Contemporary Science

TEACHER'S GUIDE

For Junior High Schools

9

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PREFACE

The Contemporary Science for Basic 7-9 is a set of three books developed for use by learners in Basic 7, 8 and 9 in Ghana. The books conform with the New Curriculum designed for Basic Schools in Ghana by the National Council for Curriculum and Assessment (NaCCA) for the Ministry of Education.

The set of books will enable learners acquire experiences for post-secondary education and work place. They are based on a Common Core Programme (CCP) that emphasises a set of high, Internationally bench-marked career and tertiary education readiness standards, for critical thinking and Problem Solving. The standards articulate what learners are expected to know, understand and be able to do by focusing on their social, emotional, cognitive and physical development.

The books have suggested the use of locally available materials that can be seen in the Ghanaian environment. Essentially, the content standards run through the entire curriculum with different aspects being emphasised each year.

The language is simple. Subject Specific Practices and Core Competencies have been integrated to enhance the acquisition of core skills by learners and also to develop cognitive, reasoning problem solving innovators.

The illustrations in the books will help learners understand scientific concepts easily. Study questions have been included to enable the learners assess themselves after every unit.

It is envisaged that the provisions in the books will help learners to fully acquire the knowledge, competencies and skills integrated in the new science curriculum. It will also assist the learners to understand basic scientific concepts and become critical thinkers, problem-solvers, creators, innovators, global communicators, collaborators, digitally-literate, culturally and globally sensitive citizens who will learn all their lives for personal development.

The guide is the main material that gives the appropriate methods, strategies, procedures, planning and resources for teaching the subject. It has Additional Information, Diagnostic Assessment Questions, Answers to all Study Questions and guidelines for all Test of Practical Activities, Group Work and Project Work.

The writing panel is a group of well-known Science educators. The books have been developed out of their wealth of experience acquired over the years in the field of Science education.

INTRODUCTION

The Teacher's Guide has been developed to empower teachers to be able to effectively assist learners as they make use of the Learner's Book. One outstanding feature of the Teacher's Guide is the fact that it clearly outlines the steps to be followed by teachers in ensuring the conduct of learner-centred Science Lessons that promote the acquisition of relevant science process skills by learners, hence improving their attitude towards the study of this integral subject. Each session within the guide contains approaches to enable teachers to clearly perform their roles as facilitators of the learning process.

The guide promotes meaningful learning by creating a clear link between the concepts to be taught and the daily experiences of the learner as well as the practical usefulness of the concept. One of the main features of the Science curriculum for Junior High School is the focus on the acquisition of core competencies and 21st Century Skills such as critical thinking and problem solving, communication and collaboration, digital literacy, creativity and innovation, cultural identity and global citizenship. In order for learners to acquire and exhibit these core skills, it is critical for teachers to create the opportunities for learners to explore and enjoy science learning through the use of different strategies and pedagogies.

A key aim for the science curriculum is to shape individuals to become scientifically literate, good problem solvers, with the ability to think creatively and develop the confidence as well as the competence to participate fully in the Ghanaian society as responsible local and global citizens. In order for this aim to be achieved, teachers need to create an enabling classroom and school environment. In this vein the guide outlines how teachers can achieve this target through adequate pre-lesson preparation, use of appropriate resources, learner-centred and dynamic classroom delivery.

In modern times, assessment is regarded as a crucial tool for promoting the attainment of learning outcomes rather than merely evaluating what the learner has learnt. The assessment provisions in the Teacher's Guide cover assessment for Learning, Assessment as Learning as well as Assessment of Learning strategies.
In each Lesson of the Teacher's Guide, the user (teacher) is provided with guidelines on how to make effective use of ICT as a pedagogical tool and also for the promotion of the acquisition of digital literacy skills by learners. Inclusivity in the science classroom is also promoted through the suggestion of different teaching and assessment strategies that cater for learners of different learning styles and abilities.

Other key features of the Guide include the suggestions of home learning activities to promote further study of science, provision of answers to various assessment tasks in the Learner's Book and the prompters to enable the teachers evaluate their own classroom delivery of each lesson. Summarily, the effective use of the guide by teachers will make science learning enjoyable for all learners and ultimately ensure the attainment of learning outcomes in the Learner's book as well as the Curriculum.

ORGANISATION OF THE TEACHER'S GUIDE

Strand: Strands are the broad learning areas or domains of the subject content to be studied.

Sub-strands: Sub-strands are the sub-divisions of the broad learning areas or strands.

Indicators: Indicators are clear outcomes or milestones that learners have to exhibit in each year to meet the content standard expectation. The indicators represent the minimum expected standard in a year.

Lesson: These align with the order of lessons in the Learner's Book and aid in cross referencing between the Guide and Textbook.

Teaching and Learning Resources:
This part details the relevant sources required for the effective teaching of the lesson. This includes improvised resources, ICT equipment such as mobile phones and laptops, science equipment and readily available local resources. Teachers are expected to gather these resources or in some cases, task learners to bring them to class in order to promote effective and interesting science learning.

Reference to Learner's Book pages: Refer to Learners Book pages
The purpose of this section of the guide is to ensure the alignment of the Guide to the Learner's Book. It promotes easy and seamless transition between the Guide and Leaner's book by directing the users of the Guide to relevant portions of the Textbook for purposes of easy cross referencing.

Learning Expectations:
These are learner centred outcomes that clearly outline what learners are expected to know, understand and be able to do after the lesson. They are provided to remind and guide teachers on the skills and competencies that their learners must demonstrate after the lesson as evidence of the acquisition of the target of the indicator.

Keywords:
The keywords here refer to subject specific words and terminologies that feature prominently in the lesson. The teacher is expected to understand these terminologies and also ensure the learners understand them.

Prior Preparation:
This sub-section of the Guide seeks to assist the teacher to prepare adequately before the actual classroom delivery.

Background:
The purpose of the background session is to provide basic and fundamental knowledge about the concept to be learnt. It also creates links between the present lesson and previous ones. The background also covers the real life application of the concept to be taught.

Additional Information:
This refers to further details on the concept of interest. It builds on the background and provides further insight about the lesson to the teacher.

Diagnostic Assessment:
The tasks set under the diagnostic session are meant to guide the teacher in identifying the possible challenges that will prevent the learners from achieving the set targets. It is expected that after diagnosis, the identified issues will be addressed in order to promote effective learning.

Teacher-Learner Activities:
This section contains the suggested approaches that will guide the teacher to effectively deliver the lesson in class. They are mostly learner-centred strategies.

Skills and Competences:
The subject specific skills as well as general 21st century skills and competencies that teachers are expected to promote in the lesson are captured under this section. They closely align with the Teacher-Learner activities.

Progress Assessment:
The progress assessment tasks are meant to consolidate the gains of learning and also scaffold further learning y identifying areas where clearers face challenges as the lesson proceeds, in order to provide the necessary redress.

Key Points of Lesson:
This section provides the essential aspects of the lesson which teachers need to stress on and which learners also must grasp.

Reflection:
Under this section, relevant questions are posed to enable the classroom practitioners to evaluate their classroom delivery and make necessary adjustments where the need be.

GOAL OF THE CURRICULUM

Goal:
The CCP science curriculum is to develop individuals to become scientifically literate, good problem solvers, have the ability to think creatively and have both the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens.

Specific Aims:
The curriculum of the Common Core Science Programme for B7 to B9 is designed for learners to achieve the following aims:

1. Develop the spirit of curiosity, creativity, innovation and critical thinking for investigating and understanding their environment.
2. Develop skills, habits of the mind and attitudes necessary for scientific inquiry.
3. Communicate scientific ideas effectively.
4. Use scientific concepts in explaining their own lives and the world around them.
5. Live a healthy and quality life.
6. Develop humane and responsible attitude towards the use of all resources in Ghana and elsewhere.
7. Show concern and understanding of the interdependence of all living things and the Earth on which they live.
8. Design activities for exploring and applying scientific ideas and concepts.
9. Develop skills for using technology to enhance learning.
10. Use materials in their environment in a sustainable manner.

Expected Learning Behaviours:
The three integral domains that should be the basis for instructions and assessment include:

- Knowledge, Understanding and Application
- Process skills
- Attitudes and Values

Conclusion:
The Contemporary Science for Basic 7 to Basic 9 and their accompanying Teacher's Guides have been carefully written and designed to offer learners the opportunity to apply what they learn in their everyday activities.

Teaching is an art, and classroom situations differ under different learning environments. For that matter, do well to complement the texts in the Learner's Book and the guidelines in the Teacher's Guide with other relevant resources that suit your environment.

CONTENTS

STRAND 1

DIVERSITY OF MATTER

Unit 1: Materials

CONTENT STANDARD: B9.1.1.1 Show an understanding of formation of binary chemical compounds and their uses (Acids, Bases and Salts).

INDICATOR: B9.1.1.1.1 Identify by name binary chemical compounds and discuss their uses

LESSON 1: BINARY CHEMICAL COMPOUNDS

Teaching and Learning Resources:

- samples of common binary compounds such as sodium chloride, water, mouth wash and sand, other compounds such as sugar and chalk.

Learner's Book 9: pages 1-8

Learning Expectations:

By the end of the lesson, the learner will:

1. explain what a binary compound is and give examples
2. list some common binary compounds and their uses

Keywords: compound, binary, formula, ammonia, carbon dioxide

Prior Preparation:

- Before the lesson bring samples of some common binary compounds such as water, sodium chloride and Sand (SiO2)
- Ask learners to find out about binary compounds and name three examples

BACKGROUND

Chemical compounds are classified based on their composition. Two or more elements combine to form a compound.

In chemistry, a binary compound is a chemical compound consisting of two different elements.

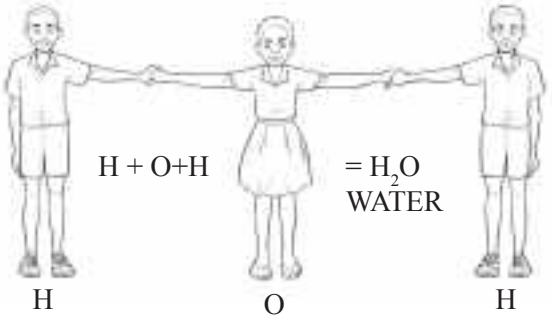
Additional Information:

What is a binary compound? Chemical compounds are substances that are made of two or more different elements. An element is a substance that is made of the same type of atom. Such substances are the fundamental building blocks of more complex compounds; they cannot be divided into simpler particles but they combine to make compounds. Chemical compounds can be divided into groups according to the types of bonds that hold their atoms together. They can also be

separated into categories according to the number of elements they contain. Some compounds are made of two different elements, while others are made of three or more different elements. A binary compound is a chemical compound that is made of atoms of two different elements. The prefix bi- means two or double. Many words in the English language uses this prefix in many common words like bilingual, biceps, and bicycles.

The binary compound definition states that such compounds are made of two elements only. The number of atoms of each element is not disclosed. What is always true of a binary compound? The main binary compound criterion states that they must contain only two elements; the number of atoms and the type of chemical bond is both irrelevant. A water H_2O molecule is made of three atoms. In spite of that, it is still classified as a binary compound because it is made of two elements.

Fig. 1



Water is made of three atoms: 2 hydrogens and 1 oxygen.
It is a binary compound because it is made of two elements.

Types of Binary Compounds

Binary compounds consist of a broad category of compounds that are composed of two elements only. They can be further classified into the following:

- Binary acids
- Binary ionic compounds
- Binary covalent/molecular compounds

Diagnostic Assessment

3. Write a list of different compounds and mixtures on the board.
4. Ask the learners to work in mixed ability groups to sort the compounds into binary compounds and other compounds which are not binary.
5. Each group presents their work and explain the reasons for their answer.
6. With the aid of the sample compounds provided, explain to students the concept of binary compounds and write examples of same on the board, showing their formulae.
7. Ask the learners to write down the chemical formula of other binary compounds they know.
8. Ask the learners to work individually to identify other common compounds and their uses.

Activity 1: Refer to page 3 of Learner's Book 9.
Guide learners to perform Activity 1 as indicated in the learners book.

Skills and Competencies
Comparing, analysing, recording, communication, personal development, collaboration, problem solving

Progress Assessment
Let learners match different binary compounds with their formulae and uses.

Key Points of Lesson
- A binary compound is a compound that consists of atoms of two different elements only.
- Common examples of binary compounds are water, carbon dioxide, ammonia and common salt.
- Some binary compounds are used for purposes such as cooking, preparation of drugs, cleaning and construction of buildings.

Reflection
Using the questioning technique, find out whether the learners are able to identify what makes binary compounds different from other compounds (in terms of their composition and chemical formulae)

ANSWERS TO END OF LESSON EXERCISE

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

Answers to Essay Type Questions
1. Refer to pages 1-3 of Learners' Book 9.
2. Refer to pages 1-3 of Learners' Book 9.
3. Refer to page 1 of Learners' Book 9.
4. Refer to pages 1-3, 5 of Learners' Book 9.

INDICATOR: B9.3.1.1.1.2 Discuss the formation of binary chemical compounds.

LESSON 2: FORMATION OF BINARY CHEMICAL COMPOUNDS

Teaching and Learning Resources:

- Chalk, marbles, bottle tops or any other counters, cut outs showing the electronic configuration of some common elements,

Learner's Book 9: pages 9-22

Learning Expectations:

By the end of the lesson, the learner will:

1. write down the building blocks of matter
2. distinguish between elements and compounds
3. differentiate between the three types of binary compounds
4. make illustrations to show how binary compounds are formed.

Keywords: elements, compounds, ionic, covalent

Prior Preparation:

- Ask learners to come to school with counters of different colours
- Prepare and cut card boards showing the configurations of different elements (one on each cardboard)
- Ask learners to find out the meaning of the terms covalent compounds and ionic compounds.

BACKGROUND

Although a binary compound contains only two elements, it can contain more than two atoms. The three types of binary compounds are binary acids, binary ionic compounds, and binary covalent compounds. There are differences between the different types of binary compounds. But they are all made up of building blocks namely, atoms, ions and molecules.

Additional Information:

Ionic bonding involves the complete transfer of valence electron(s) between atoms and is a type of chemical bond that generates two oppositely charged ions. It is observed because metals have few electrons in its outer-most orbital. By losing those electrons, these metals can achieve noble-gas configuration and satisfy the octet rule. Similarly, nonmetals that have close to 8 electrons in its valence shell tend to readily accept electrons to achieve its noble gas configuration. Binary molecular (covalent) compounds are formed as the result of a reaction between two nonmetals. Binary acids are acids composed of two atoms, a hydrogen element and a nonmetal element.

Hydroiodic acid, hydrofluoric acid, and hydrobromic acid are binary acids because they have a hydrogen element and nonmetal element (iodine, fluorine and bromine) bonded together. In contrast to metals, which are shiny and ductile, nonmetals are dull and brittle.

Diagnostic Assessment
Through a whole group discussion, let learners brainstorm on the meaning and differences between covalent and ionic compounds.

Activities

- With the aid of a chart on the periodic table, explain the differences between atoms, ions and molecules.
- Using the cut-outs on the electronic configurations of different elements as well as simulations, assist learners to know the differences in how ions and molecules are formed from atoms.
- With the aid of the cut-outs relate the formation of ions to the formation and definition of binary ionic compounds.
- Similarly, use the cut-outs to relate the formation of molecules to the formation of covalent compounds.
- Explain the formation of binary acids to learners.
- Let learners brainstorm to find out why some covalent compounds such as sugar and petrol have low melting points whilst ionic compounds have high melting points.

Lead learners to perform Activities 1, 2 and 3 on pages 10, 18 and 20 of Learners' Book 9 respectively.

Skills and Competencies
Observing, evaluating, personal development, critical thinking, creativity, problem solving

Progress Assessment
Learners sort out a list of binary compounds into ionic, covalent and acids with reasons.

Key Points of Lesson

- The building blocks of matter are atoms, ions and molecules
- Atoms, ions and molecules make up all the things we see around
- An element is a substance made up of one kind of atoms and cannot be broken down into simpler form by any known chemical means.
- A compound is formed through the chemical combination of two or more different elements in a fixed ratio,
- The three types of binary compounds are binary acids, binary ionic compounds, and binary covalent compounds.

- A binary acid consists of a hydrogen cation bonded to another atom as an anion.
- A binary ionic compound is formed through the transfer of electrons from one atom to another.
- Binary covalent compounds form when two nonmetals form a covalent bond.
- Binary Ionic compounds have properties which are different from binary covalent compounds.

Reflection
After going through the lesson, identify areas where learners still face challenges for further explanations.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 14 of Learners' Book 9.
2. Atoms, ions and molecules.
3. Refer to pages 16 and 18 of Learners' Book 9.
4. i. Refer to pages 16 and 18 of Learners' Book 9.
   ii. Refer to page 17 of Learners' Book 9.

INDICATOR: B9.1.1.1.3 Describe the characteristics of common acids,Bases and salts.

LESSON 3: ACIDS, BASES AND SALTS

Teaching and Learning Resources:

- Samples of acidic substances such as lime, orange, lemon, vinegar, lime water, milk of magnesia, common salt and limestone, a PH Scale, samples of common indicators such as litmus paper.

Learner's Book 9: pages 23-33

Learning Expectations:

By the end of the lesson, the learner will:

1. distinguish between acids and bases in terms of their properties
2. explain how salts are formed through neutralization reactions
3. demonstrate how to use the pH scale to determine whether a substance is acidic or basic.

Keywords: acids, indicator, base, salt, neutral, pH scale

Prior Preparation:

- Gather the resources such as sample acids, bases and salts
- Create a copy of the pH scale on a cardboard

BACKGROUND

Acids, bases and salts are important in our day-to-day life. They can be easily identified by their taste. Usually, acids taste sour and bases taste bitter.
Acids are usually found in many substances including various food items such as fruits.

Apart from these, there are some acids which are widely used in the laboratory, like the hydrochloric acid, sulphuric acid and nitric acid.
Usually, bases are found in household cleaners used to clean grease from windows and floors and they are also found in soaps, toothpaste, dish washing liquids and household ammonia.

Additional Information

Many of the acids that we do not consume in the household are used in the laboratories and industries. They include acids such as HCl and H_2SO_4 etc, and bases such as NaOH, KOH etc. When these acids and bases are mixed in the right proportions, the neutralization reaction thus results in the formation of salt and water. Some naturally occurring salts found in nature include NaCl and KCl etc in seawater and natural rock deposits. In this section, we will read more about acid, base, and salt and their properties.

Definitions

- A**cid:** An acid is defined as a substance whose aqueous solution tastes sour, turns blue litmus red, and neutralizes bases.
- **Base:** A substance is called base if its aqueous solution tastes bitter, turns red litmus blue, or neutralizes acids.
- **Salt:** Salt is a neutral substance whose aqueous solution does not affect litmus.

Diagnostic Assessment

Create three columns on the board and write the words Acids, Bases and Salts in the columns respectively.

Ask learners to write what they know about acids, bases or salts in the appropriate column.

Activity (i):
Show a video on acids, bases and salts and their properties.

Activity (ii):
Ask learners to write the key points under each of the substances using a word cloud on each of the substances (Acids, Bases and Salts).

Activity (iii):
Place learners into three broad groups and assign them to study about the concept prior to the lesson. Each group should do a 10 minute presentation on Acids, Bases or Salts.

Activity (iv):
After the presentation summarise the key points and show learners the sample bases, acids and salts.

Activity (v):
Use the Vinegar and limestome or soda to demonstrate the formation of carbon dioxide by acids when they react with carbonates.

Activity (vi):
Assist learners to demonstrate the formation of salt using dilute HCl and NaOH.

Activity (vii):
Draw a pH Scale on the floor or on the school compound and assist learners to identify the positions of Acids, Bases and Salts on the Scale.

Guide learners to perform Activities 1, 2, 3, 4 and 5 on pages 25, 27, 30 and 32 of Learners' Book 9.

Skills and Competences
Experimenting, investigating, recording, digital literacy, personal development, collaboration and communication.

Progress Assessment
Give learners a take home assignment to identify the pH values of common acids, Bases and salts

Key Points of Lesson

- An acid is a substance that dissociates in water to produce hydrogen ions. It is also a substance that reacts with a base to form salt and water.
- A base is a substance that dissociates in water to produce hydroxide ions. It is also defined as a substance that reacts with an acid to form salt and water.
- A salt is formed when an acid reacts with a base.
- The pH scale is used to determine whether a substance is an acid, a base or is neutral.
- Acids have a pH range of less than 7, whilst bases have pH values which are higher than 7.
- Neutral substances have pH which is exactly 7.

Reflection
Using the questioning technique, find out whether learners are able to identify differences between acids, bases and salts in terms of pH range, colour change on litmus paper, taste etc.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. i. Refer to page 24 of Learners' Book 9.
   ii. Refer to page 26 of Learners' Book 9.

2. Acids have sour taste but bases have bitter taste.
   Acids have pH less than 7 but bases have pH greater than 7.
   Acids change blue litnus paper red. bases change red litmus paper blue.

3. Refer to page 28 of Learners' Book 9.
4. Sodium Chloride (NaCl), Potassium nitrate (KNO_3), Ammonium Chloride (NH_4Cl)

CONTENT STANDARD: B9.1.1.2 Demonstrate knowledge of atomic bonding in the formation of chemical compounds.

Indicator: B9.1.1.2.1 Recognise that a chemical bond results from the attraction between atoms in a compound

LESSON 4: CHEMICAL BONDING

Teaching and Learning Resources:

- Chalk, marbles, bottle tops or any other counters, cut outs showing the electronic configuration of some common elements, sample metallic materials, water, and common salt.

Learner's Book 9: pages 34-42

Learning Expectations:
By the end of the lesson, the learner will:

1. identify the types of bond and explain how they are formed
2. distinguish between ionic, covalent and metallic bonding and their properties

Keywords: bond, electrostatic, sharing, covalent, molecular, ionic, metallic

Prior Preparation:

- Ask learners to come to school with counters of different colours.
- Prepare and cut card boards showing the configurations of different elements (one on each cardboard)
- Ask learners to find out the meaning of the terms covalent bonds and ionic bonds

BACKGROUND
We found out that different types of binary compounds contain different chemical bonds. Chemical bonding describes a variety of interactions that hold atoms together in chemical compounds. All the substances we see consist of bonds. A bond is a force of attraction between two or more different atoms. We will learn about the different kinds of bonds that exist in substances.

Additional Information
The attractive force which holds various constituents (atom, ions, etc.) together and stabilizes them by the overall loss of energy is known as chemical bonding. Therefore, it can be understood that chemical compounds are reliant on the strength of the chemical bonds between its constituents; The stronger the bonding between the constituents, the more stable the resulting compound would be. The opposite also holds true; if the chemical bonding between the constituents is weak, the resulting compound would lack stability and would easily undergo another reaction to give a more

stable chemical compound (containing stronger bonds). To find stability, the atoms try to lose their energy.
Whenever matter interacts with another form of matter, a force is exerted on one by the other. When the forces are attractive in nature, the energy decreases. When the forces are repulsive in nature, the energy increases. The attractive force that binds two atoms together is known as the chemical bond.

Diagnostic Assessment
Through a whole group discussion, let learners recall the key notes on the lesson on types of binary compounds.

