examples of animals, Plantae, Protista, Monera and Fungi
- Describe the body plan of a common animals, Plantae, Protista, Monera and Fungi
- Describe habitats of animals, Plantae, Protista, Monera and Fungi

Competencies	Contents	Learning Strategies	Assessment
• Differentiate between living and non-living things • Organize and describe characteristics of living things • Justify why movement or	**5.1 Living Things (9 periods)** 5.1.1 Characteristics of living things -movement -respiration	• Organize students into groups and ask them to discuss the differences between living things (e.g. butterfly) and non- living things (e.g. stone).	• Observe students while they are discussing about the living and non- living things and make sure that all students are participating in the group discussion and activities

locomotion from one place to another cannot be a defining characteristic of all organisms • Relate diversity with classification of organisms • Justify why scientific names of organisms should be used in science than the local names • Analyze and describe the relationships of the hierarchical levels (Kingdom to Species) in the classification of organisms	- sensitivity/ irritability -Reproduction -Nutrition -Growth -Excretion -Adaptation	• Invite the students to make a presentation of their discussions turn by turn. • Give brief summary of characteristics of living things such as growth, reproduction, respiration, and adaptation to changes in the environment. • Now, ask students to tell if a plants are categorized as living things or non-living things, and justify why. • Ask students to discuss and explain in groups if ―movement or locomotion from one place another‖ can be taken as a defining characteristic of all living things, and why. • Tell students in a very simple term that –classification‖ means –sorting‖ things based on defined characteristics or criteria. • Now, invite students to come forward turn by turn and classify their classmates into some groups based on their own criteria. • Write down the structural hierarchy of Ethiopia: Country, Region, Zone, Wereda and Kebele. • Organize the students into groups give them a chance to discuss in groups the relationships among these different structural levels. • Invite the students to make	• Record the results of the students presentations on the differences between the living and non-living things • Provide constructive comments on the gaps observed in the students‘ presentations. • Question and answers on why classification is important in biology • Record the results of the students‘ presentations on the relationships of the administrative structures: Country, Region, Zone/kifle ketema,, Wereda and Kebele. • Provide constructive comments on the gaps observed in the students‘ presentations. • Observe students responses on how to correlate the biological levels of classification with the administrative structural levels of Ethiopia (Country to Kebele) • Constructive feedback on comments given by each student if they can repeat the mnemonic of biological levels of classification at the start of every class until this content is completed • Written/test/quiz to students using analogy method by relating a large tree with classification hierarchy • Performance assessment on how students demonstrate the hierarchy of classification by drawing or making concentric circles or any model • Observe students while they are discussing about the grouping of organisms from the provided charts and make sure that all students are

		presentations of their discussions turn by turn. • Now, briefly introduce to students that classification of organisms (biological classification) is conducted in hierarchy from largest levels to lower levels in the same fashion as the above mentioned administrative levels. • List down the hierarchical levels in the biological classification as: Kingdom (highest level), Phylum (Division in plants), Class, Order, Family, Genus and Species (the lowest level). • Ask students if they can coin mnemonics using first letters of the levels such as –K‖ for Kingdom, –P‖ for Phylum, etc. for easy and frequent memorization of the levels • Give the students an example of such mnemonic as: **K**ing **P**hilip **Ca**me **O**ver **F**or**G**ood **S**paghetti (KPCOFGS) or **K**indly **P**ay **C**ash or **F**urnish **G**enuine **S**ecurity • Allow students to always rehearse this mnemonic at the beginning of your class until this Unit is completed. • Provide the students with samples of plants found in the school compound, and ask them to name each with the locally known names. • Give students a chance to discuss and explain why name is important.	participating in the group discussion and activities • Encourage students to make presentations of their discussions on classifying organisms into some groups from the provided charts; provide constructive comments on the gaps observed in the students‘ presentations. • Question and answer(oral quiz) on why scientific name should be used and how the scientific name is written over the local name in science • Provide descriptive feedback on all the students‘ activities, indicating how they shall improve their learning.