Activities

- With the aid of a video explain to learners how covalent and ionic bonds are formed.
- Alternatively engage learners on a discussion on the electronic configuration of atoms of different elements.
- Through the use of marbles or role play activities, assist learners to know how ionic bonds are formed through the total transfer of one or more electrons between atoms of different elements.
- Let learners act out how covalent bonds are formed through the sharing of outermost electrons to obtain a stable electronic configuration.
- Provide samples of covalent and ionic compounds and assist learners to know the differences in properties of compounds containing ionic and covalent bonds.
- With the aid of the metallic materials explain the formation and characteristics of metallic bonds.
- Ask learners to work in pairs to relate the properties of metals to the bonds found in them (metallic bonds)

Assist learners to perform Activities 1 and 2 on pages 36 and 39 of Learner's Book 9 respectively.

Skills and Competences
Experimenting, evaluating, drawing conclusions, personal development, critical thinking, creativity, problem solving, digital literacy

Progress Assessment
Learners identify three differences between ionic and covalent bonds.

Key Points of Lesson

- What I have learnt.
- Chemical bonds are forces that hold atoms together to make compounds or molecules.
- Chemical bonds include covalent, ionic and metallic bonds.

- Covalent bonds are formed through the sharing of atoms by two or more atoms.
- Ionic bonds are formed when an atom transfers one or more electrons to another atom.
- Metallic bonds exist mainly in metals.

Reflection
After going through the lesson, identify areas where learners still face challenges for further explanation.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. a. Refer to page 39 of Learners' Book 9.
   b. Refer to page 36 of Learners' Book 9.
2. Refer to page 40 of Learners' Book 9.
3. Refer to page 37 of Learners' Book 9.
4. It has high melting and boiling point.
   It is soluble in water.
   It conducts electricity when it dissolves in water or in a molten form.

1 Sub-Strand 2: Living Cells

CONTENT STANDARD: B9.1.2.1 Demonstrate knowledge of specialist cells of dicotyledonous plants and humans, their formation and functions for the existence of the plants and humans.

Indicator: B9.1.2.1.1 Discuss the concepts of specialised cells and how they are formed in dicotyledonous plants and humans.

LESSON 1: SPECIALISED CELLS

Teaching and Learning Resources:

- Gather specimens or pictures of some specialized cells such as the leaf palisade cell, the sperm cell, egg cell, nerve cell and xylem cells, A4 sheets, scissors, pencils, poster colours and paper glue.

Learner's Book 9: pages 43-47

Learning Expectations:
By the end of the lesson, learners will:

1. explain the term specialized cell
2. explain how specialized cells are formed

Keywords: specialized cells, stem cell, differentiation, red blood cell, white blood cell

Prior Preparation:

- Prepare specimens or charts on specialised cells
- Ask learners to bring A4 sheets, cardboard and pencils to class for the lesson

BACKGROUND
Many cells are specialised. They have structures that are adapted to help them perform specific functions. For example, muscle cells bring parts of the body closer together. They contain protein fibres that can contract when energy is available, making the cells shorter. Plants also possess specialized cells that perform specific functions within the plant.
Specialised cells are cells that have certain characteristics to enable them perform specific functions.

Additional Information:
Most cells share features such as having a nucleus, a cell membrane, cytoplasm and mitochondria. Each type of cell has its own job to do. These cells have special features that allow them to perform their functions effectively.

Cell specialization allows new cells to develop into a range of different tissues, all of which work together to make living organisms function as a whole. The process of cell specialization – exactly how cells develop into their diverse forms – is complex. There are hundreds of specific cell types in the body that arise from the very basic and general type cells called stem cells.
All of the specialized cells in the body come from the same originating tissue: the group of stem cells that make up the earliest stages of an embryo. Stem cells are a unique type of cell, because, while they are immature cells without any specialization, they can follow a developmental "blueprint" to develop into the thousands of unique cell types found throughout your body.

Diagnostic Assessment
Ask learners to write down the similarities and differences between plants and animal cells as learnt in JHS 1.

Activity (i):
Review the key points on animal and plant cells studied in form one.

Activity (ii):
Display charts of specialized cells on the board and let learners identify the differences between specialized cells and normal cells.

Activity (iii):
Using a chart explain how specialized cells are formed from sperm cells through the process of differentiation.

Activity (iv):
Engage learners in a gallery walk activity to identify different specialized cells in animals and plants.

Activity (v):
Put learners into groups to engage in a matching activity on different specialized cells and their uses.

Activity (vi):
Let each learner draw and label at least two specialized cells and write down their functions.

Guide learners to perform Activity 1 and 2 on page 43 and 46 of Learners' Book 9 respectively.

Skills and Competencies
Observing, analysing, evaluating, digital literacy, personal development, creativity, critical thinking and communication.

Progress Assessment
Let learners work in groups of 3 or 4 to design posters on different specialized cells.

Key Points of Lesson

- A specialized cell is a cell which has special characteristics to enable it perform a unique function.
- A palisade cell is a specialised cell in a plant leaf which contains a lot of chloroplasts for photosynthesis.
- A guard cell is a specialised cell in a plant leaf which can change shape to allow or stop gases from getting into the leaf.
- A xylem cell is a specialised cell which is used to form tubes in the plant to transport water.
- A root hair cell is a specialised cell found in the roots of plants and is specially adapted to absorb water.
- Specialised cells in humans include the muscle cells, nerve cells, red blood cells, white blood cells and ovum/egg cells.
- A muscle cell is a specialised cell which can change its length to allow a creature to move.
- A nerve cell is a specialised cell in animals which transmits electrical impulses around the body
- A red blood cell is a specialised cell which carries oxygen around the body.
- A white blood cell is a specialised cell which is used to fight infection

Reflection
Using the questioning technique, find out whether learners are able to identify differences between specialized cells and ordinary cells.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 43 of Learners' Book 9.
2. Refer to page 44 of Learners' Book 9.
3. Refer to page 44 of Learners' Book 9.
4. Refer to page 44 of Learners' Book 9.
5. Refer to page 44 of Learners' Book 9.

CONTENT STANDARD: B9.1.2.1 Demonstrate knowledge of specialist cells of dicotyledonous plants and humans, their formation and functions for the existence of the plants and human

Indicator: B9.1.2.1.2 Examine the functions of specialised cells in dicotyledonous plants such as epidermal, guard cells, cambium, xylem in relation to the existence of the plant

LESSON 2: SPECIALISED CELLS IN PLANTS

Teaching and Learning Resources

- gather specimens or pictures of some specialized cells such as the leaf palisade cell, the sperm cell, egg cell, nerve cell and xylem cells,
- A4 sheets,
- scissors pencils
- poster colours
- paper glue.

Reference to Learners Book Pages 48-52

Learning Expectations:

1. by the end of the the lesson learners are expected to:
2. list some specialized cells in plants
3. observe specialised dicotyledonous plant cells such as epidermal, guard cells, cambium, xylem from videos and charts and identify them by their names and shapes.
4. search from books and the internet for information on the functions of the specialised cells of dicotyledonous plants and how they relate to the existence of the plants.

Keywords: palisade, xylem, guard cell, cambium, epidermal,

Prior Preparation:

- **P**repare specimens, charts,videos,pictures on specialised cells
- Task learners to bring A4 sheets, cardboard and pencils to class for the lesson

BACKGROUND

Many cells are specialised. They have structures that are adapted to help them perform specific functions. For example, muscle cells bring parts of the body closer together. They contain protein fibres that can contract when energy is available, making the cells shorter. Plants also possess some specialized cells that perform specific functions within the plant.

Specialised cells are cells that have certain characteristics to enable them perform specific functions.

Additional Information

Most cells share features such as having a nucleus, a cell membrane, cytoplasm and mitochondria. Each type of cell has its own job to do. These cells have special features that allow them to perform their functions effectively.

Cell specialization allows new cells to develop into a range of different tissues, all of which work together to make living organisms function as a whole. The process of cell specialization – exactly how cells develop into their diverse forms – is complex. There are hundreds of specific cell types in the body that arise from the very basic and general type cells called stem cells.

All of the specialized cells in the body come from the same originating tissue: the group of stem cells that make up the earliest stages of an embryo. Stem cells are a unique type of cell, because, while they're immature cells without any specialization, they can follow a developmental "blueprint" to develop into the thousands of unique cell types found throughout your body.

Teacher Learner Activities

Activity 1:
Review the key points on animal and plant cells studied in form one using group work.

Activity 2:
Display charts of specialized cells on the board and let learners list some specialized cells in plants. Learners should identify examples of differences between specialized cells and normal cells.

Activity 3:
Observe specialised dicotyledonous plant cells such as epidermal, guard cells, cambium, xylem from videos and charts

Activity 4:
Guide learners to identify epidermal, guard cells, cambium, xylem from videos and charts by their names and shapes using group, work, think-pair-share, talk for learning etc.

Activity 5:
Engage learners through project -based learning using A4 sheets, scissors pencils ,poster, colours, paper glue to create an album or posters of epidermal, guard cells, cambium, xylem from videos and charts . Observe learners as they work on their work to give feedback and support.

Activity 6:
Search from books and the internet for information on the functions of the specialised cells of dicotyledonous plants and how they relate to the existence of the plants.Help learners to do group presentation about their work in class for discussion.

Skills and Competencies
Observing, analyzing, evaluating, digital literacy, personal development, creativity, critical thinking and communication.

Progressive Assessment
Ask learners why epidermal, guard cells, cambium, xylem are described as specialised dicotyledonous plant cells.Take feedback from learners as they give their responses in groups,in pairs or individually.

Main Points of the Lesson

- A specialized cell is a cell which has special characteristics to enable it perform a unique function. Dicotyledonous plants, also known as dicots, are a group of flowering plants that have two cotyledons (seed leaves) in their embryo. These plants have a wide range of specialized cells that perform specific functions to support their growth and survival. Here are some of the most important specialized cells in dicotyledonous plants.

- A palisade cell is a specialised cell in a plant leaf which contains lots of chloroplasts for photosynthesis.

- A guard cell is a specialised cell in a plant leaf which can change shape to allow or stop gases from getting into the leaf. Guard cells are specialized epidermal cells that surround the stomata. They regulate the opening and closing of the stomata, allowing the plant to control its water and gas exchange. Guard cells are responsible for maintaining the turgor pressure of the plant, which is important for cellular processes such as photosynthesis and transpiration.

- A xylem cell is a specialised cell which is used to form tubes in the plant to transport water.

- A root hair cell is a specialised cell found in roots of plants that is specially adapted to absorb water.

- The epidermis is the outermost layer of the plant's body, and it plays a crucial role in protecting the plant from environmental stresses such as water loss, temperature fluctuations, and pathogens. Epidermal cells are compact, with thick cell walls that provide a barrier against these stresses. They also contain stomata (small openings) that allow for gas exchange, including the release of oxygen and the uptake of carbon dioxide.

- The cambium is a meristematic layer of cells that lies just beneath the bark of the plant. It is responsible for the growth of new xylem and phloem tissue. The cambium is a critical component of the plant's vascular system, as it allows the plant to transport water, minerals, and sugars throughout its body.

- Xylem is a type of vascular tissue that transports water and minerals from the roots to the leaves. It is composed of tracheids, vessels, and xylem parenchyma cells. Xylem tissue is responsible for the plant's water and mineral uptake, and it plays a critical role in the plant's growth and survival

Diagnostic Assessment for the Teacher
With the aid of questioning, find out whether learners are able to identify differences between specialized cells and ordinary cells.

CONTENT STANDARD: B9.1.2.1 Demonstrate knowledge of specialist cells of dicotyledonous plants and humans, their formation and functions for the existence of the plants and human

Indicator: B9.1.2.1.2 Examine the functions of specialised animal cells such as (nerve, blood cells, muscle cells and sperm cells) in relation to the existence of humans

LESSON 3: FUNCTIONS OF SPECIALISED CELLS IN HUMANS

Teaching and Learning Resources:

- gather specimens or pictures of some specialized cells such as the leaf palisade cell, the sperm cell, egg cell, nerve cell and xylem cells,
- clay, Play-Doh, or craft supplies
- A4 sheets,
- scissors pencils
- poster colours
- paper glue.

Reference to Learners Book Pages 53-59

Learning Expectations:

1. Identify some specialized cells in humans
2. Observe specialised animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts.
3. Identify animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts by their names and make models to represent their shapes.
4. Mention the function of each of the specialised cells.

Keywords: Specialised cells,cilia,egg,red blood cells, white blood cell

Prior Preparation:

- **P**repare specimens, charts,videos,pictures on specialised cells.
- Task learners to bring A4 sheets, cardboard and pencils to class for the lesson.

BACKGROUND

Specialized cells in humans are cells that have specific structures and functions to perform particular tasks within the body. These cells are differentiated to carry out specific roles, contributing to the overall function and maintenance of the human body. specialized animal cells such as nerve cells, blood cells, muscle cells, and sperm cells perform essential activities related to communication, oxygen transport, immune defense, movement, and reproduction within the organism

Additional Information

Most cells have the same characteristics, such as a nucleus, a cell membrane, cytoplasm, and mitochondria.

Each cell type has a specific function. These cells have unique characteristics that allow them to carry out their jobs efficiently.

Cell specialization permits new cells to develop into a variety of tissues, all of which collaborate to ensure that live creatures function as a whole. The process of cell specialization, or how cells evolve into their various forms, is complicated. In the body, hundreds of different cell types develop from stem cells, which are the most fundamental and universal form of cell.

All specialized cells in the body derive from the same beginning tissue: the population of stem cells that comprise the embryo.

Teacher Learner Activities

Activity 1:
Review the key points on animal and plant cells studied in form one using group work.

Activity 2:
Display charts of specialized cells on the board and let learners identify some specialized cells in humans. Learners should identify examples of differences between specialized cells and normal cells.

Activity 3:
Observe specialised animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts.

Activity 4:
Guide learners to identify animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts using group, work, think-pair-share, talk for learning etc Create a game where learners have to identify different types of specialized cells in the human body, such as red blood cells, neurons, muscle cells, and skin cells. This can be done by showing images or giving descriptions of the cells.

Activity 5:
Engage learners through project -based learning using A4 sheets, scissors pencils, poster, colours, paper glue to create an album or posters of animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts from videos and charts . Organize a hands-on activity where learners construct models of specialized cells using various materials like clay, Play-Doh, or craft supplies. Encourage them to label the different parts and explain their functions
Observe learners as they work on their work to give feedback and support.

Activity 6:
Search from books and the internet for information on the functions of the animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts and how they relate to the existence of the plants.Help learners to do group presentation about their work in class for discussion.

Cell Research Project
Assign each learner a specific type of specialized cell and ask them to research and present information about its structure, function, and importance in the human body. This can be done through presentations, posters, or written reports.

Skills and Competencies
Observing, analyzing, evaluating, digital literacy, personal development, creativity, critical thinking and communication.

Progressive Assessment
Ask learners the learners the following questions to check progress of learning

- Why animal cells such as nerve cells, blood cells, muscle cells and sperm cells from pictures, videos and charts are important to human life .
- What are some examples of specialised cells in the human body and how do they contribute to overall health and functionality?

Take feedback from learners as they give their responses in groups, in pairs or individually.

Main Points of the Lesson

- Specialized animal cells such as nerve cells, blood cells, muscle cells, and sperm cells perform various activities crucial for the proper functioning of the organism.

- **Nerve Cells (Neurons):** Nerve cells, or neurons, are specialized for transmitting

information throughout the body. They receive and send electrical signals to and from the brain and other parts of the body. The main activity of nerve cells is to transmit signals in the form of electrical impulses. This allows them to facilitate communication between different parts of the body, enabling sensory perception, motor coordination, and cognitive functions.

- **Blood Cells:** Blood consists of several types of specialized cells, including red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes). Each type of blood cell has specific functions:
  Red Blood Cells: The primary function of red blood cells is to transport oxygen from the lungs to all body tissues and carbon dioxide from the tissues to the lungs.

  White Blood Cells: These cells are part of the immune system and play a crucial role in defending the body against infections and foreign invaders.

  Platelets: Platelets are involved in blood clotting, preventing excessive bleeding when a blood vessel is injured.

  Muscle Cells: Muscle cells, also known as muscle fibers, are specialized for contraction and relaxation, allowing movement and providing structural support. The main activity of muscle cells is to generate force and produce movement. There are three types of muscle tissue in the human body: skeletal muscle, cardiac muscle, and smooth muscle. Each type has unique properties and functions related to movement, posture, organ function, and circulation.

  Sperm Cells: Sperm cells are specialized male reproductive cells responsible for fertilizing the female egg during sexual reproduction. The main activity of sperm cells is to swim through the female reproductive tract to reach and penetrate the egg for fertilization. Sperm cells are highly specialized for motility and have a streamlined structure that enables them to travel efficiently towards the egg.

Diagnostic Assessment for the Teacher

- With the aid of questioning, find out whether learners are able to identify differences between specialized cells in humans and in plants.
- Did you use the appropriate resources required?
- Were the lesson activities engaging?
- Were you gender responsive in your distribution of questions and answers?
- What will you do differently if you were to teach the lesson again?

STRAND 2

CYCLES

Unit 1: Earth Science

CONTENT STANDARDS: B9.2.1.1 Demonstrate an understanding of the Nitrogen cycle as a repeated pattern of change in nature, and how it relates to the environment.

Indicator: B9.2.1.1.1 Explain the process of the Nitrogen cycle as a repeated pattern in nature.

LESSON 1: THE NITROGEN CYCLE

Teaching and Learning Resouces:

1. A chart showing the nitrogen cycle depicting processes such as:
   - Nitrogen fixation
   - Nitrification (converting ammonia into nitrates).
   - Assimilation (plants and animals using nitrogen)
   - Ammonification (adding organic nitrogen compounds to ammonia or
   - ammonia formation).
   - Denitrification.
   - A chart showing the relationship between the nitrogen cycle and the environment.
   - A picture of nitrogen cycle as a repeated pattern in nature.
   - Video clip on nitrogen cycle.

Learner's Book 9: Pages 60-64

Learning Expectations:

By the end of the lesson, learners will:

1. identify the nitrogen cycle from the internet, charts, or pictures.
2. explain the nitrogen cycle focusing on processes such as:
   nitrogen fixation
   nitrification (converting ammonia into nitrates).
   assimilation (plants and animals using nitrogen)
   ammonification (adding organic nitrogen compounds to ammonia or ammonia formation).
   denitrification.
3. explain the relationship between the nitrogen cycle and the environment.
4. explain why the nitrogen cycle is a repeated pattern in nature.
5. explain the importance of the nittrogen cycle.
6. carry out a project to show how certain plants such as leguminous crops can replenish nitrogen in the soil.

7. predict what will happen if the nitrogen cycle is interrupted by actions such as leaching, bush burning, and destruction of leguminous plants.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: nitrogen fixation, denitrification, assimilation, fossil fuel ammonification, nitrification.

BACKGROUND

Plants require nitrogen for growth. They absorb nitrogen in the form of nitrates and ammonium salts and use it to manufacture the proteins they need. Animals can feed on plants to obtain the nitrogen they require. When plants and animals die, they decay and their nitrogen content returns to the soil.

The nitrogen cycle is a cycle that describes the transformation of nitrogen and nitrogen containing compound in nature. It is a biogeochemical gaseous cycle. The nitrogen cycle is important because it improves soil fertility.

Additional Information

Nitrogen is abundant in the atmosphere, but it is unusable to plants or animals unless it is converted into nitrogen compounds.

Nitrogen-fixing bacteria play a crucial role in fixing the atmospheric nitrogen into nitrogen compounds that can be used by plants.

The plants absorb the usable nitrogen compounds from the soil through their roots. Then, these nitrogen compounds are used for the production of proteins and other compounds in the cell. Animals assimilate nitrogen by consuming these plants or other animals that contain nitrogen. Humans consume proteins from these plants and animals and then, the nitrogen assimilates into our system.

During the final stages of the nitrogen cycle, bacteria and fungi help decompose organic matter, where the nitrogenous compounds get dissolved into the soil which is again used by the plants. Some bacteria then convert these nitrogenous compounds in the soil and turn it into nitrogen gas. Eventually, it goes back to the atmosphere.

These sets of processes repeat continuously and thus maintain the percentage of nitrogen in the atmosphere.

The nitrogen cycle helps bring in the inert nitrogen from the air into the biochemical process in plants and then to animals. Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them. The nitrogen cycle helps bring in the inert nitrogen from the air into the biochemical process in plants and then to animals. Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them. air into the biochemical process in plants and then to animals.

Planning the Lesson
One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Progress Assessment
Check prior knowledge by asking the learners of the importance of the nitrogen cycle to the environment.
Ask the learners to think-pair -share on the following:

- What is the role of nitrogen in the atmosphere?

Take feedback from around the room.

Teaching the Topic
Starter
Check the learners prior knowledge by asking them to describe the process of the Nitrogen cycle as a repeated pattern in nature.
Ask the learners to think-pair -share on the following:

- What is meant by nitrogen cycle?

Take feedback from around the room.

Activity
See Pages 57, 58 and 60 of Learner's Book 9
The activities are designed to enable the learners explain the process of Nitrogen cycle as a repeated pattern in nature.

- Guide learners to carry out the Activity 1 in pages 57 of the Learner's Book 9 to investigate the meaning of nitrogen cycle.

Engage the learners to observe the following:
A chart showing the following nitrogen cycle processes:
Nitrogen fixation
Nitrification (converting ammonia into nitrates).
Assimilation (plants and animals using nitrogen).

Ammonification (adding organic nitrogen compounds to ammonia or ammonia formation).
Denitrification.
Engage the learners to watch a video clip on the nitrogen cycle.
Engage the learners in a discussion on the nitrogen cycle focusing on processes such as:
Nitrogen fixation
Nitrification (converting ammonia into nitrates).
Assimilation (plants and animals using nitrogen)
Ammonification (adding organic nitrogen compounds to ammonia or ammonia formation.

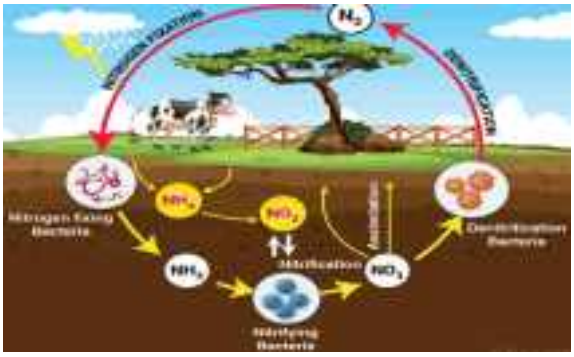
- Denitrification.
- Engage the learners to explain why the nitrogen cycle is a repeated pattern in nature.
- Guide the learners to identify the importance of nitrogen cycle to the environment.

Help learners to perform Activities 1 page 61 of Learners' Book 9 respectively.

Main Points of the Lesson

- The nitrogen cycle is the process by which nitrogen lost from the soil is replaced.
- The nitrogen Cycle is a biogeochemical process through which nitrogen is converted into many forms, consecutively passing from the atmosphere to the soil to organisms and back into the atmosphere.
- The nitrogen cycle describes the continuous interlocking succession of events and processes through which nitrogen lost from the soil is naturally replenished.
- Nitrogen continues to be lost in soils through the following activities:
- Soil erosion.
- Leaching.
- Crop removal.
- Denitrification
- Excess nitrogen in the soil increases the growing period and delays maturity. Plants tend to grow very tall and slender, becoming more susceptible to logging. Such an excess can lead to a reduction in crop yield.
- The nitrogen cycle plays very important roles in the environment.
- Some of these include the following:
- Nitrogen cycle replaces lost nitrogen in the soil and therefore improves soil fertility and nutrient balance.
- It provides optimum plant growth.
- It prevents the accumulation of foul-smelling odour in plant tissues.

- It releases nitrogen locked up in the plant and animal tissues.
- Nitrogen cycle supplies nitrogen in the form of nitrates to plant for vegetative growth and development.
- Activities that interrupt the nitrogen cycle are: leaching, bush burning and destruction of leguminous plants.



Reflective cycle Nitrogen cycle

Fig. 1

Home Work/Project
Let learners carry out a project as outlined in the Learner's Book 9 to find out from the Internet the relationship between the carbon cycle and the nitrogen cycle.

Think and Discuss
Learners in pairs should discuss the process of the Nitrogen cycle as a repeated pattern in nature. Take feedback from the various groups. Ensure that the less able learners participate in the discussion.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Did the majority of the class respond as expected?
- There any reasons you could identify the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and the below average learners?
- Self-Evaluation

- Did you teach well?
- Self-assess the effect your teaching has had on learning
- Consider new ways of teaching which can improve the quality of learning
- Try these ideas in practice
- Repeat the process of teaching

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 61 of Learners' Book 9.
2. Refer to page 61 of Learners' Book 9.
3. Refer to page 61 of Learners' Book 9.
4. Refer to page 62 of Learners' Book 9.
5. Refer to page 62 of Learners' Book 9.

Home Work/Project

Let learners carry out a project using the internet to show how certain plants such as leguminous crops can replenish nitrogen in the soil.

CONTENT STANDARDS: B9.2.1.1 Demonstrate an understanding of the Nitrogen cycle as a repeated pattern of change in nature, and how it relates to the environment

Indicator: B9.2.1.1.2 Describe the importance of the nitrogen cycle to the environment.

LESSON 2: THE IMPORTANCE OF THE NITROGEN CYCLE TO THE ENVIRONMENT.

Teaching and Learning Resources:
Pictures, charts and video clip on the importance of nitrogen cycle to the environment
Learner's Book 9: Pages 65-72

Learning Expectations:
By the end of the the lesson, learners are expected to:

1. describe the importance of nitrogen to the environment.
2. carry out a project to show how certain plants such as leguminous crops can replenish nitrogen in the soil.
3. predict what will happen if the nitrogen cycle is interrupted by actions such as leaching, bush burning, and destruction of leguminous plants.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: Nitrogen fixation, Assimilation, Ammonification, Nitrification, Denitrification, fossil fuel.

Prior Preparation:

- Prepare charts,videos,pictures on nitrogen cycle to help describe the importance of nitrogen to the environment in mixed ability groups.
- Think of the project learners will carry out to show how certain plants such as leguminous crops can replenish nitrogen in the soil.
- Prepare charts,videos,pictures on leaching and bush burning, or get a nearby place where leaching and bush burning occurred.

BACKGROUND INFORMATION

Plants require nitrogen for growth. They absorb nitrogen in the front of nitrates and ammonium salts and use it to manufacture the proteins they need. Animals can feed on plants to obtain nitrogen they require. When plants and animals die, they decay and their nitrogen returns back to the soil.The nitrogen cycle is a cycle that describes the transformation of nitrogen and nitrogen containing compound in nature. It is a biogeochemical gaseous cycle. The nitrogen cycle is important because it improves soil fertility.

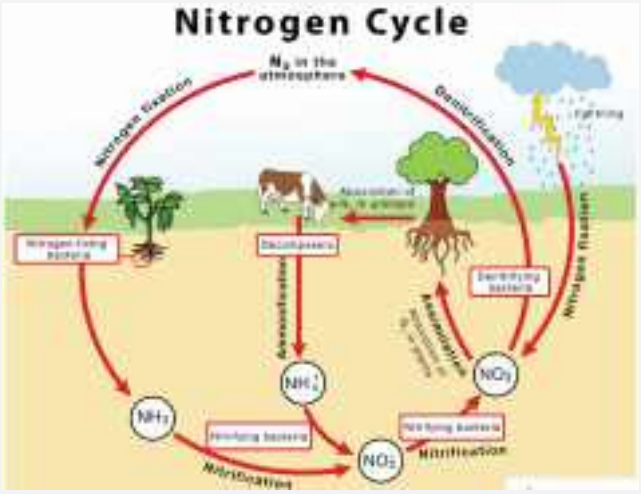
Aditional Information

Legumes are able to convert nitrogen to nitrates and nitrites. the use of nitrates by bacteria in soil. microbes in soil and water that change ammonia into nitrites. bacteria called Nitrosomonas that convert ammonia to nitrites.The nitrogen cycle is the biogeochemical cycle responsible for cycling nitrogen amongst plants, animals, and the abiotic factors of their environment. The process is a natural component of the entire Earth system. Like most biogeochemical cycles, human activities are capable of altering the natural conditions of the nitrogen cycle.

Nitrogen from fertilizers, most often in the form of nitrate, causes extensive environmental damage. Nitrogen is carried downward through soil or leaves Earth's surface as runoff, it enters streams, rivers, lakes, groundwater, and oceans. It serves as a pollutant in human drinking water supplies and every ecosystem it enters nitrogen cycle helps bring in the inert nitrogen from thehe nitrogen cycle helps bring in the inert nitrogen from the air into the biochemical process in plants and then to animals. Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them. he nitrogen cycle helps bring in the inert nitrogen from the air into the biochemical process in plants and then to animals.

Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them. he nitrogen cycle helps bring in the inert nitrogen from the air into the biochemical process in plants and then to animals. Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them. air into the biochemical process in plants and then to animals. Plants need nitrogen to synthesize chlorophyll and so the nitrogen cycle is absolutely essential for them.

Teacher Learner Activities
See Page 65 of learner's Books 9



The activities are designed to enable learners describe the importance of the nitrogen cycle to the environment.

- Engage learners to identify the stages of the nitrogen cycle in groups.
- Guide learners to carry out the activity 1 on page 65 of the Learner's Book 9 to investigate the role of nitrogen to the environment.
- Engage the learners to watch a video clip on how the nitrogen cycle helps the environment.
- Guide the learners to identify the importance of nitrogen cycle to the environment.

Progressive Assessment
Check knowledge by asking the learners of the importance of the nitrogen cycle to the environment.
Ask the learners to think-pair -share on the following:

- What is the role of nitrogen in the atmosphere?
- Take feedback from around the room

Homework / Project
Let learners carry out a project as outlined in in pages xx of the Learner's Book 9 to use the internet, carry out a project to show how certain plants such as leguminous crops can replenish nitrogen in the soil.

Main Points of Lesson

Nitrogen cycle has very important role to play in the environment.
Some of these include the following:

1. Nitrogen cycle replaces lost nitrogen in the soil and therefore improves soil fertility and nutrient balance.
2. It provides optimum plant growth.
3. It prevents the accumulation of foul-smelling odour in plant tissues.
4. It releases nitrogen locked up in the plant and animal tissues.
5. Nitrogen cycle supplies nitrogen in the form of nitrates to plant for vegetative growth and development.
6. Activities that interrupt the action of nitrogen cycle are: leaching, bush burning and destruction of leguminous plants.

Diagnostic Assessment for the Teacher

At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery by using the cycle below and the questions.

1. Did you teach well?
2. Self-assess the effect your teaching has had on learning expectations
3. Consider new ways of teaching which can improve the quality of learning
4. Try these ideas in practice
5. Repeat the process of teaching

Answers to Essay Type Questions

1. i. **Assimilation** - Refers to plants and animals using nitrogen. Nitrates and ammonia resulting from nitrogen fixation are assimilated into bodies of plants and algae. Animals then ingest these algae and plants, converting them into their own body compounds.

   ii. **Denitrification** - This process is the reverse of nitrification that occurs in the deep layers of soil where the bacteria convert nitrates (NO_3^-) into N_2 and other gaseous compounds like NO_2. This occurs because in deep layers of soil, oxygen is not available and the soil bacteria use these nitrogen compounds instead of oxygen.

   iii. **Ammonification** - The remains of all living things - and their waste products - are decomposed by microorganisms in the process of ammonification, which yields ammonia (NH_3) and ammonium (NH_4^+).

   iv. **Nitrification** - The nitrification process takes place in two steps. In the first step, ammonia is converted to nitrates. This conversion is done by bacteria such as Nitrosomonas and Nitrococcus present in the soil. In the second step, the bacterium called Nitrobacter converts nitrite (NO_2^-) to nitrate (NO_3^-). This conversion is very important as ammonia gas is toxic for plants.

2. The nitrogen cycle is a repeating cycle of processes during which nitrogen moves through both living and non-living things: the atmosphere, soil, water, plants, animals and bacteria. In order to move through the different parts of the cycle, nitrogen must change forms.

3. Refer to page 67 of Learners' Book 9.

4. Answers will vary.

2 Sub-Strand 2: Life Cycle of Organisms

CONTENT STANDARD: B9.2.2.1 Demonstrate an understanding of the life cycle of grasshopper and assess how their activities affect humans.

Indicator:
B9.2.2.1.1 Describe the life cycle of the grasshopper as a form of incomplete metamorphosis.
B9.2.2.1.2 Examine how the activities of the grasshopper affect humans.

LESSON 1: THE LIFE CYCLE OF THE GRASSHOPPER

Teaching and Learning Resources:
- Pictures or videos of materials in the environment, chart

Learner's Book 9: Pages 73-76

Learning Expectations:
By the end of the lesson, the learner will:
1. describe grasshopper's life cycle
2. identify the satges of grasshopper's life cycle, such as eggs, nymphs and adults.
3. make a list of all the stages of the grasshopper.
4. examine how the activities of the grasshopper affects humans.

Learning Skills
- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: metamorphosis, incomplete metamorphosis, complete metamorphosis locust.

BACKGOUND
Life cycle of some organisms such as the housefly and the mosquito have been discussed in Basic 7 and 8 respectively. We learnt that they are insects that are mostly found in our environment. They both transmit diseases such as typhoid, dynsentery, malaria and cholera. The life cycle of these insects were said to be complete metamorphosis. Life cycle is a series of changes in form that an organism undergoes and returns to its starting state.
In this lesson we shall discuss the life cycle of another insect called grasshopper that undergoes

incomplete metamorphosis.

- Outline the activities of the grasshopper in everyday life (e.g feeding on grasses, crops and weeds.)
- Examine how the activites of the grasshopper affect humans.
- Search for information on activities of the grasshopper that are harmful or beneficial to humans.
- Generate activities that will reduce the effect of the activities of the grasshopper on humans.

Activity 1 and 2: Refer to page 63 and 65 of Learners' Book 9.

- Observing the various stages of the life cycle of the grasshopper
- Encourage learners to work in groups. (Groups of how many)
- Guide learners to observe critically the various stages of the lifecycle on a chart.
- Guide learners to observe carefully what happens at each stage.
- Guide learners to sketch the various stages of development as seen in the video clip. i.e., egg ⟶ nymph ⟶ adult
- Observing daily activities of grasshoppers
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Ask the learners to work in groups
- Take the learners on a nature walk in a nearby garden or a football field.
- Guide learners to observe the grasshopper in activities such as leaping, flying from one point to another and feeding on grass, weeds or crops.
- Show learners a video clip to observe more activities of grasshoppers.
- Guide learners to seek for information on the Internet of journals on activities of the grasshopper that are harmful or beneficial to humans.

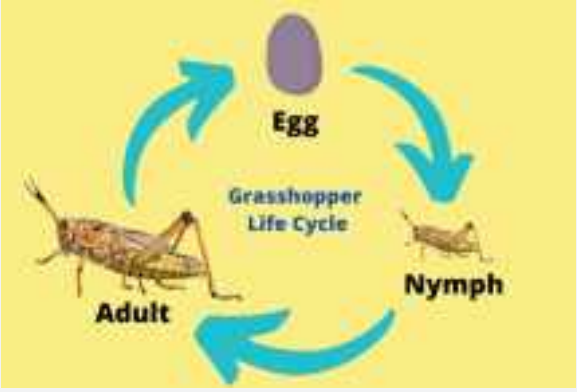


Fig. 2 - The life cycle of the grasshopper

Reflection

Use peer assessment to find out from learners what they have learnt from the lesson.
Ask learners the following questions

- What are the 3 Stages of a Grasshopper Life Cycle?
- Is it a complete cycle or incomplete cycle? Explain your answer.
- Why is the life cycle of grasshopper important?

Research Work/Project Work

In your usual groups use blu tack to make a model of a grasshopper.
Let learners to search further from books, journals and internet for information on life cycle of grasshopper and how the economic importance. Present your ideas in class for discussion.

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Were assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through your resources?
4. Did the learners systematically follow the progress used in the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can you do to improve the lesson?
7. What was the reaction of the learners to your integration of ICT activities?

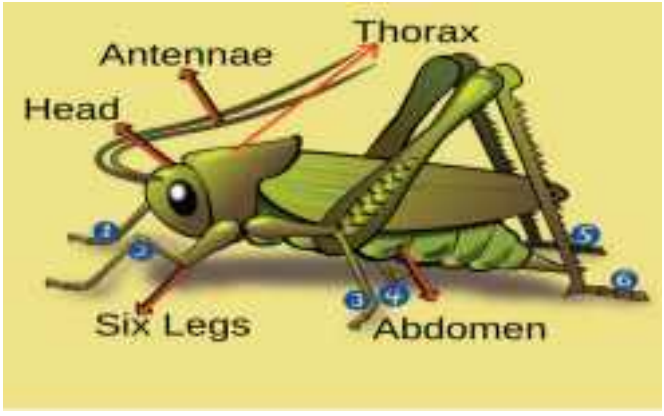


Fig. 3 - A picture of a labelled grasshopper

Progressive Assessment

- Use peer assessment to find out from the learners what they have learnt from the lesson.
- Use effective questions to find out from the learners how the lesson will benefit them in everyday life.
- Ask the learners to tell the importance of grasshoppers to humans.

Reflection

1. Can the learners explain potential misconceptions about the lesson?
2. Were assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners to my integration of ICT activities into the lesson?

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 74 of Learners' Book 9.
2. Refer to page 75 of Learners' Book 9.
3. Refer to page 75 of Learners' Book 9.
4. Refer to page 74 of Learners' Book 9.

5. A complete metamorphosis is where an insert undergoes four stages of development while incomplete metamorphosis is where the insert undergoes three stages of development.

6. Refer to page 74 of Learners' Book 9.

7. a. A life cycle of insects which involves changes from the egg to the adult stage either through intermediate stage of numph (incomplete) or larva or pupa.

   b. i. mosquito, butterfly, housefly
      ii. Grasshoper, dragon fly, praying mantis.

Project Work/Further ICT Reading

Let learners:

1. Generate activities to promote or reduce the effect of the activities of grasshoppers on humans. Tell learners they will present their work in class for discussion.
2. Search further from books, journals and the Internet for information on the process of the life cycle of grasshoppers.
3. Present their ideas in class for discussion.
4. Learners can us the following website for further studies:
   - extension.entm.purdue.edu>insects
   - www.plantnatural.com>lawn-pests
   - www.eluniversal.commx>English

CONTENT STANDARD: B9.2.2.1 Demonstrate an understanding of the life cycle of grasshopperand assess how their activities affect human

Indicator: B9.2.2.1.2 Examine how the activities of the grasshopper affect humans.

LESSON 2: THE ACTIVITIES OF THE GRASSHOPPER THAT AFFECT HUMANS.

Teaching and Learning Resources:
Pictures or videos of materials in the environment, chart of grasshopper
Learner's Book 9: Pages 77-82

Learning Expectations:
By the end of the the lesson, learners are expected to:

1. outline the activities of the grasshopper in everyday life (e.g. feeding on grasses, crops and weeds.)
2. examine how the activities of the grasshopper affect humans.
3. search for information on activities of the grasshopper that are harmful or beneficial to humans.
4. generate activities that will reduce the effect of the activities of grasshoppers on humans

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: succulent, tender, secondary consumers, feeding, herbivores

Prior Preparation:

- Prepare charts,videos,pictures on nitrogen cycle to help describe the activities of the grasshopper
- Think of the project learners will carry out to Carry out a search for information on activities of the grasshopper that are harmful or beneficial to humans.-
- Prepare to help learners to generate activities to promote or reduce the effect of the activities of grasshoppers on humans.

BACKGROUND INFORMATION

Among insect pests that destroy annual crops on the field are locusts. Their feeding habits as they prefer to feed on green succulent crops make them to destroy crops. While grasshoppers primarily impact the ecosystem and agricultural systems, there are a few ways their activities can indirectly affect humans. It's important to note that while grasshoppers can have some indirect impacts on humans, they also play crucial roles in the ecosystem. Efforts to manage grasshopper populations often focus on sustainable and environmentally-friendly approaches to minimize their negative effects while preserving their ecological significance.

Additional Information

Crop Damage: Grasshoppers are known to be voracious feeders and can cause significant damage to crops. When grasshopper populations are high, they can consume large quantities of agricultural plants, leading to reduced crop yields and economic losses for farmers. This can result in higher food prices and potential food shortages.

Pest Control Challenges: Grasshoppers are considered pests in agriculture due to their feeding habits. Controlling grasshopper populations can be challenging, as they reproduce rapidly and can quickly spread to new areas, making it difficult for farmers to protect their crops from damage.

Habitat Destruction: Grasshoppers thrive in grassy habitats and can impact grasslands and natural ecosystems. Their feeding activities can lead to the destruction of vegetation, affecting the overall balance of the ecosystem. This habitat destruction can have indirect consequences for humans, such as reduced biodiversity and changes in ecosystem services.

Disease Transmission: While rare, some species of grasshoppers can serve as vectors for diseases. They can carry and transmit pathogens that can be harmful to humans, livestock, or other animals. However, the risk of disease transmission from grasshoppers to humans is generally low.

Ecotourism and Aesthetic Value: Grasshoppers play a role in the natural environment and contribute to its biodiversity. Their vibrant colors, unique mating behaviors, and characteristic sounds make them valuable components of ecosystems. This aesthetic value can contribute to ecotourism activities, such as insect-watching or nature photography, which may indirectly benefit local economies and communities.

Teacher Learner Activities

Activity 1:
Observing daily activities of grasshoppers
Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.

1. Encourage learners to work in groups
2. Take learners to a nature walk at nearby garden or a football field.
3. Guide learners to observe the grasshopper in activities such as leaping, flying from one point to another and feeding on grasses, weeds or crop.
4. Show and let learners watch a video clip to observe more activities of grasshoppers.
5. Guide learners to seek for information on the internet of journals on activities of the grasshopper that are harmful or beneficial to humans.

Progressive Assessment
Use peer assessment to find out from learners what they have learnt from the lesson. Use effective questions to find out from learners how the lesson will be benefit them in everyday life. Ask learners to tell the importance of grasshopper to humans.

Diagnostic Assessment for the Teacher

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWER TO THE QUESTION FROM THE LEARNERS BOOK

Exercise A (Objectives)

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

Exercise B

1. They destroy vegetation and crops
2. Grasshopper provides A, B and C vitamin and protein

ICT

Let learners:

1. generate activities to promote or reduce the effect of the activities of grasshoppers on humans. Tell learners they will present their work in class for discussion.
2. search further from books, journals and internet for information on the activities of life cycle of grasshopper.
3. present your ideas in class for discussion.
4. learners can us the following website for further studies.
    - extension.entm.purdue.edu>insects
    - www.plantnatural.com>lawn-pests
    - www.eluniversal.commx>English.

2 Sub-Strand 3: Crop Production

CONTENT STANDARD

- **B9.2.3.1** Show an understanding of differences in maturities of different crops grown in different soils and different seed beds
- **B9.2.3.2** Demonstrate knowledge and understanding of uses of different crops at different maturity stages

Indicator

- **B9.2.3.1.1** Observe and describe differences in maturation of crops grown in different soils and on different seed beds
- **B9.2.3.2.1** Observe and record the uses of different crops at different maturity stages.

LESSON 1: DIFFERENCES IN MATURATION OF CROPS GROWN IN DIFFERENT SOILS AND ON DIFFERENT SEED BEDS

Teaching and Learning Resources:

- Pictures or videos of materials in the environment, video clip on maturation and uses of different cops, writing materials.

Learner's Book 9: Pages 83-86

Learning Expectations:

By the end of the lesson, the learner will:

1. observe and record the maturity stages of different crops grown in different soils and seed beds
2. discuss the differences in maturity stages among the different crops on the different soils and seed beds
3. discuss and write the uses of each maturity stage of each crop identified

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

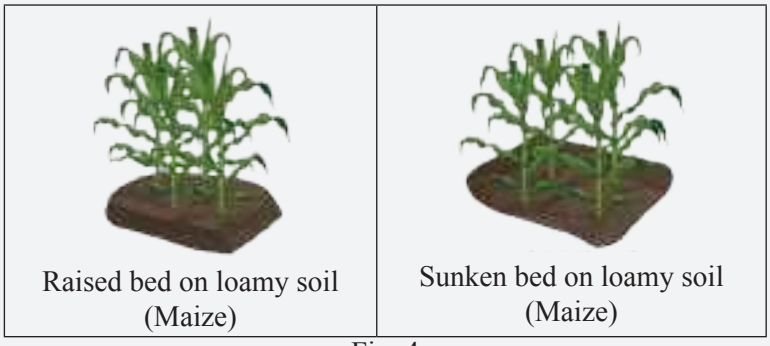
Keywords: sunken bed, maturation, seed bed, raised bed, maturation, categorise, prerequisites, aroma, nutritional, fodder, silage, forage

BACKGROUND

Crop maturity is the process for the determination of the perfect stage to harvest the crop. The stage at which the harvest of the crop is done is an important factor for good quality. Perfect quality can be attained when the harvest is done at a perfect stage of maturity. Before the crop reaches its maturity, it goes through different stages.

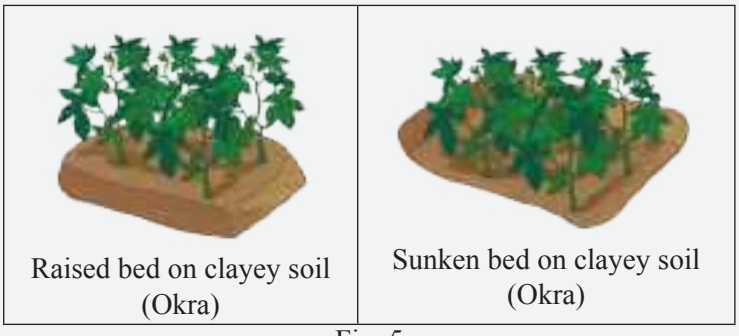
Activity 1: Refer to pages 83 and 84 of Learner's Book 9.

- Observing and recording the maturity stages of different crops grown in different soils and seed beds.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Ask the learners to work in groups.
- Let each group prepare two raised and sunken bed each on different soil types i.e. one raised bed on a loamy soil and a sunken bed on a clayey soil; another raised bed on a loamy soil and another sunken bed on a clayey soil.



Raised bed on loamy soil (Maize) | Sunken bed on loamy soil (Maize)

Fig. 4



Raised bed on clayey soil (Okra) | Sunken bed on clayey soil (Okra)

Fig. 5

- Guide learners to grow different crops on the beds as indicated above.
- Guide learners to apply all the necessary cultural practices till maturity.