		• Explain to students that organisms can be known by their local names or scientific names, and the differences of the two names • Give example of scientific names (e.g.*Homo sapiens* for Human species), and explain to them that it is known as Binomial naming. • Ask students to explain what each word may stand for, why the first name should be always written in capital initial letter and the second name in lower case. • Ask students to search for the local and scientific names of a wide variety of living things (e.g. plants, animals, fungi, bacteria) from Internet and other sources, and submit it for assessment.	
• Compare the five Kingdoms of living things by describing their distinguishing characteristics • Summarize the commonest examples of organisms belonging to each Kingdom • Describe the body plans of insects such as butterfly, amphibians such as frogs, mosses, liverworts, ferns, conifers such as junipers, flowering plants, Paramecium, Algae, and Mushroom • Describe the body plan for different organism belong to kingdom Animalia.	**5.2 Kingdoms of Life** (14 periods) 5.2.1. Kingdom Animalia • Major characteristics of animals • Major groups of animal and their habitats: Invertebrates (worms, insects), Vertebrates (fish, amphibians, reptiles, birds & mammals) 5.2.2. Kingdom Plantae • Major characteristics of plants • Major habitats of plants : seedless plants (bryophytes,	• Introduce the topic by brainstorming students on the multitude diversity of living things on the planet Earth; • Organize students into groups, and ask them to to identify the major groups of animals and their habitats. • Organize students into groups, and ask them to to identify the major groups of animals and their habitats. • Allow students to make	• Observe students while they are discussing about classifying organisms from the provided charts and make sure that all students are engaged in the group discussion and activities • Record the results of the students‘ presentations on classifying the organisms provided in the charts. • Provide constructive comments on the gaps observed in the students‘ presentations. • Question and answers on how students differentiate among the five

• Describe the body plan for different organism belong to kingdom plantae. • Relate each Kingdom of organisms to their major habitat types as aquatic, terrestrial or moist	pteridophytes) seed bearing plants (gymnosperms, flowering plants) Major groups of plants and their habitats: seedless plants (bryophytes, pteridophytes, gymnosperms), seed plants (flowering plants)	presentations of their discussions • Challenge students with a question that there are organisms in the provided charts that are neither animals nor plants. • Now, introduce to the students the concept that living things can be classified into five broad categories at Kingdom level as Animalia, Plantae, Protista, Monera and Fungi • Again ask the students to re- work on the already provided charts and categorize the organisms under any of these five groups; ask students for their reasons to assign the organisms to any one of the Kingdoms, and explain why. • Now, briefly summarize the major distinguishing characteristics of each kingdom including their habitats (as aquatic, terrestrial, moist, etc.); give examples of each, and ask the students to accordingly verify their group work on classification against the conceptual explanation you provided. • Organize a schedule for students to make collection of flatworms and insects (butterfly) from the school compound and the surrounding	Kingdoms of living things by describing their distinguishing characteristics • Students should give examples of organisms that belong to each Kingdom. • Supervise and guide the students in all of the suggested practical activities; make sure active participation of each student. • Ask students to discuss among themselves and reflect on why it is important to handle animals with maximum humanity (care) when collecting and working on them for scientific studies. • Provide descriptive feedback on all the students‘ activities, indicating how they shall improve their learning.

		environment and identify their parts; guide students with provision of the necessary materials as well as with orienting students on careful (humane) handling of the animals during collection, killing (when necessary), and using them to identify major structural parts. Where collection of these organisms from the school compound or its environs is not possible, the teacher should look for options of visiting pedagogical center in the school that may have collection of these organisms. • Organize a schedule for students to make collections of amphibians (frogs) from the school environment and identify their body parts; guide students with provision of the necessary materials. • Organize a schedule for students to make collection of mosses, liverworts, ferns, Junipers, flowering plants from the environment and identify their major parts; guide students with provision of the necessary materials; guide students with provision of the necessary materials. • Make arrangements for the students to grow (culture) paramecium (a protozoan) in the lab using hay infusion, and observe its parts under a microscope.	

		• Place hay in a plastic beaker of reasonable size and cover it with water, and leave it as side in the lab at least for one week before you return to check for the growth of a paramecium. • Organize a schedule for students to make collection of algae from moist areas and describe their major parts; guide students with provision of the necessary materials. • Organize a schedule for students to make collection of Mushroom from the environment and describe their major parts; guide students with provision of the necessary materials.	