- Let learners observe and record the maturity stages of the different crops grown in different soils and seed beds.
- Guide learners to identify the differences in maturity stages among the different crops on the different soils and seed beds.
- Ask the learners to record their observations and present them to class for discussion.
- Let learners watch a video clip on maturation stages of different crops.
- Guide learners to identify the use of each crop at different maturity stages.
- Discuss with the learners and let them categorise the crops by their different maturity stages and uses.
- Guide learners in their group to discuss how the knowledge of the maturity stages of different crops helps a farmer in crop selection of crop variety, time of planting time of harvest and cultural practices to be employed.
- Guide learners present their findings for class discussion.

Reflection

- Use group discussion to help learners go though what they have learnt.
- Ask learners to list crops grown in their community and state the maturity stage of the crops.

Project Work/ICT

Working in pairs search from the Internet or journals for information the growth stages of common crops found in your community.

Reflection

Use Gibbs' reflective cycle to get feedback from the learners.

Fig. 6 - Gibbs cycle

Reflection

- Use group discussion to help learners go through what they have learnt.
- Why should maturity of crops should be studied in this lesson?

Research Work/Project Work

- Agriculturistmusa.com
- www.agrifarming.in>maturity-of-f...
- www.researchgate.net>puplication

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Were assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progress of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Fig. 7 - Tomato plant growth

Fig. 8 - Cucumber plant growth

Fig. 9 - Plant growth stages

Review Question
What is the importance of maturity of crops?

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Were assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressive of the lesson?
5. Did the learners appreciate the creative pedagogies I used?
6. What can I do to improve the lesson?
7. Did I integrate ICT in the lesson?

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 83 of Learners' Book 9.

2. Refer to page 84 of Learners' Book 9.

3. Refer to page 84 of Learners' Book 9.

4. Refer to pages 84 and 85 of Learners' Book 9.

5. The knowledge of maturity stages will enable farmers to:
    - control weeds
    - apply pesticides
    - apply fertilizer
    - time for irrigation
    - staking
    - pruning

6. This will enable farmer to avoid environmental stress and pest

7. Responses will depend on the learner's community

Research Work/Project Work
In your group compare different stages of maturity of crops identified in the community with those used in other places.
Use the following link
- www.nepjol.info>article.download
- www.researchgate.net?>puplication

CONTENT STANDARD: B9.2.3.2 Demonstrate knowledge and understanding of uses of different crops at different maturity stages.

Indicator: B9.2.3.2.1 Observe and record the uses of different crops at different maturity stages.

LESSON 2: USES OF DIFFERENT CROPS AT DIFFERENT MATURITY STAGES.

Teaching and Learning Resources:
Pictures or videos of materials in the environment, video clip on maturation and uses of different cops, writing, materials.
Learner's Book 9: Pages 87-90

Learning Expectations:
By the end of the lesson, the learner will:

1. discuss and write the uses of each maturity stage of each crop identified.
2. categorise crops by their different maturity stages and uses.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: Maturation, Categorise, prerequisites

BACKGROUND INFORMATION

In our previous lesson we observed and described the differences in maturity of crops grown in different soils and on different seed beds. In our observations we were able to describe some differences in maturity among these crops. Understanding the maturation process of different crops is key to maximizing their potential uses and benefits. By aligning harvesting and processing activities with the appropriate stage of crop maturation, farmers, food processors, and consumers can optimize crop utilization and support sustainable agricultural practices

Additional Information

The maturation of crops refers to the process by which crops reach their full development and are ready for harvest. Here are some common uses of crop maturation:

Harvesting for Food Consumption: The primary use of crop maturation is to indicate when crops are ready for harvest and consumption. Depending on the crop, maturation can signify the optimal time for picking fruits, vegetables, grains, or herbs, ensuring they have reached their peak flavor, texture, and nutritional value.
Seed Production and Propagation: Maturation is essential for seed production. When crops reach maturity, the seeds within them are fully developed and can be collected for future planting. Proper timing of seed harvest ensures viable and genetically stable seeds for propagation, maintaining crop diversity and enabling the continuation of agricultural practices.

Crop Processing and Preservation: Maturation influences the quality and characteristics of crops for various processing methods. For example, grains like wheat and rice need to fully mature and dry before harvesting for milling. Fruits and vegetables may be harvested at different stages of maturity, depending on their intended use, such as fresh consumption, canning, freezing, or processing into products like juices, sauces, or pickles.

Market Timing and Economic Considerations: Monitoring crop maturation is crucial for farmers and agricultural businesses to plan harvests and manage supply and demand. Understanding when crops will reach maturity allows for strategic market timing, ensuring optimal pricing and profitability. It also helps in coordinating logistics, storage, and transportation of harvested crops to markets or processing facilities.

Livestock Feed and Forage: Maturation of certain crops, such as corn or alfalfa, is important for producing feed and forage for livestock. Timing the harvest correctly ensures the highest nutrient content and palatability, providing animals with a balanced diet for growth, milk production, or meat quality.

Research and Development: Crop maturation plays a vital role in agricultural research and development. Researchers study the factors influencing crop maturation, such as genetics, environmental conditions, and agronomic practices, to optimize crop yield, quality, disease resistance, and other desirable traits. This knowledge helps in developing improved crop varieties and production techniques.

Activity 1: Uses of maturation of different crops.
Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.

1. Encourage learners to work in groups.
2. Guide learners to identify the use of each crop at different maturity stage.
3. Discuss with the learners and let them in their group categorise the crops by their different maturity stages and uses.
4. Let learners watch a video clip on maturation stages of different crops.

Progressive Assessment

Use group discussion to help learners explain why should maturity of crops should be a concern to humans?

Diagnostic Assessment

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Research Work / Project Work

- Agriculturistmusa.com
- www.agrifarming.in>maturity-of-f...
- www.researchgate.net>puplication

CONTENT STANDARD: B9.2.3.2 Demonstrate knowledge and understanding of uses of different crops at different maturity stages.

Indicator: B9.2.3.2.2 Evaluate the importance of knowledge of maturity stages of different crops to human beings.

LESSON 3: THE IMPORTANCE OF KNOWLEDGE OF MATURITY STAGES OF DIFFERENT CROPS TO HUMAN BEINGS

Teaching and Learning Resources:
Pictures or videos of materials in the environment, video clip or pictures of maturity stages of crops.
Learner's Book 9: Pages 91-93

Learning Expectations:
By the end of the lesson, learners are expected to:

1. explain the specific use(s) of each maturity stage of different crops to humans, other crops, animals, and the environment.
2. explain how the knowledge of the maturity stages of different crops helps a farmer in crop selection, time of harvest, and others.
3. compare different stages of maturity of crops identified in the community with those used in other places.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Presentation
- Research skills

Keywords: aroma, nutritional, fodder, silage, forage.

Activity 1

1. Encourage learners to work in groups demonstrating the importance of knowledge of the maturity stages of different crops
2. Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
3. Let learners watch a video clip or charts or pictures on maturity stages of different crops.
4. Guide learners to identify the use(s) of the crops at various stages of maturity.

5. Guide learners in their group to discuss how the knowledge of the maturity stages of different crops helps a farmer in crop selection of crop variety, time of planting time of harvest and cultural practices to be employed.
6. Assist learners present their findings for class discussion. Ensure both boys and girls participate I the activities.

Progressive Assessment

1. Use group discussion to help learners what they have learnt.
2. What is the importance of maturity of crops?

Diagnostic Assessment For The Teacher

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWER TO THE QUESTION FROM THE LEARNERS BOOK

1. Refer to page 92 of Learner's Book 9.

2. The knowledge of maturity stages will enable farmers to:
   - control weeds
   - apply pesticides
   - apply fertilizer
   - time for irrigation
   - staking
   - pruning

3. This will enable farmer to avoid environmental stress and pest.

4. Responses will depend on the learner's community

Research Work / Project Work

1. In your group compare different stages of maturity of crops identified in the community with those used in other places.
2. Use the following link

- www.nepjol.info>article.download
- www.researchgate.net?>puplication

2 Sub-Strand 4: Animal Production

CONTENT STANDARD
B9.2.4.1 Demonstrate understanding of the preparation of feed for domestic and commercial animals
B9.2.4.2 Demonstrate skills and knowledge of feeding domestic and commercial animals.

Indicator:
B9.2.4.1.1 List the ingredients and the method of preparation of different feed for different domestic and commercial animals.
B9.2.4.2.1 Describe and select appropriate feed for different domestic and commercial animals.
B9.2.4.2.2 Differentiate between different types of feed for different stages of domestic and commercial animals.
B9.2.4.2.3 Perform the feeding of domestic and commercial animals

LESSON 1: PREPARATION OF FEED FOR DIFFERENT AND COMMERCIAL ANIMALS

Teaching and Learning Resources:
- Materials for preparing different feeds for farm animals.

Learner's Book 9: Pages 94-97

Learning Expectations:
By the end of the lesson, the learner will:
1. prepare feed for different domestic and commercial animals with ingredients.
2. write down the process of preparing feed for different domestic and commercial animals with the ingredients.
3. compile a table, matching feed, ingredients and method of preparing.
4. formulate and prepare feed for domestic and commercial animals.
5. compile a list of feed commonly consumed by the different domestic and commercial animals in the environment.
6. compare and contrast the characteristics of different kinds of feed commonly consumed by ruminants, monogastrics, and poultry.
7. record feed used to feed domestic and commercial animals on farms over a period of time.
8. identify named samples of feed for three categories of domestic and commercial animals (ruminants, monogastrics, and poultry).

Learning Skills

- Making observations
- Communicating information Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: ensiling, ingredients, blending, formulate, concentrate supplements, hay, silage, formulation

BACKGROUND

Animal feed is food given to domestic animals, especially livestock in the course animal husbandry. As long as livestock remains an integral part of agricultural society, there will always be the demand for animal feed on a large scale, with large variety livestock from ruminants to poultry to non-ruminants. There must also be a large variety of different feed to accommodate their individual needs. Modern feeds are produced by carefully selecting and blending ingredients to provide highly nutritional diets that both maintain the health of the animal and increase the quality of products such as meat milk and eggs. The type, age and state of the animal is considered when preparing feed for farm animals.

Additional Information

Activity 1: Refer to Activity 1 on page 94 of Learners' Book 9.

- Preparing animal feed for different domestic and commercial animals.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Encourage learners to work in groups.
- Let learners to watch a video clip on the preparation of feed for animals.
- Guide learners to get all the necessary ingredients for the preparation of the feed.
- Guide learners to formulate a formula for a balanced diet.
- Guide learners to mix the ingredients.
- Guide learners to mix put them into bags and label.
- Organise the learners and make a visit to a commercial farmer.
- Guide learners to find out the type of feed given to different types of farm animals.
- Let learners to record feed used to feed commercial animals over a period of time.
- Let learners compare and contrast the characteristics of different types of feed usually consumed by monogastric, ruminants, and poultry.

- Guide learners to present your recordings for class discussion.

Fig. 10 - Animal Feed

- Ingredients for the preparation of feed for animals. Let learners to watch a video clip on animals at the various stages of feeding.
- Guide learners to find out the type of feed they rely on at their different stages of growth.
- Guide learners to find out the ingredients used in preparing the feed.
- Guide learners in their group to find out the function of the ingredients in the feed.

Precaution: Go with farm attendant as some animals can be wild on strangers.

- Encourage learners to work in groups.
- Let learners clean the pen or house of the animals.
- Guide learners to wash all feeding trough and water trough.
- Guide learners to put feed in feeding trough or hang them if the feed is forage.
- Let learners fetch water into the water trough.
- Let learners allow the animals to feed.
- Encourage learners to present a report on your achievement or difficulty.

Reflection

- Use group discussions to help learners understand what they have learnt.
- Use peer assessment to find out from learners what they have learnt from the lesson. Use effective questioning to find out from learners how the lesson will benefit them in everyday life. Let them mention types of feed used for the various stages of growth in their domestic and commercial ruminants, monogastric and poultry.

Research Work/Project Work

In groups of four formulate and prepare feed for a named domestic or commercial farm animal.

Use the following link also to access the lesson

- www.britannica.com
- www.pullish.csiro.au

Diagnostic Assessment/Application

- Can the learners explain potential misconceptions about the lesson?
- Where assessment for learning and assessment as learning strategies well used in the lesson?
- Did the learners understand the lesson through my resources?
- Did the learners systematically follow the progressiveness of the lesson?
- Did the learners understand the creative pedagogies I used?
- What can I do to improve the lesson?
- What was the reaction of the learners of my integration of ICT activities?

Fig. 11 - Types of feed for different stages of domestic and commercial animals.

Review Question

Ask learners to do the following:

- What types of farm animals are found in your environment?
- How do they feed?
- What kinds of feeds do they usually feed on?
- List the types of feed used for the various stages of growth in domestic and commercial ruminants, monogastrics and poultry in the community.
- Let learners also state the importance these feeds in the animals.

Reflection

- Can the learners explain potential misconceptions about the lesson?
- Where assessment for learning and assessment as learning strategies well used in the lesson?
- Did the learners understand the lesson through my resources?
- Did the learners systematically follow the progressiveness of the lesson?
- Did the learners understand the creative pedagogies I used?
- What can I do to improve the lesson?
- What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO END OF LESSON EXERCISE.

Objectives

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

Answers to Essay Type Questions

1. Refer to page 95 of the Learners' Book 9.
2. Refer to page 95 of the Learners' Book 9.
3. Refer to page 95 of the Learners' Book 9.

Research Work/Project Work

Let learners:

- compare and construct the major functions of feed in each growth stage of different animals in a tabular form and present their work in class for discussion.
- let them use power point and concept map for their presentation.

Let learners to use their parents or care givers phone to us ethe following links to do further learning.

- www.luke.fi>agriculture.animal
- the-chicken-chick.com
- www.britannica.com

CONTENT STANDARD: B9.2.4.2 Demonstrate skills and knowledge offeeding domestic and commercial animals.

Indicator: B9.2.4.2.1 Describe and select appropriate feed for different domestic and commercial animals.

LESSON 2: APPROPRIATE FEED FOR DIFFERENT DOMESTIC AND COMMERCIAL ANIMALS

Teaching and Learning Resources:
Pictures or videos of materials in the environment, video clip on feeds or pictures on feeds commonly consumed by domestic and commercial farm animals in labelled bags.
Learner's Book 9: Pages 98-102

Learning Expectations:
By the end of the lesson, learners are expected to:

1. categorise different types of animals according to their stages of growth (young, growing and matured stages).
2. list the types of feed used for the various stages of growth in their domestic and commercial ruminants, monogastrics and poultry.
3. compare and construct the major functions of feed in each growth stage of different animals.
4. discuss types of feed used to feed different domestic and commercial animals at different stages of growth.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Presentation
- Research skills

Keywords: feed supplements, nutrition, digestion enzymes, fodder.

Prior Preparation

- Make a nature walk with the learners to a nearby farm animal farmer.
- Let learners look out for different types of feed for different stages of domestic and commercial animals using pictures or realia.

BACKGROUND INFORMATION

A variety of foodstuffs that are required for the maintenance and production of farm animals is describe as feed. In this lesson learners will:

- Compile a list of feed commonly consumed by the different domestic and commercial animals in the environment.
- Compare and contrast the characteristics of different kinds of feed commonly consumed by ruminants, monogastrics, and poultry.
- Record feed used to feed domestic and commercial animals on farms over a period of time.
- Identify named samples of feed for three categories of domestic and commercial animals (ruminants, monogastrics, and poultry).

Teacher Learner Activities

1. Encourage learners to work in mixed ability groups to do the following activities
2. Compiling a list of feed commonly consumed by the different domestic and commercial animals in the community
3. Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences with reference to domestic and commercial animals
4. Make a nature walk with the learners to a nearby farm animal farmer.
5. Guide learners to find out the type of feed given to different types of farm animals.
6. Record feed used to feed domestic animals over a period of time.
7. Organise the learners and make another visit to a commercial farmer.
8. Guide learners to find out the type of feed given to different types of farm animals.
9. Let learners to record feed used to feed commercial animals over a period of time.
10. Let learners compare and contrast the characteristics of different types of feed usually consumed by monogastric, ruminants, and poultry.
11. Guide learners to present your recordings for class discussion.
12. Accept responses from all learners and give support.

Progressive Assessment

Use group discussions to help learners talk about what they have learnt using the following questions

1. Which types of farm animals are found in your environment?
   - How do they feed?
   - What kinds of feeds do they usually feed on?

Diagnostic Assessment

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?

6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTION FROM THE LEARNERS BOOK

1. Refer to page 98 and 99 of Learner's Book 8.

2. Answer will vary.

3. Knowledge in the characteristics of feed will enable farmers to:
   give farm animals that can be digested
   give maintenance feed
   provide feed for reproduction.
   feed to improve produce

4. Millet
   Maize
   Sorghum

5. Enzymes in the rumen of ruminant breakdown fibre.

Research Work / Project Work

Use the following links for further study

- www.britannica.com
- www.pullish.csiro

CONTENT STANDARD: B9.2.4.2 Demonstrate skills and knowledge offeeding domestic and commercial animals.

Indicator: B9.2.4.2.2 Differentiate between different types of feed for different stages of domestic and commercial animals.

LESSON 3: DIFFERENTIATING BETWEEN DIFFERENT TYPES OF FEED FOR DIFFERENT STAGES OF DOMESTIC AND COMMERCIAL ANIMALS

Teaching and Learning Resources:
Pictures or videos of materials in the environment,
Learner's Book 9: Pages 103-106

Learning Expectations:
By the end of the lesson, learners are expected to:

1. categorise different types of animals according to their stages of growth (young, growing and matured stages).
2. list the types of feed used for the various stages of growth in their domestic and commercial ruminants, monogastrics and poultry.
3. compare and construct the major functions of feed in each growth stage of different animals.
4. discuss types of feed used to feed different domestic and commercial animals at different stages of growth

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Presentation
- Research skills

Keywords: feed supplements, nutrition, digestion enzymes, fodder.

Prior Preparation

- Make a nature walk with the learners to a nearby farm animal farmer.
- Let learners look out for different types of Categorise different types of animals according to their stages of growth (young, growing and matured stages).

BACKGROUND INFORMATION

At their various stages of growth farm animals do need different types of feed. The feed may be for growth, maintenance or reproduction. In this lesson we shall look at the different type of feed that the animal will need at their various stages of growth.

Teacher Learner Activities

Activity 1

Finding out the type of feed farm animals eat at the various stages of growth.

Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.

1. Encourage learners to work in different groups.
2. Let learners to watch a video clip on animals at the various stages of feeding.
3. Guide learners to find out the type of feed the animals rely on at their different stages of growth.
4. Guide learners to find out the ingredients used in preparing the feed.
5. Guide learners in their group to find out the function of the ingredients in the feed.

Progressive Assessment

Use peer assessment to find out from learners what they have learnt from the lesson. Use effective questioning to find out from learners how the lesson will be benefit them in everyday life. Let them mention types of feed used for the various stages of growth in their domestic and commercial ruminants, monogastric and poultry.

Ask learners to do the following:

List the types of feed used for the various stages of growth in their domestic and commercial ruminants, monogastrics and poultry in their community.

Diagnostic Assessment for the Teacher

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTION FROM THE LEARNERS BOOK

1. Young mammals of farm animals require milk feed.

2. Feed for matured farm animals are for
   - maintenance of good health
   - increase the quality of end products

3. The importance of feed in the feed of growing animals are for:
   - growth
   - maintenance
   - production of by-products

Research Work / Project Work

Let learners

1. Compare and construct the major functions of feed in each growth stage of different animals in a tabular form and present their work in class for discussion. Let them use power point and concept map for their presentation.
2. Let learners to use their parents or care givers phone to us ethe following links to do further learning.
   - www.luke.fi>agriculture.animal
   - the-chicken-chick.com
   - www.britannica.com

CONTENT STANDARD: B9.2.4.2 Demonstrate skills and knowledge offeeding domestic and commercial animals.

Indicator: B9.2.4.2.3 Perform the feeding of domestic and commercial animals.

LESSON 4: FEEDING OF DOMESTIC AND COMMERCIAL ANIMALS

Teaching and Learning Resources:
Pictures or videos of materials in the environment, materials to clean the house or pen, prepared feed, water.
Learner's Book 9: Pages 107-110

Learning Expectations:
By the end of the lesson, learners are expected to:

1. demonstrate how to feed domestic and commercial animals at different stages of growth and production, with appropriate feed in the school farm or a farm in the community.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Presentation
- Research skills
- Analytical skills
- Critical thinking

Keywords: Animal feed, growth

Prior Preparation

- Make a nature walk with the learners to a nearby farm animal farmer.
- Let learners look out for different types of Categorise different types of animals according to their stages of growth (young, growing and matured stages).

BACKGROUND INFORMATION
Our previous lessons saw us discussing the type of feed required by domestic and commercial animals at their various stages of growth. We have also learnt how to prepare some of these feeds. Now we are going to feed these animals being it domestic or commercial.

Additional Information
Dietary enrichment refers to providing additional mental and physical stimulation during feeding to improve the overall well-being of domestic animals. Here are some ways to incorporate dietary enrichment:

Food Puzzle Toys: Use food puzzle toys that require animals to work for their food. These toys can be filled with treats or kibble, encouraging animals to engage in problem-solving and physical activity while eating.

Treat-Dispensing Toys: Treat-dispensing toys can be filled with small treats that are released gradually as the animal interacts with the toy. This stimulates the animal's natural foraging instincts and provides mental stimulation during feeding.

Interactive Feeders: Interactive feeders are designed to slow down the eating process, encouraging animals to eat more slowly and engage in mental and physical activity. These feeders can include mazes or obstacles that the animal must navigate to access their food.

Food Scattering and Hiding: Scatter food or hide small portions of food in different areas of the house or yard. This encourages animals to use their natural instincts to search and forage for their meals, keeping them mentally and physically active.

Proper Feeding Management and its Impact on Commercial Animal Operations: Proper feeding management plays a vital role in the productivity and profitability of commercial animal operations. Here's how it can impact the operations:

Nutritional Balance: Ensuring animals receive a well-balanced diet that meets their specific nutritional requirements is crucial for their growth, health, and performance. Proper feeding management involves formulating diets that provide the necessary nutrients in the right proportions, leading to improved productivity and overall health of the animals.

Feed Conversion Ratio (FCR): FCR is a measure of how efficiently animals convert feed into desired outputs, such as meat, milk, or eggs. Good feeding management practices, including providing optimal nutrition, feed quality, and feeding techniques, can help improve FCR. This leads to better feed efficiency, reduced feed wastage, and improved profitability in commercial animal operations.

Health and Disease Prevention: Proper feeding management includes strategies to prevent and mitigate the risk of diseases associated with nutrition. This includes regular monitoring of animal health, addressing nutritional deficiencies, and preventing overfeeding or underfeeding. Maintaining proper hygiene and sanitation during feeding also helps prevent the spread of diseases among animals, reducing the need for costly treatments and improving profitability.

Growth and Performance: Feeding management practices such as providing adequate nutrition, optimizing feeding schedules, and monitoring growth rates can significantly impact the growth and performance of commercial animals. Proper feeding management ensures that animals reach their target weight or production goals at the desired timeframe, leading to increased productivity and profitability.

Animal Welfare: Implementing proper feeding management practices is essential for ensuring good animal welfare in commercial operations. Animals that are well-fed, receive appropriate nutrition, and have access to clean water and feed are more likely to exhibit better health, behavior, and overall well-being. This can positively impact the reputation and public perception of commercial animal operations.

By incorporating dietary enrichment for domestic animals and implementing proper feeding management in commercial animal operations, we can enhance animal welfare, improve productivity, and contribute to the overall profitability of the operations.

Teacher Learner Activities
Activity 1

1. Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
2. **Note:** This activity should be done on the school farm or a nearby farm
3. What you will need: materials to clean the house or pen, prepared feed, water.
4. **PRECAUTION:** Go with farm attendant as some animals can be wild on strangers.
5. Encourage learners to work in mixed ability groups.
6. Let learners clean the pen or house of the animals.
7. Guide learners to wash all feeding trough and water trough.
8. Guide learners to put feed in feeding trough or hang them if the feed is forage.
9. Let learners fetch water into the water trough.
10. Let learners allow the animals to feed.
11. Encourage learners to present a report on your achievement or difficulty.

Progressive Assessment

1. Use peer assessment to find out from learners what they have learnt from the lesson . Use effective questions to find out from learners how the lesson will be benefit them in everyday life. Ask learners to mention professions that are associated with the feeding of domestic and commercial animals

2. Ask learners to find out what should be done when feeding domestic and commercial animals at different stages of growth and production, with appropriate feed in the school farm.

Diagnostic Assessment for the Teacher

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Research Work / Project Work

1. Let learners choose a farm in the community and write how to feed domestic and commercial animals at different stages of growth and production, with appropriate feed.
2. Encourage learners to develop report on their projects.

ANSWER TO THE QUESTION FROM THE LEARNERS BOOK

1. Responses will depend on learner.
2. Responses will depend on learner.

STRAND
3

SYSTEMS

Unit 1: The Human Body Systems

CONTENT STANDARD: B9.3.1.1 Demonstrate understanding of the blood circulatory system, health problems associated with the system and its relationship with the respiratory system in humans

Indicator: B9.3.1.1.1 Explain the concept of the circulatory system, state the function of each part of the system and the health challenges associated with it

LESSON 1: THE CIRCULATORY SYSTEM

Teaching and Learning Resources:

- Videos or charts on the circulatory system.

Learner's Book 9: Pages 111-122

Learning Expectations:

By the end of the lesson, the learner will:

1. identify the key parts of the circulatory system
2. explain how blood is circulated through the body
3. identify the functions of each part of the circulatory system
4. demonstrate how blood is circulated in the body.
5. list some diseases that affect the circulatory system and how to prevent them.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking

Keywords: heart, blood vessels, arteries, veins, capillaries, pulmonary, systemic, circulation

Prior Preparation:

- Ask learners to find out about diseases that affect the circulatory system
- Gather charts, videos or a model on the circulatory system

BACKGROUND

The circulatory system is made up of the heart and blood vessels that carry blood away from and towards the heart. Arteries carry blood away from the heart and veins carry blood back to the heart. The circulatory system carries oxygen, nutrients, and hormones to cells, and removes waste products, like carbon dioxide.

The heart usually beats about 60 to 100 times per minute. With each heartbeat, the heart sends blood throughout our bodies, carrying oxygen to every cell. After delivering the oxygen, the blood returns to the heart. The heart then sends the blood to the lungs to pick up more oxygen. This cycle repeats over and over again.

Additional Information

Your heart and blood vessels make up the circulatory system. The main function of the circulatory system is to provide oxygen, nutrients and hormones to muscles, tissues and organs throughout your body. Another part of the circulatory system is to remove waste from cells and organs so your body can dispose of it. Your heart pumps blood to the body through a network of arteries and veins (blood vessels). Your circulatory system can also be defined as your cardiovascular system. Cardio means heart, and vascular refers to blood vessels.

The circulatory system's function is to move blood throughout the body. This blood circulation keeps organs, muscles and tissues healthy and working to keep you alive.

The circulatory system also helps your body get rid of waste products. This waste includes:

Carbon dioxide from respiration (breathing).

Other chemical by-products from your organs.

Waste from things you eat and drink.

Your circulatory system functions with the help of blood vessels that include arteries, veins and capillaries. These blood vessels work with your heart and lungs to continuously circulate blood through your body.

Diagnostic Assessment

Prior to introducing the lesson, engage learners in a pair activity to review their previous knowledge of the circulatory system (based on what they learnt in primary school)

Activities

- Ask learners to share their answers on the task assigned to them to investigate the diseases of the circulatory system and how the system can be taken care of properly.
- With the aid of a chart, assist learners to identify the parts of the circulatory system
- Use cut-outs containing the functions of the various parts of the system to explain to learners the role(s) of the various parts of the system.
- Let learners read out the functions of each part of the circulatory system from sheets of paper.
- With the aid of a detailed diagram or a video, explain to learners the pathway of blood through the human body.
- Engage learners in an activity to role play the double circulation of blood in the heart.
- Guide learners to mention various diseases that affect the circulatory system.
- Engage learners in a whole class activity to link diseases to lifestyles and eating habits.
- Ask learners to individually tell what they have learnt and tell the rest of the class what they will do to avoid diseases of the circulatory system.

Refer to pages 116, 117 and 118 of the Learners' Book 9 for Activities 1 and 2.

Skills and Competencies

Observing, evaluating, personal development, critical thinking, creativity, problem solving

Progress Assessment

Create a mind map on the circulatory system, its parts and their functions, diseases and how to protect the system from diseases.

Main Points of the Lesson

- The circulatory system consists of the heart and blood vessels that transport blood and other substances in the body.
- The main organ of the circulatory system is the heart. The blood vessels and blood are also components of the circulatory system
- Two types of circulation take place in the body are the pulmonary circulation and the systemic circulation.
- The pulmonary circulation ensures the exchange of blood between the heart and the lungs while the systemic circulation ensures the distribution of blood throughout all other systems and tissues of the body.
- Diseases such as stroke, heart failure, heart attack and hypertension can affect the circulatory system.

- To prevent such diseases, we need to eat healthy foods, exercise regularly, avoid smoking and go for regular medical check-ups.

Reflection
After going through the lesson, identify areas where learners still face challenges for further clarification.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 111 of Learners' Book 9.
2. Refer to pages 112 and 113 of Learners' Book 9.
3. Refer to pages 116 and 117 of Learners' Book 9.
4. Refer to pages 118 and 119 of Learners' Book 9.
5. Refer to page 118 of Learners' Book 9.

INDICATOR: B9. 3.1.1.2 Explain the concept of respiration and show how the respiratory and circulatory systems complement each other

LESSON 2: THE RESPIRATORY SYSTEM

Teaching and Learning Resources:

- Charts, models and videos on the respiratory system, balloons, straws, plastic bottles and a knife.

Learner's Book 9: Pages 123-130

Learning Expectations:

By the end of the lesson, the learner will:

1. identify the parts of the respiratory system and the role they play in respiration
2. describe how the respiratory system interacts with the circulatory system

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking

Keywords: respiratory, lungs, diaphragm, breathing, oxygen, carbon dioxide, alveoli

Prior Preparation:

- Ask the learners to study the respiratory system of humans prior to the lesson.
- Assemble and test the model for demonstrating breathing, prior to the lesson.

BACKGROUND

The respiratory system is responsible for breathing in oxygen and breathing out carbon dioxide. The respiratory system consists of a network of organs. Its primary organs are the lungs, which carry out the exchange of gases as we breathe.

The lungs work with the circulatory system to pump oxygen-rich blood to all cells in the body. The blood then collects carbon dioxide and other waste products and transports them back to the lungs, where the waste products are pumped out of the body when we exhale.

The human body needs oxygen to sustain itself. After only about five minutes without oxygen, brain cells begin to die. This shows how important our respiratory system is.

Additional Information

What does the respiratory system do? The respiratory system has many functions. Besides helping you to inhale (breathe in) and exhale (breathe out), it:

Allows you to talk and to smell.

Warms air to match your body temperature and moisturizes it to the humidity level your body needs.

Delivers oxygen to the cells in your body.

Removes waste gases, including carbon dioxide, from the body when you exhale.

Protects your airways from harmful substances and irritants.

The respiratory system has many different parts that work together to help you breathe. Each group of parts has many separate components. Your airways deliver air to your lungs. Your airways are a complicated system that includes your:

- **Mouth and nose:** Openings that pull air from outside your body into your respiratory system.
- **Sinuses:** Hollow areas between the bones in your head that help regulate the temperature and humidity of the air you inhale.
- **Pharynx (throat):** Tube that delivers air from your mouth and nose to the trachea (windpipe).
- **Trachea:** Passage connecting your throat and lungs.
- **Bronchial tubes:** Tubes at the bottom of your windpipe that connect into each lung.
- **Lungs:** Two organs that remove oxygen from the air and pass it into your blood.
- From your lungs, your bloodstream delivers oxygen to all your organs and other tissues.
- Muscles and bones help move the air you inhale into and out of your lungs. Some of the bones and muscles in the respiratory system include your:
- **Diaphragm:** Muscle that helps your lungs pull in air and push it out.
- **Ribs:** Bones that surround and protect your lungs and heart. When you breathe out, your blood carries carbon dioxide and other waste out of the body. Other components that work with the lungs and blood vessels include:
- **Alveoli:** Tiny air sacs in the lungs where the exchange of oxygen and carbon dioxide takes place.
- **Bronchioles:** Small branches of the bronchial tubes that lead to the alveoli.
- **Capillaries:** Blood vessels in the alveoli walls that move oxygen and carbon dioxide.
- **Lung lobes:** Sections of the lungs — three lobes in the right lung and two in the left lung.
- **Pleura:** Thin sacs that surround each lung lobe and separate your lungs from the chest wall.

Some of the other components of your respiratory system include:

- **Cilia:** Tiny hairs that move in a wave-like motion to filter dust and other irritants out of your airways.

- **Epiglottis:** Tissue flap at the entrance to the trachea that closes when you swallow to keep food and liquids out of your airway.
- **Larynx (voice box):** Hollow organ that allows you to talk and make sounds when air moves in and out.

Diagnostic Assessment
Give learners an assignment to find out the differences between respiration and breathing.

Activities:

- Ask the learners to breathe in and out for a period of 30 seconds and identify the system of the body responsible for breathing in and out?
- With the aid of a video or a chart, guide learners to know the pathway of air from the nostrils to the body and back.
- Make use of the chart and video to assist learners to learn about the main organs of respiration and their functions.
- Through a pair activity, learners create cut-outs bearing the names of the organs of the respiratory system, and their functions for a matching activity on parts of the respiratory system and their functions.
- With the aid of the water bottles, balloons and straw, guide learners to work in groups to create an improvised model for demonstrating how inhalation and exhalation of air by the lungs takes place.
- Give learners a home task to learn about respiratory diseases and their prevention for group presentations.
- Summarise the lesson by going over the functions, parts, diseases and protection of the respiratory system through a whole class discussion.

Let learners work in groups of 10 and perform Activies 1 and 2 on page 97 of learner's book.

Skills and Competencies
Investigating, analysing, evaluating, recording, digital literacy, personal development, collaboration and communication, leadership, creativity and innovation.

Progress Assessment
Learners work in groups to create a flow chart on the pathway of air through the various parts of the respiratory system

Main Points of Lesson

- The respiratory system is the network of organs and tissues that help you to breathe in and out.
- Humans breathe in oxygen and breathe out carbon dioxide.

- The main parts of the respiratory system are the lungs.
- Other parts of the respiratory system are the diaphragms, trachea, alveoli, bronchi, nostril etc.
- the respiratory system works with the circulatory system to help you transport oxygen and carbon dioxide into and out of the body through the blood.
- We must protect the respiratory system by eating healthy foods, avoiding smoking and exercising regularly.

Reflection
With the aid of the questioning techniquevand a short test, find out the extent to which learners understood the concept learnt.

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. a
2. d
3. c
4. c
5. a
6. c
7. a
8. d
9. a
10. c

Answers to Essay Type Questions

1. Refer to page 124 of the Learners' Book 9.
2. Refer to page 124 of the Learners' Book 9.
3. Refer to page 127 of the Learners' Book 9.
4. Refer to page 128 of the Learners' Book 9.
5. Answers will vary.

3 Sub-Strand 2: Solar System

CONTENT STANDARD: B9.3.2.1 Demonstrate knowledge of other non- planetary bodies such as comets, asteroids, and their relationship with the solar system

Indicator: B9.3.2.1.1 Understand the movement of non-planetary Bodies in the solar system

LESSON 1: NON-PLANETARY BODIES IN THE SOLAR SYSTEM

Teaching and Learning Resources:

- Charts, models and videos on the solar system, A4 Sheets, poster colours, paper glue, pencils and crayons

Learner's Book 9: Pages 131-140

Learning Expectations:

By the end of the lesson, the learner will:

1. explain the term non-planetary bodies
2. identify some types of non-planetary bodies

Keywords: non-planetary, asteroid, satellite, moon, comet, dwarf planet

Prior Preparation:

- Assemble the relevant resources such as charts, videos and models on the solar system.

BACKGROUND

Previously, we have learnt about the sun and the eight planets that move around it. There are other bodies in the solar system that are not planets, but also move around the sun. The small bodies in the solar system include comets, asteroids, moons, dwarf planets and interplanetary dust.

Why the smaller objects in the solar system are not classified as planets

Before a body in the solar system can be classified as a planet, it must be able to do three things:

- It must orbit a star (the Sun).
- It must be big enough to have enough gravity to force it into a spherical shape.
- It must be big enough that its gravity cleared away any other objects of a similar size near its orbit around the Sun.

In our solar system, only eight bodies meet the criteria above, and these are the eight planets that you already know about.

Additional Information

The small bodies in the solar system include comets, asteroids, the objects in the Kuiper Belt and the Oort cloud, small planetary satellites, Triton, Pluto, Charon, and interplanetary dust. As some of these objects are believed to be minimally altered from their state in the young solar nebula from which the planets formed, they may provide insight into planet Earth and the formation and evolution of the solar system.

The Oort Cloud is a spherical shell of millions of icy bodies which surrounds the solar system at vast distances and is thought to be the birth place of long-period comets.

The Kuiper Belt is a region extending from Neptune's orbit out to the far and distant reaches of the solar system and possibly holds the best available record of the original interstellar materials that formed the solar nebula. This region beyond Neptune is also the most probable birthplace of the short-period comets.

Comets are pristine remnants from the formation of the solar system that are comprised of minerals, rock and mostly ice, much like a dirty snowball. They travel around the sun in elliptical orbits and can be inclined to the plane of the solar system at any angle. Comets can sprout tails extending many tens of millions of miles, during their closest approach to the sun. Short period comets are thought to come from the Kuiper Belt on the outskirts of Neptune's orbit and further, and longer period comets are thought to come from the Oort cloud.

Asteroids are rocky remnants from the formation of the solar system. They are not spherical and have differing compositions and histories. Most, although not all asteroids, reside in a region between Mars and Jupiter where numerous other small rocky worlds orbit the sun.

Diagnostic Assessment

Give learners a list of names of objects in the solar system for them to classify into planetary and non-planetary bodies.

Activities:

- Place learners into groups and ask them to research about comets, asteroids, meteors, satellites and dwarf planets.
- Ask learners to share their findings with the rest of the class, in turns.
- With the aid of posters or pictures, help learners to know the key features of meteors, satellites, asteroids, comets and dwarf planets.
- Let learners brainstorm to find out the differences between, planets and dwarf planets, comets and asteroids, meteors and meteorites.
- Assist learners to create posters on the various planetary bodies using the A4 sheets, poster colours, pencils and crayons.
- Summarise the lesson by telling learners the criteria for classifying a body as a planet.

Let learners perform Activities 1 annd 2 on page 136 and 137 of learners book.

Skills and Competences
Investigating, analysing, evaluating, recording, digital literacy, personal development, collaboration and communication, leadership, creativity and innovation, global citizenship.

Progress Assessment
Ask the learners to explain the main differences between planets and non-planetary bodies.

Main Points of Lesson

- There are some natural objects in our solar system that also revolve around the sun even though they are not planets. These are known as non-planetary objects.
- Examples of non-planetary objects are dwarf planets, moons, asteroids and comets.
- Asteroids are small, rocky objects that orbit the Sun. Although asteroids orbit the Sun like planets, they are much smaller than planets.
- A comet is a relatively small body, made of ice and dust, that has a highly eccentric elliptical orbit. Its orbital period can range from a few years to a million years or more.
- A moon is a heavenly body or natural satellite that moves around another body, usually a planet.
- A dwarf planet is smaller in size than a planet.

Reflection
With the aid of questioning and a short test, find out the extent to which learners understood the concept learnt.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 131 of Learners' Book 9.
2. Refer to page 131 of Learners' Book 9.
3. i. Refer to page 134 of Learners' Book 9.
   ii. Refer to pages 136 and 137 of Learners' Book 9.
4. i. Refer to pages 137 and 138 of Learners' Book 9.
   ii. Refer to pages 134 to 137 of Learners' Book 9.

3 Sub-Strand 3: Ecosystem

CONTENT STANDARD: B9.3.3.1 Recognise the interdependence of organisms in an ecosystem and appreciate their interaction to maintain balance in the system

Indicator: B9.3.3.1.1 Conduct research into the composition of an ecosystem and discuss how the components depend on each other for survival

LESSON 1: INTERDEPENDENCIES WITHIN AN ECOSYSTEM

Teaching and Learning Resources:

- Charts, models and videos on ecosystems

Learner's Book 9: Pages 141-151

Learning Expectations:

By the end of the lesson, the learner will:

1. describe how organisms depend on each other in different ecosystems.
2. state the differences between an ecosystem and a habitat.
3. construct a food chain and a food web found in an ecosystem.
4. predict and justify your predictions on how interferences affect the organisms within an ecosystem.

Keywords: symbiosis, mutualism, parasitism, commensalism, food chain, food web, producer, consumer, decomposer trophic level

Prior Preparation:

- Identify a nearby ecosystem which the class can visit

BACKGROUND

Living organisms interact amongst themselves and with their environment. All organisms live in various ecosystems. There can be different types of ecosystems. To be able to learn more about ecosystems, they are generally divided into smaller forms. Within an ecosystem, many relationships exist between different organisms. Ecology is the field that studies the relationships between the living organisms and their surrounding environment. This covers various interactions among different living things, feeding relationships and energy transfer within the ecosystem.

Additional Information

All organisms in an ecosystem depend upon each other. If the population of one organism rises or falls, then this can affect the rest of the ecosystem.

A simple food chain is:
grass → rabbit → fox
If the foxes in the food chain above were killed, the population of rabbits would increase because they are no longer prey to the foxes. As a result the amount of grass would decrease because the increased population of rabbits would be eating it.
Often very small changes in ecosystems have large consequences, which can be difficult to predict. This means that all the organisms in an ecosystem are dependent upon each other. We call this interdependence.

Diagnostic Assessment
Prior to the lesson ask the learners to sort the components of ecosystems into biotic and abiotic components. Afterwards engage them to explain how the biotic components of an ecosystem depend on each other.

Activities:

- Take the learners on a field trip to a nearby ecosystem such as a small pond or a little bush. You can also take them to a nearby tree with birds and insects or show them pictures or videos of different ecosystems.
- Ask the learners to identify other examples of ecosystems they know of and mention the living and non-living components of ecosystems.
- In groups of three, learners should explain how plants and animals are interdependent on each other and relate it to life within an ecosystem.
- Write down key terminologies such as mutualism, commensalism, saprophytism, symbiosis, food chain, food web and parasitism on the white board.
- Cite relevant examples to explain to learners the various forms of interdependent relationships in an ecosystem and let learners provide examples through whole group discussions.
- Engage learners in a brainstorming session on the ways that humans disrupt ecosystems and how this can be minimized.
- Use paper-cut outs to demonstrate the feeding relationship within an ecosystem by forming and joining paper rings representing different feeding levels.
- Assign learners into groups to work on projects on developing posters, charts or models on different feeding relationships within an ecosystem.

Guide the learners to perform Activities 1, 2 and 3 on page 146, 148 and 150 of the Learner's Book 9.

Skills and Competencies
Investigating, analysing, evaluating, creativity and innovation, digital literacy, cultural identity, personal development, collaboration and communication, leadership, creativity and innovation.

Progress Assessment
Let learners do group presentations based on the project work assigned to them.

Main Points of Lesson

- An ecosystem consists of different organisms living in a given place at a given time.
- All organisms in an ecosystem depend upon each other. If the population of one organism rises or falls, then this can affect the rest of the ecosystem.
- Habitat is the place where an organism resides whilst the interaction and interrelationship between living and non-living factors in a given place make up the ecosystem.
- A food chain is a linear feeding relationship that shows the transfer of energy from one organism to the other. A food web is made up of different food chains connected together.
- Feeding relationships in an ecosystem include mutualism, commensalism and parasitism.

Reflection
With the aid of questioning and a short test, find out the extent to which learners understood the concept learnt.

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to page 141 of Learners' Book 9.
2. Refer to pages 144 to 147 of Learners' Book 9.
3. Grasshopper ⟶ bird ⟶ snake ⟶ hawk
4. Refer to page 142 of Learners' Book 9.
5. Refer to pages 145 to 148 of Learners' Book 9.

3 Sub-Strand 4: Farming Systems

CONTENT STANDARD: B9.3.4.1 Demonstrate knowledge and skills in the preparation of different types of manure from animal and plant waste

Indicator: B9.3.4.1.1 List and explain the different plant and animal waste used in preparing different types of manure

LESSON 1: PLANT AND ANIMAL WASTE USED IN PREPARING MANURE

Teaching and Learning Resources:
Charts, videos, plants and animal waste, samples of manure
Learner's Book 9: Pages 152-155

Learning Expectations:
By the end of the lesson, learners are expected to:

1. list some types of manure used by farmers.
2. identify and write down the materials used in preparing manure and their sources
3. categorise manure into those from plant wastes and animal wastes.
4. compile list of plant parts or wastes and animal parts or wastes that are used to prepare manure.
5. justify the use of different animal and plant manures (poultry droppings, cow dung, animal parts and carcass, pig dung, human excreta, domestic refuse, leaves, waste fruits, plant parts and shavings, etc.) under different soil and climatic conditions.

Keywords: manure, carcass, deficiency, texture

Prior Preparation:

- Gather the required resources such as samples of manure
- Arrange a visit to a nearby farm

BACKGROUND
Manure is an organic matter used as a kind of fertilizers. It is something like natural fertilizer. It can be of animal or plant source.
Manure is mainly used for plantation purposes instead of chemical fertilizers. It saves money and also waste materials are reused.
Like other plants crop plants obtain their nutrients from the soil. Continuous growing of crops in the field causes deficiency of mineral nutrients in the soil. Therefore, manure is added to the soil to make up the deficiency of mineral nutrients. This process is called manuring.

The types of manure usually used by farmers are:

- Animal manure
- Compost and
- Green manure

Additional Information

What is Manure?

Manure is the decomposed form of dead plants and animals, which is applied to the soil to increase production. It is a natural form of fertilizer and is cost-effective. The human and animal excreta is also used as manure. The livestock manure is rich in nitrogen, phosphorus, and potassium.

Manure is highly rich in organic matter and humus and thus improves the soil fertility. These are better in the long run and does not cause any pollution. It is a valuable and renewable resource. Manure can be obtained from various sources.