Unit Six: Earth in Space (16periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Describe the shape, dimensions and motion of the earth.
- Construct the model of earth and use it to explain phenomena related to its motion

Competencies	Contents	Learning Strategies	Assessment
• Describe the shape of the earth • Identify evidences supporting the shape of the earth • List local and global ideas about the shape of the earth • Name dimensions (circumferences, diameters, and angular distances) of the earth	**6.1Shape & dimensions of the earth** **(6 periods)**	Allow students to build model of the earth. Make to discuss about the shape, body parts, movement and dimension of the earth. Make a group of 4 students to make a discussion about circumferences, diameters, and angular distances and parts of the earth. Give individual exercise on what will happen when the earth moves on itself and about the sun. Allow students to find evidences supporting the shape of the earth from intermediate and other references.	• Assist the discussion and give feedback. • Monitor Presentation • Follow the exact representation of model. • Follow what they search about shape of the earth.
• Recognize all parts of the earth • Describe the organization and contents of the different parts of the earth • Explain different observations about the earth in terms of the nature and behaviors of the different parts of the earth.	**6.2 Parts of the Earth (Body & Atmosphere)** **(5 periods)**	Allow each student to name all parts of the earth Make a group and discuss on organization and contents parts of the earth Using intermediate connection (references) explain about the earth in terms of the nature and behaviors of the different parts of the earth.	• Assist the discussion and give feedback. • Observe what they search from different sources
• Demonstrate movements of the earth (revolution and rotation) • Explain the effects of motions of the earth • Construct the model of earth and use it to explain phenomena related to its motion	**6.3 Movements of the Earth** **(5 periods)**	• Using torch (light) lighting on prepared model of the earth .Show movement of the earth .Explain effects of motions of the earth	• Strictly follow whether the give clear movement and effects of the earth.

Unit Seven: Motion, Force, Energy and energy resources (28 periods) Periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Explain types of motion.
- Demonstrate the pulling/pushing activity of force.
- List all effects of force.
- Relate effects of force with their daily life experience
- Understand the concept of energy.
- Distinguish between renewable and non-renewable forms of energy.
- List the strategies of conservation of energy
- **Identify types of motion**

Competencies	Contents	Learning Strategies	Assessment
• Describe the term motion • Identify types of motion based on the shape of the path. (rectilinear motion, circular motion, rotary motion and curvilinear motion) • Demonstrate hose types of motion in the class.	**7.1 Definition and types of motion** **(2 periods)**	Enable students in categorizing types of energy existing in their surroundings. Make a group and discuss on identifying different forms of energy and its source. Make every student to practice how to use and conserve energy in their daily life experience.	• Assist the group and provide constructive feedback to improve their learning. • Asking student how they are using and conserve energy

• Explain the term force. • Demonstrate the pulling/ pushing activity of force. • Explain gravitational force.	7.2 Definition of force and gravitational force (3 periods)	• Ask each student to explain force • Take two students in front of the class and allow to show the pulling/ pushing activities to define a force • Ask the student why every thrown object falls o the ground? And make to explain gravity.	• Follow what they do in the activity and give constructive feedback
• List effects of force • Demonstrate some effects of force. • Relate effects of force with their daily life experience	7.3 Effects of force (4 periods)	• Ask student to write ffects of force • Enable students to demonstrate all effects of force in the class in front of the student • Retrieve from the students all effects of force face them in their daily life experience.	• Ask student to reflect what they know about effects of force
• Name measuring device of force • Identify different measuring scales on measuring device of force • Explain parts of measuring device of force	7.4 Measuring forces (4 periods)	• Make a group and allow to name measuring device of force • Take a sample of force measuring device allow student to show the scale of division. • Enable students to show all parts of the measuring device of force	• Assist the group and follow showing exact scale of measuring device
□ Define energy as a property of matter that can be converted from one form to another form.	7.5 Definition of Energy (3 periods)	□ Make students to bring the definition of energy from different sources (books, internet, parents, etc.).	□ Observe what they bring from different sources

• List all forms of energy • Explain which energy converted to other forms of energy.	7.6 Forms and Conversion of Energy (3periods)	• Make a group. Allow the group to list some forms of energy. Identify to which forms of energy they are converted.	• Assist the group and give constructive feedback
• List sources of energy. • Distinguish between renewable and non-renewable forms of energy.	7.7 Energy Sources (sun, fuel, hydroelectric, wind, nuclear) (3 periods)	• Make a group and allow to list all forms of energy and differentiate renewable and non-renewable forms of energy	• Strict follow the group and give constructive feedback
• Describe how energy is used wisely. • List the strategies of conservation of energy	7.8 Wise use & Conservation of energy (2 periods)	• Give reading assignment and make to present wise use of energy and strategies of conservation of energy	• See strictly their assignment
• Explain resource depletion and environmental degradation.	7.9 Resource depletion & environmental degradation (3 periods)	• Make a group and discuss on resource depletion and environmental degradation. • Ask students to identify all types of motions.	• Assist the group and give constructive learning

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