The different sources of manure are mentioned below:

- Cattle dung, urine, and slurry from biogas plants.
- Wastes from human habitation such as human urine, night soil, sludge, sewage, domestic waste.
- Droppings of goat and sheep
- Waste from the slaughterhouses such as bones, meat, horn and hoof meal, fish waste
- By-products of agricultural industries
- Crop waste
- Weeds, water hyacinth

Types of Manure

Manure can be grouped as animal manure, green manure and compost manure.

Diagnostic Assessment

Engage learners in a whole class discussion to find out their level of understanding on preparation, types and sources of manure.

Activity 1: Refer to page 152 of Learners' Book 9

- Take learners on a field trip to a nearby crop farm to observe different types of manure and to listen or observe their preparation. Alternatively, make use of the resources such as samples of manure to explain the benefits and source of manure.
- Present to learners pictures or samples of different types of plant and animal-based manure for them to identify with reasons.
- Assist learners to know the differences between the three main types of organic manure namely, green manure, compost and animal manure.

- With the aid of chronological charts, explain to learners the methods of manure preparation and the processes involved in the preparation of each type of manure.
- Place learners into groups to work on producing each of the types of manures after 2 weeks.
- Let learners review the key steps involved in the preparation of animal manure, compost and green manure.

Skills and Competencies
Manipulating, observing, evaluating, creativity and innovation, problem solving, cultural identity, personal development, collaboration and communication, leadership, creativity and innovation.

Progress Assessment
Let learners talk about the advantages and disadvantages associated with each type of manure.

Main Points of the Lesson
- Manure is an organic matter used as a kind of fertilizers.
- The manure used by most farmers are animal manure, compost and, green manure.
- Both plant and animal manure contain nitrogen, phosphorus and other nutrients that plants require to grow.
- Among the methods used in preparing manure are pot compositing and Bokashi method.
- The starter introduces the bacteria that cause decay of the materials and also nitrogen that facilitates the process of decomposition.
- Bacteria are inactive in dry conditions.
- The manure heap must be given some oxygen to keep the bacteria alive and this is done by aerating the heap by turning it from time to time.

Reflection
With the aid of the questioning technique and a short test, find out the extent to which learners understood the concept learnt.

ANSWERS TO END OF LESSON EXERCISE

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

Answers to Essay Type Questions

1. Refer to page 122 of Learners' Book 9.
2. Refer to page 123 of Learners' Book 9.
3. Refer to page 123 of Learners' Book 9.
4. Refer to page 123 of Learners' Book 9.

CONTENT STANDARD: B9.3.4.1 Demonstrate knowledge and skills in the preparation of different types of manure from animal and plant waste.

Indicator: B93.4.1.2 Demonstrate the preparation of different types of manure

LESSON 2: THE PREPARATION OF DIFFERENT TYPES OF MANURE

Teaching and Learning Resources:
crop residue, farmyard waste, organic materials such as fruit and vegetable scraps, eggshells, coffee grounds, grass clippings, and dry leaves.
Learner's Book 9: Pages 156-160

Learning Expectations:
By the end of the lesson, learners are expected to:

1. prepare manure from the different plant and animal wastes.
2. discuss the preparation of manure using the plants and animal wastes that are available in a community.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking

Keywords: Composting, anaerobically, fermenting, parasitic

Prior Preparation:

- Ensure the materials for the lessons are available to learners to aid participation of all the learners

BACKGROUND INFORMATION
Manure is a valuable source of nutrients for plants and plays a crucial role in agriculture. There are various types of manure, each with its own preparation process. The most common types of manure include compost, animal manure, green manure, and vermicompost.

Additional Information

Animal manure is derived from the waste of livestock such as cows, horses, pigs, and poultry. To prepare animal manure for use as fertilizer, it needs to be aged or composted to reduce the risk of pathogens and to allow for the breakdown of ammonia. This can be achieved by storing the manure in a designated area for a specific period while regularly turning it to facilitate decomposition.

Green manure involves growing specific crops that are then plowed back into the soil to improve its fertility. Common green manure crops include legumes like clover and vetch, as well as grasses such as rye and oats. The preparation process includes planting the green manure crop, allowing it to grow to a certain stage, and then incorporating it into the soil before it reaches maturity.

Vermicompost is produced through the activity of earthworms on organic matter. The preparation involves creating a suitable environment for earthworms to thrive, such as a bin with bedding material and food scraps. The worms consume the organic matter and excrete nutrient-rich castings, resulting in vermicompost.

Each type of manure has its unique preparation process tailored to maximize its nutrient content and minimize any potential risks associated with its use.

Teacher Learner Activities

1. Engage learners to prepare manure from the different plant and animal wastes.
2. Your language of instruction should be devoid of stereotyping.

Activity 1: Preparation of Different Types of Manure

- Collect organic materials such as fruit and vegetable scraps, eggshells, coffee grounds, grass clippings, and dry leaves.
- Layer the organic materials in a compost bin or pile, alternating between green materials (high in nitrogen) and brown materials (high in carbon).
- Keep the compost pile moist and turn it regularly to aerate the mixture.
- After a few months, the compost will be ready to use as a nutrient-rich soil amendment.

Activity 2

- Set up a vermicomposting bin with bedding material such as shredded newspaper or cardboard.
- Add organic waste such as kitchen scraps and yard waste to the bin.
- Introduce earthworms to the bin and ensure proper moisture and aeration.
- The worms will consume the organic matter and produce nutrient-rich castings, which can be harvested for use in gardening.
- The plants and animal wastes that are available in a community and make presentations.

Progressive Assessment
Ask learners to mention the importance of manure to plants and what will happen if plants do not get manure.

Diagnostic Assessment for the Teacher

1. Did I do mixed ability groupings well?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Main Points of Lesson
The significance of manure preparation for plants is indeed a splendid topic to explore. Manure, as you may know, is a natural fertilizer derived from animal waste, which when properly prepared, can greatly benefit plant growth and health.:

1. **Nutrient Enrichment:** Manure, through its decomposition process, releases a plethora of essential nutrients such as nitrogen, phosphorus, and potassium, commonly referred to as NPK. These nutrients are vital for plant growth, as they promote root development, flowering, and fruiting.

2. **Soil Conditioning:** Properly prepared manure possesses organic matter that improves soil structure. It enhances soil aeration, water-holding capacity, and overall soil fertility. This aids in the prevention of soil erosion, promotes beneficial microbial activity, and increases nutrient availability to plants**.**

3. **Sustainable Option:** Utilizing properly prepared manure is an environmentally friendly alternative to synthetic fertilizers. It helps reduce dependence on chemical inputs, minimizes the risk of nutrient runoff, and supports sustainable agricultural practices.

4. **Cost-effectiveness:** For farmers and gardeners, manure preparation offers a cost-effective means of enriching the soil and promoting plant growth. It can be readily sourced from livestock operations, making it an accessible option for many.

5. **Disease Suppression:** Some types of properly prepared manure possess natural antimicrobial properties. These properties can help suppress certain plant diseases, providing additional protection to crops or plants.

STRAND
4

FORCES OF ENERGY

Unit 1: Energy

CONTENT STANDARDS:
B9.4.1.1 Show understanding of the concept of conservation of energy and ways of conserving energy.
B9.4.1.2 Demonstrate understanding in and the capability to do calculations involving energy and how to conduct energy audit.

Indicator:
B9.4.1.1.1 List the ways to conserve energy. Examples: ironing in bulk, using energy efficient appliances and switching off appliances when not in use.
B9.4.1.1.2 Explain the importance of energy conservation in daily life.
B9.4.1.2.1 Explain how to calculate energy consumed over a period of time.

LESSON 1: WAYS OF CONSERVING ENERGY

Teaching and Learning Resources:
- Electric pressing iron, incandescent light bulbs, energy saving bulbs, electric pressing iron, electric fan, immersion heater, videos and pictures of conserving energy for future use in life.
- Science Curriculum Basic 9, Learner's Textbook for Basic 9, ICT tools, pictures, charts, video clips or digital contents on how to calculate electricity bills.
- Electricity bill, electric meter, electrical appliances such as electric bulbs, electric iron, electric fan.

Learner's Book 9: Pages 161-164

Learning Expectations:
By the end of the lesson, learners are expected to:
1. identify and discuss various strategies of conserving energy.
2. research information about energy conservation and discuss its importance to life.
3. calculate electrical energy consumed by the use of electrical appliances in kilowatt-hour (kWh). P = IV, where P is power, I is current, V is voltage.

Learning Skills
- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: conservation of energy, efficiency, energy efficient appliance, power, kilowatt hour (kWh).

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

The rate at which energy is transferred or consumed is called electric power. Electric power is measured in joules per second or watts (W).

kilowatt-hour is a unit of electrical energy consumed or transferred.

The electric meter records the electricity consumed.

Main Points of the Lesson

- Energy is used to do work.
- Energy is expensive so it must be used wisely.
- Conserving energy refers to the practice of reducing the quantity of energy used.
- Energy conservation is necessary in order to save money.
- The following are some ways of conserving energy:
- Use energy efficient gadgets instead of second-hand gadgets. The energy efficiency of gadgets such as deep freezers and refrigerators is indicated by number of stars. The more the number of stars are the greater the efficiency.
- Do ironing in bulk instead of in bits. A heated pressing iron can be used to iron a number of clothes to conserve electricity.
- Switching off lights when they are not needed or when you leave a room.
- Do not use air conditioner unless when it is really needed. You may have to use a well ventilated room to avoid overdependence on air conditioners which consume a lot of electrical energy.
- Use cars which consume less fuel.
- Energy conservation is way of preventing waste or reducing the quantity of energy used.
- Over eighty percent of energy sources are not renewable.
- There is the need to conserve energy and avoid wastage.
- The quantity of electrical energy consumed can be calculated.
- In any community, there is a fixed amount for a range of kilowatt-hours consumed by homes, schools and industry. The kilowatt-hours consumed in every home is recorded by the electric meter.

Progress Assessment

Check prior knowledge by asking the learners of List the ways to conserve energy.

Ask the learners to think-pair -share on the following:

- Why is it advisable to iron clothes in bulk?

- How is the use of electricity managed in your homes to conserve it?
- What is the function of electric meters in our homes?

Take feedback from around the room.

Activity 1 and 2 Guide:
See Page 161 of Learner's Book 9
These activities are designed to enable learners list the ways to conserve energy.

- Guide the learners to carry out the Activity 1 to investigate ways of conserving energy.
- Engage the learners to discuss what is meant by 'energy conserving' and also discuss ways of conserving different forms and sources of energy.
- Ask the learners to watch a digitized content on energy conservation.
- Ask the learners to observe the movement of the readings on an electric meter when an electric kettle or a pressing iron is switched on for ten minutes and also watch the reading on the meter when energy saving bulbs only are switched on.
- Ask the learners to compare the two readings observed.
- Ask the learners to discuss the strategies to be adopted at home to conserve energy.
- Guide learners to carry out the Activity 2 to calculate cost of the electricity consumed.

Home Work/Project
Let learners carry out a project to:

- design posters on how to conserve energy
- use the posters to educate the people in their community and get their responses.
- ask the learners to switch on an electric pressing iron and used it for ten minutes read the meter after ten minutes and calculate the kilowatt-hours consumed.
- engage the learners to calculate the cost of electricity consumed, assuming 1 kwh costs 1kw h costs 50 pesewas.
- ask learners to take an electricity bill of a particular month, find out the kilowatt hours of electricity consumed, and calculate the cost of electricity consumed according to the bill.

Think and Discuss
Group learners in pairs to discuss ways to conserve energy.
Take feedback from the various groups. Ensure that the less able learners participate actively in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

ICT LINKS
You may use the following links:

- https://www.arcadia.com/energy-101/energy-bills/how-to-calculate-your-electric-bill-from-reading-your-meter/
- https://www.arcadia.com/energy-101/energy-bills/how-to-calculate-your-electric-bill-from-reading-your-meter/
- https://www.directenergy.com/learning-center/how-to-calculate-electric-bill
- https://www.youtube.com/watch?v=x5lnOgkdBic

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were your lessons interesting and stimulating?
- Were the majority of the class responding as you would expect them to?
- Are there any reasons you could identify the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve upon the learners understanding of the topic?
- To what extent did you cater for learners with disability and the below average learners?

ANSWERS TO END OF LESSON EXERCISE

1.

Turning off appliances when on holidays - **Good**	Leaving lights on in an empty room - **Bad**	Using an electric blanket - **Good**	Using fluorescent lights - **Good**	Using filament lights - **Bad**
Wearing jerseys and warm clothes in cold weather - **Good**	Leaving outside lights on during the day - **Bad**	Using electric toothbrush - **Bad**	Running full loads in the washing machine - **Bad**	Switching off the geyser (bathing heater) during the day - **Good**
Boiling a full kettle - **Bad**	Using a gas heater - **Good**	Hanging clothes outside to dry - **Good**	Turning the TV of when no one is watching - **Good**	Ironing clothes in bulk instead of in bits at different times - **Good**
Running half loads in dishwasher - **Good**	Leaving the oven door open when nothing is cooking - **Bad**	Using electric can opener - **Bad**	Running an air conditioner with the windows open - **Bad**	Using the electric fan on during a rainy day - **Bad**

b. the opposite of the statements

Project Work/Community Engagement
Let learners carry out a project as outlined in the Learner's Book 9 to calculate the amount of electricity consumed in their home for the next month. They are to compare the bill submitted by Electricity Company of Ghana with their calculated value.

CONTENT STANDARD: B9.4.1.3 Evaluate the application of light energy in life

Indicator: B9.4.1.3.1 Demonstrate that light changes path when it travels from one medium to a different medium.

LESSON 3: REFRACTION OF LIGHT

Teaching and Learning Resources:

- Glass of water, pencil, straw, coin, pencil, laser pointer or flashlight, rectangular glass block,

Learner's Book 9: Pages 171-175

Learning Expectations:

By the end of the lesson, the learner will:

1. carry out a practical activity to show that light bends as it travels from one medium to another. E.g. A rod appears bent in water; deep water appears shallow than its real depth.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: refraction, real depth, apparent depth

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- Light always travels in a straight line in a given medium.
- When the medium changes, for example, from air through water or glass the path of light changes.
- This change in the path of light ray as it travels from a denser to a less- dense medium or vice-versa is known as refraction.
- Objects in water appear to be at a shallower depth (an apparent depth) than they really are as a result of refraction of light.

- A straight stick partly immersed in a glass of water appears bent because of refraction of light.

Fig. 1 - Bending of a pencil in water

Progress Assessment

Check prior knowledge by asking the learners to demonstrate that light changes path when it travels from one medium to a different medium.

Ask the learners to think-pair-share on the following:

- What do you observe in the path of light rays when light from a flashlight is focussed on transparent glass containing water?
- Explain your observation.

Take feedback from around the room.

Activity 1 Guide:

See Pages 171 and 172 of Learner's Book 9

The activities are designed to enable learners demonstrate that light changes path when it travels from one medium to a different medium.

- Guide learners to carry out Activity 1 to observe the path of light travelling through different media.
- Engage the learners to focus a flashlight or laser pointer on the glass of water.
- Ask the learners to observe the path of light as it travels from air through the water. Engage the learners to focus a flashlight or laser pointer at an angle at one side of a rectangular glass prism.
- Ask the learners to observe the path of light as it travels through the glass prism. Does the path of light change as it travels from air through glass? Does the path of light change as it emerges from the glass block?

- Engage the learners to insert a pencil or stick or a straw into the glass of water and ask the learners to observe the shape of the pencil or stick in the water.
- Guide the learners in a discussion on the refraction of light.

Think and Discuss
Learners in pairs should discuss the change in the direction of light as it travels from one medium to a different medium. Take feedback from the various groups. Ensure that the less able learners participate actively in the discussion.

Diagnostic Assessment
Let learners provide answers to the questions at the end of the lesson in their exercise books.

You may visit the following links for more information:
- https://www.physicsclassroom.com/class/refrn/Lesson-1/The-Direction-of-Bending
- https://byjus.com/physics/refraction-of-light/

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.
- Were the learners interested and stimulated?
- Was the majority of the class responding as you would expect them to?
- Were there any reasons for the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve upon the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

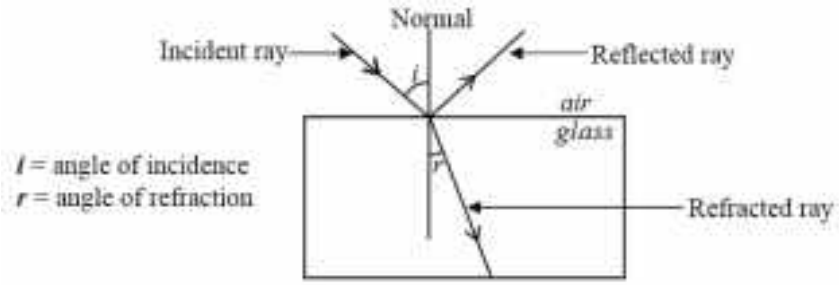
Objectives
1. c
2. b
3. a
4. b
5. c

Answers to Essay Type Questions
1. a. Apparent depth is the depth of the image of an object immersed in a liquid..
   b. it is as a result of refraction of light.

2. You scoop it as a point lower than the image. This is to get the real depth, since the image is at the apparent depth.

3. i Objects in water appear to be at a shallower depth (an apparent depth) than they really are.
   ii. A straight stick partly immersed in a glass of water appears bent because of refraction of light.

4.



5. A pencil partly immersed in a glass of water appears bent. As you look through the side of the glass at the portion of the pencil or stick or straw located above the water's surface, light travels directly from the pencil to your eye. Since this light does not change medium, it will not refract so the stick is straight. As you sight at the bottom of the pencil or stick that was submerged in water, light travels from water to air. This light ray changes direction and undergoes refraction. As a result, the image of the pencil appears to be bent in water.

Home Work/Project
Let learners carry out a project to design a poster to create an awareness of real depth and apparent depth to be posted near a swimming pool.

CONTENT STANDARD: B9.4.1.3 Evaluate the application of light energy in life

Indicator: B9.4.1.3.2 Describe how images are formed in cameras

LESSON 4: FORMATION OF IMAGES IN A CAMERA

Teaching and Learning Resources:

- A photographic plate, tracing paper, frosted glass, a square or rectangular box (pin-hole camera), a candle stick, matches, camera.

Learner's Book 9: Pages 176-180

Learning Expectations:

By the end of the lesson, the learner will:

1. create a model of a camera and describe how it works to form an image.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: image, camera, pinhole camera, magnification

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- An image is simply a representation of the external form of an object by reflected or refracted rays of light.
- Cameras are used to produce images of objects.
- A lens camera takes light from large, distant objects and forms smaller, real images on either film in a traditional camera or the sensor in a digital camera. A converging lens produces an inverted real image as long as the object is at a distance greater than two times its focal length.
- The image formed by a camera is used to form a real, inverted and diminished image on a screen.

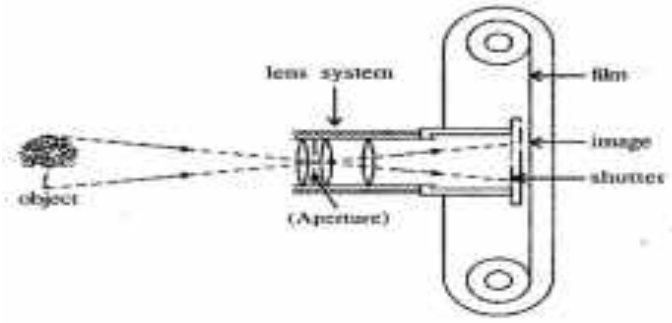


Fig. 2 - A lens camera

Progress Assessment
Check prior knowledge by asking the learners of how images are formed in cameras
Ask the learners to think-pair -share on the following:

- Take a selfie with a mobile phone camera or a photograph taken with a camera. Explain how the image was formed.

Take feedback from around the room.

Activity (i) Guide:

- Task learners to work in groups to develop pin-hole cameras using the items provided.
- Let them take pictures using the camera.
- Through think-pair-share, compare and distinguish between the image formed in a pin-hole camera and a digital camera.
- Work with the class to solve sample questions on magnification.

Guide learners to carry out Activity 1 on pages 176 and 177 of the Learners' Book 9.

Home Work/Project
Let learners carry out a project to design a pinhole camera and use it to form images of trees and buildings around them.

Think and Discuss
Learners in pairs should discuss how images are formed in cameras. Take feedback from the various groups. Ensure that the less able learners participate actively in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection

At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

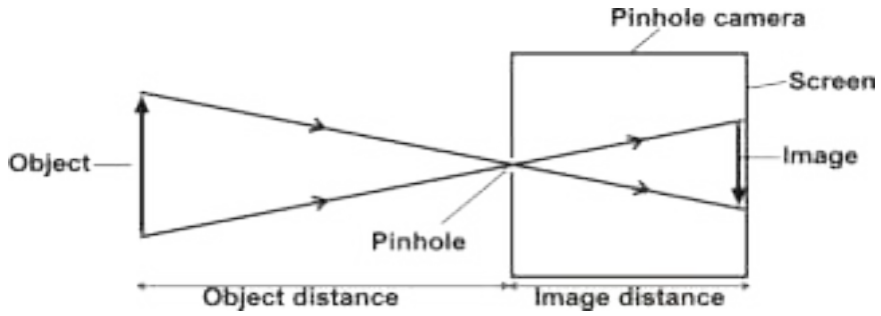
- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Was there any reason you could assign for the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve upon the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. Refer to text on page 177 of the Learner's Book 9.
2. 

3. i. The image will be sharper if the aperture is small
   ii. The image will be brighter if the aperture is large
   iii. The image will be smaller if the object if far from the aperture.

4. Image height = 50 cm

CONTENT STANDARD B9.4.1.3: Evaluate the application of light energy in life

Indicator: B9.4.1.3.3 Describe the formation of shadows

LESSON 5: FORMATION OF SHADOWS

Teaching and Learning Resources:

- A lamp or bulb in a ray box, an opaque object such as a stone or tennis ball, a screen, a source of electric power.
- A flashlight (representing the Sun), a big football or a globe (representing the Earth), a tennis ball or an orange (representing the moon).

Learner's Book 9: Pages 181-184

Learning Expectations:

By the end of the lesson, the learner will:

1. discuss the terms umbra and penumbra in relation to the formation of shadows and explain how they are formed.
2. use a model to illustrate how an eclipse is formed.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: shadow, umbra, penumbra, solar eclipse, lunar eclipse

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- A shadow is a dark region that is formed on a wall or screen when an opaque object blocks light from striking a surface.
- The formation of shadows shows that light travels in straight line.
- Generally, a shadow has two parts: These are the umbra and penumbra.
- When light is completely blocked, a very dark shadow called the umbra is formed.
- The penumbra receives a certain amount of light from the source, but not as much as it would receive if the obstacle were removed.

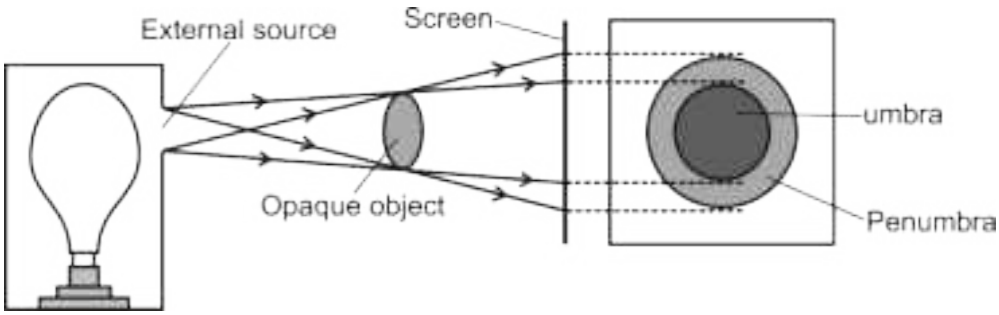


Fig. 3 - Umbra and penumbra formation from an extended source

- An eclipse occurs when light from the Sun is cut off or obscured from reaching the Moon or the Earth
- The occurrence of eclipse shows that light travels in a straight line.
- Solar eclipse or the eclipse of the Sun by the Moon occurs when the Moon passes between the Sun and the Earth and all the three are in a straight line.
- Lunar eclipse or the eclipse of the Moon occurs when the Earth is between the Sun and the Moon and all the three are in a straight line.

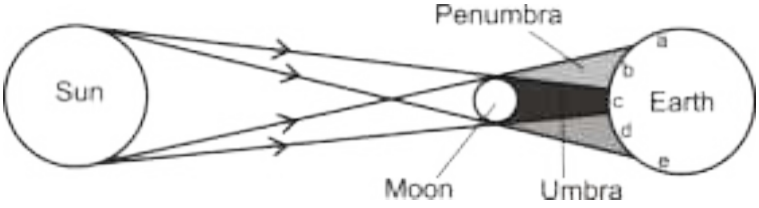


Fig. 4 - An eclipse of the Sun by the Moon (Solar eclipse)

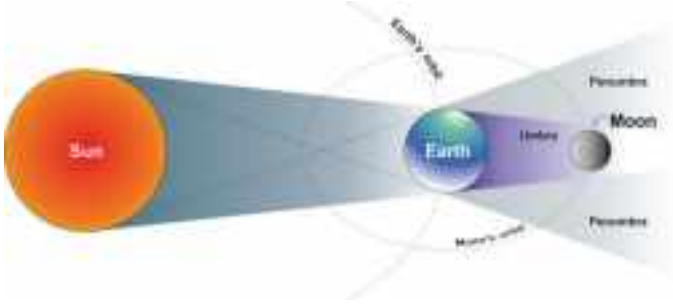


Fig. 5 - An eclipse of the Moon by the Earth (Lunar eclipse)

Progress Assessment

Check prior knowledge by asking the learners of the formation of shadows.

- Ask the learners to think-pair -share on the following:
- Why does the length of the shadow of a pole in an open space keep changing at certain times of the day?

- Ask learners through questions and answers on formation of eclipses.
- Ask learners the following questions also:
- Do you remember the last time you watched an eclipse in the sky?
- What types of eclipse do we have? How are they formed?

Take feedback from learners as they give their responses.

Activity Guide 1: Refer to pages 181 of Learners' Book 9.
FORMATION OF SHADOWS

- The activities are designed to enable learners describe the formation of shadows.
- Guide learners to carry out Activity 1 to form shadows.
- Engage the learners to brainstorm to explain what a shadow is and how it is formed.
- Engage the learners to form shadows using bulbs and opaque objects.
- Ask the learners to watch a video clip on formation of shadows.

Activity Guide 2: Refer to pages 151-152 of Learners' Book 9.
FORMATION OF ECLIPSE

- Guide learners to demonstrate formation of an eclipse.
- Ask the learners to place a globe or a big football on a table on the right and a flashlight on another table on the left, about one metre apart, in a dark room (or with light switched off).
- Ask them to switch on the flashlight.
- Ask them to move the tennis ball or orange in-between the flashlight and the globe or football but a bit closer to the globe or football.
- Ask them to observe what happens to the shadow formed by the tennis ball or orange on the football or the globe.
- Ask the learners to identify the umbra and penumbra.
- Engage the learners to move the tennis ball slowly in a circular orbit around the football or globe.
- Engage the learners to indicate the shadow formed on the football or the globe anytime the tennis ball is in line with the light from the flashlight and the football or the globe and state the type of eclipse formed.

Research Task

Engage the learners to carry out further research on the formation and application of shadows and eclipse.

You may use the following links:

- https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-an-eclipse-58
- https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-an-eclipse-58
- https://www.esa.int/ESA_Multimedia/Videos/2018/07/What_is_an_eclipse

Think and Discuss

Learners in pairs should discuss the formation of shadows. Take feedback from the various groups. Ensure that the less abled learners participate in the discussion.

Diagnostic Assessment

Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection

At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

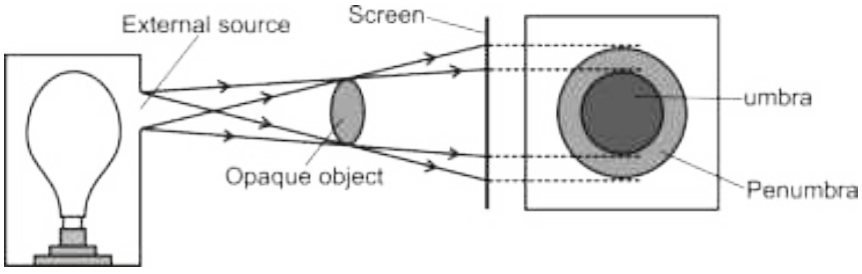
- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Was there any reasons you could assign for the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve upon the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. b
2. a
3. c
4. d
5. c

Answers to Essay Type Questions

1. a. Refer to page 181 of the Learners' Book 9.
2. 

3. A shadow is a dark region that is formed on a wall or screen when an opaque object blocks light from striking a surface.

4. a. the shadow will darken the image formed and it should be prevented.
   b. the should be enough street lights to minimize the shadows formed
   c. the police officer trace the position of people based on their shadows.

5. a. The length of the shadow will increase.
   b. Accept appropriate diagrams. The source of light should be directly above the object.

6. i. the shadow will be very dark.
   ii. the shadow appears grey.

7. With reference to the diagram for the answer to question 8, the umbra is total darkness and the peumbra is partial darkness.

Home Work/Project
Let learners carry out a project as outlined in the Learner's Book 9 to design a street lighting system where shadows of trees along the street can add extra attraction.

CONTENT STANDARD: B9.4.1.2 Demonstrate understanding in and the capability to do calculations involving energy.

Indicator: B9.4.1.2.4 Demonstrate the formation of an eclipse

LESSON 6: FORMATION OF AN ECLIPSE

Teaching and Learning Resources

- a globe or a big football
- a table
- a flashlight
- a dark room (or with light switched

Learner's Book 9: Pages 185-188

Learning Expectations:
By the end of the lesson, the learner will:

1. use a model to illustrate how an eclipse is formed

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Communicating information
- Carrying out investigations

Keywords: eclipse, solar eclipse, lunar eclipse

Prior Preparation
Teaching the formation of an eclipse requires a comprehensive understanding of both solar and lunar eclipses, as well as the scientific principles behind them. Here are some prior preparations for teaching the formation of an eclipse:

- **Understanding Solar and Lunar Eclipses:** Before teaching about the formation of eclipses, it is essential to have a thorough understanding of both solar and lunar eclipses. Solar eclipses occur when the moon passes between the sun and the earth, blocking all or part of the sun's light. On the other hand, lunar eclipses occur when the earth comes between the sun and the moon, casting its shadow on the moon.

- **Scientific Principles:** It is crucial to have a strong grasp of the scientific principles that govern eclipses. This includes understanding celestial mechanics, such as the orbits of the Earth, moon, and sun, as well as concepts like umbra and penumbra.

- **Visual Aids and Demonstrations:** Incorporating visual aids and demonstrations can greatly enhance the learning experience for learners. Utilizing models, diagrams, and simulations can help learners visualize how eclipses are formed and understand the relative positions of the Earth, moon, and sun during an eclipse.

- **Historical and Cultural Significance:** Exploring the historical and cultural significance of eclipses can add depth to the lesson. Many ancient civilizations had myths and legends surrounding eclipses, so incorporating these narratives can make the topic more engaging for learners.

- **Safety Precautions:** When discussing solar eclipses, it is crucial to emphasize safety precautions for observing them. Directly looking at the sun during a solar eclipse can cause serious eye damage, so teaching safe observation methods is important.

- **Interactive Activities:** Engaging learners in interactive activities such as group discussions, role-playing exercises, or hands-on experiments can deepen their understanding of eclipse formation.

BACKGROUND INFORMATION

An eclipse occurs when one celestial body moves into the shadow of another. There are two main types of eclipses: solar and lunar. A solar eclipse happens when the moon passes between the Earth and the sun, blocking all or part of the sun's light. On the other hand, a lunar eclipse occurs when the Earth comes between the sun and the moon, causing the Earth's shadow to fall on the moon. The occurrence of eclipses is influenced by various factors such as orbital dynamics, tilt angles, and distances between celestial bodies. The gravitational forces exerted by these bodies also play a crucial role in determining when and where an eclipse will occur.

Additional Information

An eclipse occurs when one celestial body passes directly between the Sun and Earth, blocking the Sun's light and casting a shadow on our planet. There are three types of eclipses: solar eclipses, lunar eclipses, and transit eclipses.

Solar Eclipse: A solar eclipse occurs when the Moon passes directly between the Sun and Earth, blocking the Sun's light and casting a shadow on our planet. The Moon's shadow has two parts: the umbra and the penumbra. The umbra is the darker inner part of the shadow, where the Sun is completely obscured, while the penumbra is the lighter outer part of the shadow, where the Sun

is only partially obscured. During a solar eclipse, the Moon's shadow moves across the Earth's surface, causing day to turn into night.

Lunar Eclipse: A lunar eclipse occurs when the Earth passes directly between the Sun and the Moon, blocking the Sun's light from reaching the Moon. The Earth's shadow falls on the Moon, causing the Moon to darken and sometimes take on a reddish hue. Lunar eclipses are relatively rare because the Moon's orbit is tilted at an angle to the Earth's orbit around the Sun, so the Moon is usually above or below the Earth's shadow. However, when the Moon is in the right position, a lunar eclipse can occur.

Transit Eclipse: A transit eclipse occurs when a planet or other object passes directly between the Sun and Earth, blocking the Sun's light and casting a shadow on our planet. This type of eclipse is relatively rare, as the planets' orbits are not always aligned with the Earth's orbit around the Sun.

Teacher Learner Activity

See Page 185 of learner's Books 9

- Guide learners to carry out the activity 2 in page 185 of the Learner's Book 9 to demonstrate formation of an eclipse.
- Ask the learners to place a globe or a big football on a table on the right and a flashlight on another table on the left, about one metre apart, in a dark room (or with light switched off).
- Ask them to switch on the flashlight.
- Engage them to move the tennis ball or orange in-between the flashlight and the globe or football but a bit closer to the globe or football.
- Ask them to observe what happens to the shadow formed by the tennis ball or orange on the football or the globe.
- Ask the learners to identify the umbra and penumbra.
- Engage the learners to move the tennis ball slowly in a circular orbit around the football or globe.
- Engage the learners to indicate the shadow formed on the football or the globe anytime the tennis ball is in line with the light from the flashlight and the football or the globe and state the type of eclipse formed.

Progressive Assessment

Ask learners to distinguish between Eclipse of the sun and the moon

Diagnostic Assessment for the Teacher

1. Did I do mixed ability groupings well?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners understand the creative pedagogies I used?
5. What can I do to improve the lesson in order to avoid stereotyping?

Main Points of the Lesson

- The formation of an eclipse is a complex and precise alignment of celestial bodies, and can only occur during specific times and locations on Earth. The frequency and timing of eclipses are determined by the Moon's orbit around the Earth, and the Earth's orbit around the Sun.

- A solar eclipse occurs when the Moon passes directly between the Sun and Earth, blocking the Sun's light and casting a shadow on our planet. This can only happen during a new moon, when the Moon is positioned between the Earth and the Sun. There are two types of solar eclipses: partial eclipses, where the Moon only blocks a portion of the Sun's light, and total eclipses, where the Moon completely blocks the Sun's light, revealing the Sun's corona.

- A lunar eclipse, on the other hand, occurs when the Earth passes directly between the Sun and the Moon, blocking the Sun's light that normally reflects off the Moon's surface. This can only happen during a full moon, when the Earth is positioned between the Sun and the Moon. There are two types of lunar eclipses: penumbral eclipses, where the Earth's shadow only partially blocks the Sun's light, and umbral eclipses, where the Earth's shadow completely blocks the Sun's light, causing the Moon to darken and sometimes take on a reddish hue.

Homework / Project

Let learners carry out a project as outlined in in pages xx of the Learner's Book 9 to design a street lighting system where shadows of trees along the street can add extra attraction.

Research Task

Engage the learners to carry out further research on the formation and application of shadows and eclipse

You may use the following links:

- https://www.nasa.gov/audience/forlearners/5-8/features/nasa-knows/what-is-an-eclipse-58
- https://www.nasa.gov/audience/forlearners/5-8/features/nasa-knows/what-is-an-eclipse-58
- https://www.esa.int/ESA_Multimedia/Videos/2018/07/What_is_an_eclipse

4 Sub-Strand 2: Electricity and Electronics

CONTENT STANDARDS: B9.4.2.1 Construct electrical circuits and illustrate how electrical energy is transformed into other forms of energy and perform electrical calculations.

Indicator: B9.4.2.1.1 Demonstrate transformation of electrical energy to other forms of energy in both series and parallel circuits and perform simple calculations involving the flow of current in circuits.

LESSON 1: SERIES AND PARALLEL CIRCUITS

Teaching and Learning Resources:

- A switch, small lamp or bulb holders, a battery holder, three big (type D) dry cells each of 1.5 V, connecting wires, torch bulbs.

Learner's Book 9: pages 189-166

Learning Expectations:

By the end of the lesson, learners are expected to:

1. predict the impact of changes in electrical circuits with regards to the output of bulbs. Describe how electrical energy transformation occurs in series and parallel circuits.
2. construct simple electrical circuits and measure the voltage, current and resistance.
3. calculate the potential difference in a circuit using the formula: V = IR (where I is the current and R the resistance).

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: electric circuit, series circuit, parallel circuit, electric current, potential difference, resistance, Ohm's law.

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- An electric circuit is the path through which current flows.
- In series connection, the same current flows through every component in the circuit.
- In a parallel connection, different currents flow through the components found in the circuit.
- Electric current is the rate of flow of electric charges.
- The potential difference between two points in an electrical circuit is the work done in transferring a unit positive charge between the two points.
- Resistance is the opposition to the flow of current in an electric circuit.
- Ohm's law states that the potential difference (V) across a metallic conductor is directly proportional to the current (I) flowing through it at constant temperature.
- Thus, V = IR,
  where R is the resistance of the conductor.

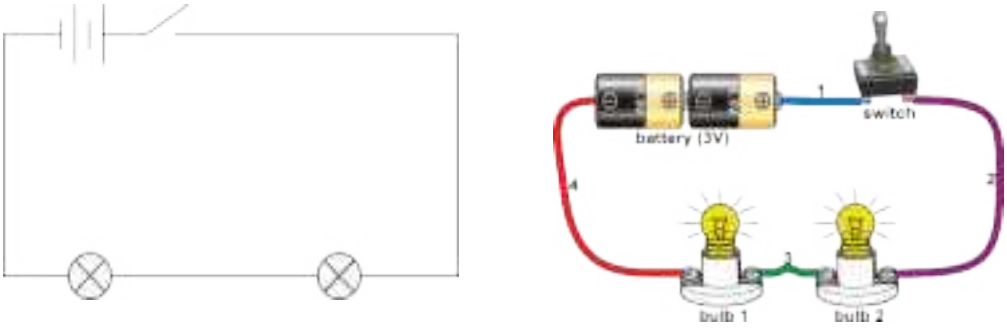


Fig. 6 - Two bulbs in series with a battery of two cells

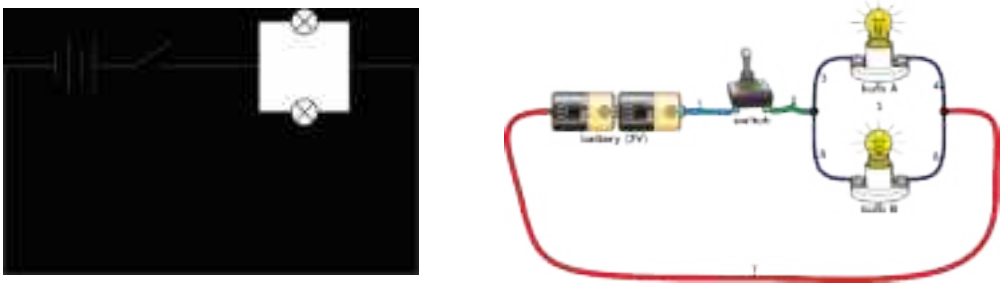


Fig. 7 - Two bulbs in parallel with a battery of two cells

Progress Assessment

Check prior knowledge by asking the learners of how electrical energy transformation occurs in series and parallel circuits.

- Ask the learners to think-pair -share on the following:
- What is a series circuit?

- What is a parallel circuit?
- Get feedback from around the room.

Activities 1, 2 and 3 Guide:
See Pages 189-195 of Learner's Book 9

- The activities are designed to enable learners describe how electrical energy transformation occurs in series and parallel circuits.
- Guide learners to carry out the Activity 1 on pages 190-191 of the Learner's Book 9 to connect a simple series electrical circuit.
- Guide learners to carry out the Activity 2 on pages 191-192 of the Learner's Book 9 to connect a simple parallel electrical circuit.
- Guide learners to carry out the Activity 3 on pages 194-195 of the Learner's Book 9 to construct simple electrical circuits and measure the voltage, current and resistance.
- Guide the learners to discuss Ohm's law and calculate the potential difference in a circuit using the formula: V = IR (where I is the current and R the resistance).

Home Work/Project
Let learners:

- carry out a task of connecting a series arrangement of a 3 V battery, a switch, a single torchlight bulb (A) in series with two torchlight bulbs (B and C) which are connected in parallel.
- investigate the behaviour of the rest of the bulbs when one of them is removed.

Think and Discuss
Learners in groups should discuss how electrical energy transformation occurs in series and parallel circuits. Get feedback from the various groups. Ensure that the less able learners participate actively in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

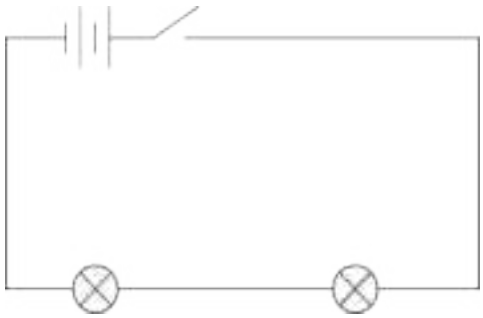
- Were the activity interesting and stimulating?
- Were the majority of the class responding as you would expect them to?
- Are there any reasons for the cause of this response?
- If you were to facilitate this lesson again, what measures will you take to improve upon the learners' understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

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

Answers to Essay Type Questions

1. 

2. ▪ V = IR
   • V = 18 V, and R = 6

3. Parallel circuits offer more than one pathway for the current to flow. In a parallel circuit, different currents flow through the components found in the circuit so if one appliance is faulty the rest can function.

CONTENT STANDARDS: B9.4.2.2 Demonstrate an understanding of Forward and Reverse Bias and explain the behaviour of LEDs, Diodes, Resistors and Capacitors in electronic circuits

Indicator: B9.4.2.2.1 Describe Forward Bias and Reverse Bias and explain the relationship among the components, such as: LEDs, Diodes, Resistors and Capacitors, in an electronic circuit.

LESSON 2: THE BEHAVIOUR OF LEDS, DIODES, RESISTORS AND CAPACITORS IN ELECTRONIC CIRCUITS

Teaching and Learning Resources:

- 3 V battery, a switch, a P-N junction diode, an LED, connecting wires and crocodile clip
- 3 V battery, a switch, 330 Ω resistor, 2,200 Ω resistor, LED, connecting wires and LED.
- A 6 V or 9 V battery, a switch, a 1000 capacitor, a 1000 Ω resistor (Brown-Black-Red-Gold an), LED, connecting wires and crocodile clips.

Learner's Book 9: Pages 199-207

Learning Expectations:

By the end of the lesson, the learner will:

1. explain Forward Bias and Reverse Bias in an electronic circuit.
2. construct different electronic circuits (the forward and reverse bias), and observe what happens to the LED).
3. construct different electronic circuits involving resistors and capacitors and observe what happensto the LED and report on their findings.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: P-N junction diode, forward bias, reverse bias, Light Emitting Diode (LED), capacitor, inductor

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- A P-N junction diode allows current to flow in only one direction.
- The current flows in a diode when it is forward biased.
- A diode is said to be forward biased when the P-region of the diode is connected to the positive terminal of the battery, and the N-region to the negative (-) terminal of the battery and a large current flows.
- A diode is said to be reversed biased when the P-region of the diode is connected to the negative terminal of the battery, and the N-region to the positive (-) terminal of the battery and no current flows.
- A resistor opposes the flow of electric current.
- As the resistance increase less current flows.
- A capacitor is a device for storing electric charges.
- A charged capacitor can be discharged through an electronic component.

Progress Assessment

Check prior knowledge by asking the learners about Forward Bias and Reverse Bias and explain the relationship among the components, such as: LEDs, Diodes, Resistors and Capacitors, in an electronic circuit.

- Ask the learners to think-pair -share on the following:
- What basic device in a car trafficator causes the blinking of the light?

Take feedback from around the room.

Activities 1, 2 and 3 Guide

See Pages 202-205 of Learner's Book 9

- The activities are designed to enable learners describe Forward Bias and Reverse Bias and explain the relationship among the components, such as: LEDs, Diodes, Resistors and Capacitors, in an electronic circuit.
- Guide learners to carry out the Activity 1 on pages 202-203 of the Learner's Book 9 to demonstrate the behaviour of a P-N Junction diode in an electronic circuit.
- Guide learners to carry out theActivity 2 on pages 203-204 of the Learner's Book 9 to demonstrate the behaviour of a resistor in an electronic circuit.
- Guide learners to carry out the Activity 3 on pages 204-205v of the Learner's Book 9 to demonstrate the behaviour of a capacitor in an electronic circuit.

Think and Discuss

Learners in groups should discuss Forward Bias and Reverse Bias and explain the relationship among the components, such as: LEDs, Diodes, Resistors and Capacitors, in an electronic circuit. Take feedback from the various groups. Ensure that the less abled learners participate in the discussion.

Diagnostic Assessment

1. Did I explain potential misconceptions about the lesson to the learners?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did I use appropriate resources for the lesson?
4. Was the lesson progression systematic?
5. Did I use creative pedagogies effectively?
6. What can I do to improve the lesson?
7. Did I integrate ICT in my activities

Reflection

At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Were there any reasons for these types of properties?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. d
2. b
3. a
4. c
5. a

Answers to Essay Type Questions

1. i. A light emitting diode (LED) is an electronic device which changes electrical energy to light energy.
   ii. A P-N junction diode allows current to flow is only one direction.
   iii. A resistor opposes the flow of electric current.
   iv. A capacitor is a device for storing electric charges.

2. i. A diode is said to be forward biased when the P-region of the diode is connected to the positive terminal of the battery, and the N-region to the negative (-) terminal of the battery and a large current flows.
   ii. A diode is said to be reversed biased when the P-region of the diode is connected to the negative terminal of the battery, and the N-region to the positive (-) terminal of the battery and no current flows.

Home Work/Project
Let learners carry out a further research on the behaviour of electronic components in an electronic circuit.

4 Sub-Strand 3: Conversion and Conservation of Energy

CONTENT STANDARDS: B9.4.3.1 Show an understanding of conversion and conservation of energy and their application to life

Indicator: B9.4.3.1.1 Describe how energy can be converted from one form to another and show how conservation of energy occurs

LESSON 1: CONVERSION AND CONSERVATION OF ENERGY

Teaching and Learning Resources:

- Football, orange, inclined plane, simple pendulum set-up, electric fan, the internet, multimedia sources, books or any available resource.
- The internet, multimedia sources, books or any available resource.

Learner's Book 9: Pages 208-212

Learning Expectations:

By the end of the lesson, the learner will:

1. differentiate between conversion of energy and conservation of energy and show their application to life.
2. distinguish between energy conversion and conservation using everyday examples.
3. identify opportunities to conserve energy and produce a report of your work.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: energy conversion, energy conservation

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Energy conversion is a process of changing energy from one form to another.

Energy is always conserved. It cannot be destroyed.

Conserving energy can be explained as a process of reducing energy use of an energy service.

Main Points of the Lesson

- Energy conversion, also termed as the energy transformation, is the process of changing one form of energy into another.
- The law of conservation of energy states that when one form of energy is converted to another, no energy is destroyed in the process.
- Any form of energy can be converted into any other form.
- Conserving energy means saving energy, or not wasting it.
- Energy conversion is a process of changing energy from one form to another.
- Energy is always conserved. It cannot be destroyed.

Progress Assessment

Check prior knowledge by asking the learners how energy can be converted from one form to another and show how conservation of energy occurs

Ask the learners to think-pair -share on the following:

- List two ways energy can be conserved.
- What is the difference between conservation of energy and conversion of energy?

Take feedback from around the room.

Activity 1 Guide

See Page 208 of Learner's Book 9

- Guide the learners to carry out Activity 1 to distinguish between energy conversion and conservation using everyday examples and to identify opportunities to conserve energy.
- Engage the learners to review what they learnt about energy conversion and energy conservation from the previous lesson.
- Ask the learners to use everyday examples to distinguish between energy conversion and energy conservation.
- Engage learners to identify opportunities to conserve energy at home and industry.

The activities are designed to enable learners describe how energy can be converted from one form to another and show how conservation of energy occurs.

- Guide learners to carry to demonstrate energy conversion and energy conservation.
- Engage the learners to brainstorm to come up with the meaning of energy conversion and give examples of energy conversions.
- Guide the learners to demonstrate energy conversions using the motion of an object down an inclined plane, the motion of a simple pendulum, rubbing of hands, switching on an electric fan.
- Engage the learners to brainstorm to come up with the meaning of energy conservation.

- Ask the learners to distinguish between the conservation of energy and the conversion of energy.
- Engage the learners to use the Internet, multimedia sources, books or any available resource, and search for information on energy conservation in their environment.
- Ask the learners to make a poster presentation on their findings for class discussion.
- Ask the learners to make a poster presentation on their findings for class discussion.
- Engage the learners to review what they learnt about energy conversion and energy conservation from the provious lesson.
- Ask the learners to use everyday examples to ditinguish between energy conversion and energy conservation.
- Engage learners to identify opportunities to conserve energy at home and industry.

Think and Discuss

Learners in groups should discuss how energy can be converted from one form to another and show how conservation of energy occurs.

Take feedback from the various groups. Ensure that the less able learners participate in the discussion.

Diagnostic Assessment

Ask the learners to provide answers to the questions at the end of the lesson in their exercise books.

A flashlight producing light

A person ironing

Fig. 8

ICT LINKS

You may use the following links:

- https://www.energysage.com/energy-efficiency/101/ways-to-save-energy/
- https://blog.constellation.com/2016/01/01/31-ways-to-save-energy-in-your-home/
- https://www.thegreenage.co.uk/100-ways-to-save-energy-in-your-home/

End Of Lesson Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Were there any reasons for this type of response?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISES

Objectives

1. b
2. b
3. c
4. a
5. a

Answers to Essay Type Questions

1. A change from one form of energy to another is called an energy conversion.

2. Chemical energy in the human body is changed to Elastic potential energy in the stretched catapult and then to kinetic energy of the moving stone.

3. The law of the conservation of energy states that when one form of energy is converted to another, no energy is destroyed in the process. According to the law of conservation of energy, energy cannot be created or destroyed; it can be transformed from one form to another. So the total amount of energy is the same before and after any process. All energy can be accounted for.

4. Potential energy is changed to kinetic energy
   But potential energy = mgh
   = 500 x 10 x 30
   = 150,000 J
   Hence kinetic energy of the car = 150,000 J

5. i. Iron clothes in bulk
   ii. Turn off lights when they are not needed.

iii. Refrigerators and freezers are properly sealed.
iv. Turn off the TV when you are not watching it.
v. Use hand tools rather than power tools for small repair jobs.
vi. Switch off fan, freezer and other gadgets when their use is not necessary.
vii. Use energy efficient bulbs and gadgets with higher energy efficient ratings. More stars mean more efficiency.

6. Conserving energy for future use is a major concern of every nation. Sources of energy such as fossil fuel is getting depleted and there is the need to save or not waste it.

7. Energy is never created nor destroyed but can be changed from one form to another.

8. i. In the use of electric pressing iron to iron clothes, electrical energy is converted or
ii. transformed to heat energy.
iii. In a car, chemical energy in petrol is converted into mechanical energy to move the car.
iv. When a flashlight is switched on, chemical energy is converted to electrical energy and it is also converted to light energy

9. Chemical energy from fossil fuels is from decayed plants which obtained their energy from the sun when they were alive.
The production of fossil fuels such as petrol, diesel, natural gas and coal is a result of energy conversions. The plants of vast forests that once covered the Earth provides us with energy we use today. The energy is stored in fuels. Some of the fuels used today were formed hundreds of millions of years ago by geological means. These fuel, including coal, petroleum, and natural gas, are known as fossil fuels. When plants and animals died, they were buried within the earth and they formed the fossil fuels at high pressures and temperatures. Fossil fuel contain energy that came from the sun. the solar energy is converted into chemical as stored food in plants.

Home Work/Project
Let the learners:
- carry out further research on energy conversion and energy conservation.
- design a simple pendulum where friction and energy loss due to air resistance is reduced to the barest minimum.

CONTENT STANDARD: B9.4.3.1 Show an understanding of conversion and conservation of energy and their application to life.

Indicator: B9.4.3.1.2 Describe how conversion and conservation of energy are applied in life.

LESSON 2: APPLICATION OF ENERGY CONVERSION AND CONSERVATION

Teaching and Learning Resources

- Simulations and Virtual Labs
- pictures
- videos
- charts
- electrical station
- hand-crank generator to produce electricity, which can then power a small fan or light bulb.

Learner's Book 9: Pages 213-216

Learning Expectations:
By the end of the lesson, the learner will:

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models
- Communicating information
- Carrying out investigations

Keywords: conversion and conservation.

Prior Preparation
Energy is a fundamental concept in physics, and its conversion and conservation play crucial roles in various aspects of everyday life. The principles of energy conversion and conservation are applied in numerous ways, influencing everything from the operation of simple machines to the functioning of complex biological systems. Understanding how energy is converted from one form to another and how it is conserved is essential for comprehending the workings of the natural world and the technologies that shape modern society.

Energy Conversion in Transportation
One prominent application of energy conversion is evident in transportation systems. For instance, in an automobile, chemical energy stored in gasoline is converted into kinetic energy through the process of combustion within the engine. This kinetic energy then propels the vehicle forward, demonstrating the conversion of one form of energy into another. Similarly, in electric vehicles, electrical energy from batteries is converted into kinetic energy to drive the vehicle.

Renewable Energy Sources
The utilization of renewable energy sources also exemplifies the concept of energy conversion. Solar panels convert sunlight into electrical energy, while wind turbines transform the kinetic energy of wind into electricity. These processes demonstrate how natural resources can be harnessed and converted into usable forms of energy to power homes, businesses, and entire communities.

Energy Conservation in Buildings
In the context of energy conservation, buildings provide a pertinent example. Various strategies such as insulation, efficient lighting, and smart HVAC systems are employed to conserve energy by reducing unnecessary consumption. By minimizing heat loss or gain and optimizing electricity usage, these measures contribute to conserving energy resources and reducing environmental impact.

Biological Systems
The principles of energy conversion and conservation are also integral to biological systems. In living organisms, food serves as a source of chemical potential energy that is converted into mechanical work and heat to sustain life processes. The metabolic processes within cells involve intricate conversions of chemical energy into forms that support growth, movement, and other physiological functions.

Industrial Processes
In industrial settings, numerous processes rely on the conversion and conservation of energy. For example, manufacturing operations often involve converting electrical or mechanical energy into various forms such as heat, light, or sound to accomplish specific tasks. Additionally, optimizing these processes for energy efficiency contributes to cost savings and environmental sustainability.

BACKGROUND INFORMATION

The concepts of energy conversion and conservation are pervasive in everyday life, shaping how we travel, power our homes and cities, sustain biological functions, and conduct industrial

activities. Understanding these principles not only facilitates technological advancements but also promotes responsible resource management and environmental stewardship

Additional Information
In daily life, the principles of conversion and conservation of energy are applied in various ways, playing a crucial role in numerous activities and processes. These principles are fundamental to understanding how energy is utilized, transformed, and preserved in different contexts.
Energy conversion is evident in several aspects of daily life. For instance, when driving a car, the chemical energy stored in the fuel is converted into kinetic energy to propel the vehicle forward.

Similarly, in the case of electrical appliances, electrical energy is converted into various forms such as light, heat, or mechanical energy to perform specific tasks. Furthermore, the human body also serves as an example of energy conversion, where the food consumed is transformed into chemical energy that powers bodily functions and physical activities.

The principle of conservation of energy states that the total energy within a closed system remains constant over time. In daily life, this principle is observed in numerous scenarios. For instance, when using renewable energy sources such as solar panels or wind turbines, the energy from these sources is harnessed without depleting natural resources. Additionally, in simple everyday activities like throwing a ball or lifting an object, the potential energy is converted into kinetic energy while adhering to the conservation principle.

Applications in Various Sectors:
The application of energy conversion and conservation extends to various sectors such as transportation, industry, and environmental sustainability. In transportation, advancements in electric vehicles demonstrate the conversion of electrical energy into mechanical motion for propulsion, contributing to reduced reliance on fossil fuels. In industrial processes, technologies like cogeneration systems optimize energy use by converting waste heat into additional power, aligning with the principle of conservation. Moreover, efforts to promote sustainable practices and reduce carbon emissions align with the conservation of energy by minimizing unnecessary energy loss.

Teacher and Learner Activities
Engage learners in mixed ability groups, using gender responsive teaching to help learners do the following activities.

Teaching the concepts of conversion and conservation of energy in a classroom setting can be engaging and effective through various activities. These activities are designed to help learners understand how these principles are applied in real-life scenarios. Here are some activities that can be used:

- **Energy Transformation Stations:** Set up different stations in the classroom, each representing a different form of energy such as mechanical, electrical, thermal, and chemical. Learners can rotate through these stations and observe how energy is converted from one form to another. For example, at the electrical station, learners can use a hand-crank generator to produce electricity, which can then power a small fan or light bulb.

- **Energy Audit Project:** Assign learners the task of conducting an energy audit either at home or within the school premises. They can identify various sources of energy consumption and analyze ways to conserve energy. This project encourages critical thinking about energy usage and conservation in everyday life.

- **Renewable Energy Design Challenge:** Divide the class into groups and challenge them to design and build a device that utilizes renewable energy sources such as solar or wind power. This hands-on activity allows learners to apply their knowledge of energy conversion while also exploring sustainable energy solutions.

- **Case Studies and Real-World Examples:** Present case studies or real-world examples that demonstrate the application of energy conversion and conservation. This could include discussing how hybrid cars utilize regenerative braking to convert kinetic energy into electrical energy for storage, or how energy-efficient appliances reduce overall energy consumption in households.

- **Simulations and Virtual Labs:** Use interactive simulations or virtual labs to demonstrate energy conversion processes that may be difficult to replicate in a traditional classroom setting. Virtual experiments can provide a visual representation of complex energy transformations, making the concepts more accessible to learners.

- **Debate on Energy Policies:** Organize a debate or discussion on current energy policies and their impact on conservation efforts. This activity encourages learners to consider the societal implications of energy use and the importance of conservation measures in addressing environmental challenges.

- **Field Trips to Energy Facilities:** Arrange field trips to local power plants, renewable energy facilities, or even recycling centers where learners can witness firsthand how energy is generated, converted, and conserved on a larger scale.

Progressive Assessment
Let learners identify opportunities to conserve energy and report their findings in class for discussion.

Diagnostic Assessment for the Teacher

1. Did the teacher ask open-ended questions related to energy conversion and conservation to gauge the depth of understanding among learners.
2. Were the learners provided with a short quiz or worksheet that includes problems related to energy conversion and conservation that can help the teacher evaluate individual learner comprehension.
3. Encouraging peer evaluation where learners assess each other's understanding of energy conversion and conservation concepts can provide additional perspectives. Was it done?
4. Assigning follow-up tasks or projects that require learners to apply their knowledge of energy conversion and conservation in practical scenarios can help assess long-term retention of the concepts. Were these activities carried out?
5. Did the teacher review the outcomes of hands-on activities or experiments conducted during the lesson to show more insights into how well learners grasped the concepts.

Main Points of the Lesson

- Energy conversion refers to the process of changing one form of energy into another. This occurs constantly in various aspects of our daily routines. For example, when we switch on a light bulb, electrical energy is converted into light and heat energy. Similarly, when driving a car, the chemical energy stored in gasoline is converted into kinetic energy to propel the vehicle forward. Another common example is the transformation of solar energy into electrical energy through solar panels. In each of these instances, energy is being converted from one form to another to serve a specific purpose.

- On the other hand, energy conservation involves reducing the amount of energy used while achieving a similar outcome. This principle is often applied to minimize waste and

promote sustainability. An everyday example of energy conservation is using energy-efficient appliances at home. These appliances are designed to perform the same tasks as their traditional counterparts but with significantly less energy consumption. Additionally, turning off lights and unplugging electronics when they are not in use are simple yet effective ways to conserve energy. Furthermore, insulating homes to reduce heat loss during winter months is another form of energy conservation.

4 Sub-Strand 4: Force and Motion

CONTENT STANDARDS: B9.4.4.1 Demonstrate understanding of the concept of pressure and explain how pressure acts in everyday life

Indicator: B9.4.4.1.1 Explain the concept of pressure and show how pressure relates to force; perform activities that work on the principle of pressure in the daily lives of humans.

LESSON 1: THE CONCEPT OF PRESSURE

Teaching and Learning Resources:

- Balloons, water jets at washing bays, enamel, syringe, bicycle tyre pump or car tyre pump, drinking straw, deflated football, cement block, sharp pencil.

Learner's Book 9: Pages 217-222

Learning Expectations:
By the end of the lesson, the learner will:

1. demonstrate the action of pressure through a number of activities such as using drinking straw, pumping car tyres, filling of balloons, water jets at washing bays, etc. to understand the concept of pressure.
2. describe the relationship between pressure and force and discuss the application of pressure in everyday life.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: force, pressure, atmospheric pressure

INTRODUCTION
One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- Pressure is defined as the force acting perpendicularly per unit area.

$$\text{Pressure (P)} = \frac{\text{Force } (F)}{\text{Area } (A)}$$

- The atmosphere is the thick layer of air surrounding the Earth.
- This pressure exerted by the layer of air on the surface of the Earth is called the atmospheric pressure.
- Pressure has many applications in everyday life.

Progress Assessment

Check prior knowledge by asking the learners of the concept of pressure and show how pressure relates to force; perform activities that work on the principle of pressure in the daily lives of humans.

Ask the learners to think-pair -share on the following:

- Describe what happens to an inflated balloon when you exert a force on it

Take feedback from around the room.

Activity Guide

See Page 217 of Learner's Book 9

The activities are designed to enable learners explain the concept of pressure and show how pressure relates to force; perform activities that work on the principle of pressure in the daily lives of humans.

- Guide learners to carry out to demonstrate the action of pressure through a number of activities.
- Engage the learners to discuss what is meant by the term 'pressure.'
- Demonstrate the pressure exerted by the same force over a small area and over a large area.
- Ask the learners to press their palm gently with the side of a pen, followed by the pointed side and compare the pressure exerted by the solid over different areas of contact.
- Engage the learners in a discussion on the application of atmospheric pressure in the use of a drinking straw, the use of enamel, the use of bicycle pump and demonstrate the use of these devices.

Think And Discuss

Ask the learners in group to discuss the concept of pressure and show how pressure relates to force. Let them also discuss activities that depend on the principle of pressure in the daily lives of humans.

Take feedback from the various groups. Ensure that the less abled learners participate in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. A
2. D
3. D

Answers to Essay Type Questions

1. Refer to pages 219-221 in the Learner's Book 9.

2. The plastic bottle must have sealed holes (with corks or cellotape) staggered at points A, B, and C with water (fig. 1).

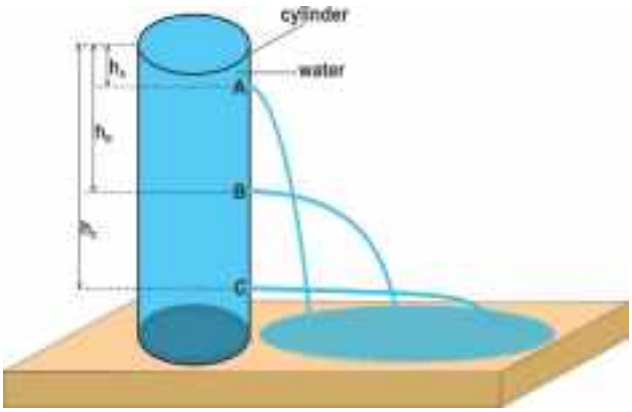


Fig. 9 - Variation of pressure with depth

The corks or cellotapes are quickly removed. It would be observed that the water squirt out fastest at C and least at A. The speed with which water squirts out of bottom hole C is greatest, followed by that at B and least at the top (hole at A). Thus, pressure increases with depth.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Were there any reasons for these types of response?

- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

Home Work/Project
Let the learners carry out a project to design a fountain or a syphon to transport water from one place to another.

CONTENT STANDARDS: B9.4.4.2 Demonstrate an understanding of Newton's Third Law of Motion and its application in everyday life

Indicator: B9.4.4.2.1 Explain the importance of Newton's Third Law of motion in life

LESSON 2: THE IMPORTANCE OF NEWTON'S THIRD LAW OF MOTION

Teaching and Learning Resources:

- A football, a hammer, nail, wooden board, the internet, multimedia sources, books or any available resource.
- A book, a table, football, basketball, balloons, toy boat

Learner's Book 9: Pages 223-227

Learning Expectations:

By the end of the lesson, the learner will:

1. state newton's third law of motion.
2. discuss newton's third law of motion and show its importance to life.
3. predict what happens when:
4. a force is exerted on an object.
5. there is a reaction from the object
6. the force exerted is the same as the reaction of the object.
7. perform an activity to justify your predictions.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: laws of motion, action, reaction

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- Newton's third law states that to every action there is an equal and opposite reaction.

- Whenever one object exerts a force (called action) on a second object, the second object exerts a force (called reaction) back on the first object.
- Newton's third law of motion is important in life.

Progress Assessment

Check prior knowledge by asking the learners of the importance of Newton's Third Law of motion in life.

Ask the learners to think-pair -share on the following:

- What is high tides?
- A balloon is inflated and the mouth is held tight. What happens is if air is let out of the balloon? What is the direction of the air that gushes out and that of the deflated balloon?

Take feedback from around the room.

Activity Guide 1

See Page 223 of Learner's Book 9

The activities are designed to enable learners explain the importance of Newton's Third Law of motion in life.

- Guide learners to carry out Activity 1 to investigate Newton's third law of motion.
- Engage the learners to discuss Newton's first, second and third laws of motion.
- Engage the learners to brainstorm to come up with the meaning of 'action' and 'reaction.'
- Discuss with the learners the action and the reaction in the activity of the football on the wrist.
- Discuss with the learners the action force and the reaction force as they walk.
- Discuss with the learners the importance of Newton's third law of motion to life.

Activity Guide 2

See Page 226 of Learner's Book 9

- Guide learners to carry out Activity 2 to demonstrate applications of Newton's third law of motion.
- Demonstrate the application of Newton's third law of motion using a bouncing football.
- Engage the learners to predict which of the force is action and which is the reaction and whether they of the same magnitude and direction.
- Demonstrate the application of Newton's third law of motion using a toy boat on water.

Ask the learners to predict what happens when:

- a force is exerted by the paddle on the water.
- there is a reaction from the water on the boat.
- the force exerted by the paddle on the water is the same as the reaction of the water on the boat.

Place a chair in front of a class and let a learner sit on it.
Ask the learners to predict:

- The action on the chair?
- The reaction of the chair on the learner?
- If the action was the same as the reaction?
- What happens if the chair breaks down when a person sits on it, and what they can say about the action and reaction forces?
- Discuss why a person slips when walking on a frictionless floor.

Think and Discuss

Learners in groups should discuss the importance of Newton's Third Law of motion in life. Take feedback from the various groups. Ensure that the less abled learners participate in the discussion.

Diagnostic Assessment

Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection

At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Are there any reasons for these types of response?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISES

Objectives

1. b
2. b
3. a
4. c
5. d

Answers to Essay type Question

1. Newton's third law states that to every action there is an equal but opposite reaction.

2. Whenever one object exerts a force (called action) on a second object, the second object exerts a force (called reaction) back on the first object.

3. Refer to pages 224-226 in the learner's Book 9.

4. When a force is exerted on the water by paddling it, the water exerts an equal and opposite force on the boat to move it forward.

5. If a boat is paddled backward, the water exerts a reaction on the boat and this moves the boat forward.

6. i. the action of the man on the chair is 80 kg force (or 800 N) downwards
   ii. the reaction of the chair on the man is 80 kg force (or 800 N) upwards.

7. If a ball drops on the floor from a height, the force exerted by the ball on the floor is the action. The floor in turn, exerts an upward force or reaction on the ball and this reaction causes the ball to bounce upwards.

Home Work/Project
Let learners carry out a project to explore the internet and learn about Newton's third law of motion.

CONTENT STANDARDS: B9.4.4.2 Demonstrate an understanding of Newton's Third Law of Motion and its application in everyday life

Indicator: B9.4.4.3.1 Explain Newton's Laws of motion and their applications in daily life.

LESSON 3: NEWTON'S LAWS OF MOTION AND THEIR APPLICATIONS IN DAILY LIFE

Teaching and Learning Resources:

- Toy car, football or spherical metal ball, cart/truck, different loads, Internet, pictures, charts and videos on Newton's laws of motion.

Learner's Book 9: Pages 229-235

Learning Expectations:

By the end of the lesson, the learner will:

1. explain Newton's laws of motion and relate them to momentum.
2. demonstrate the application of Newton's Laws of motion in everyday life.
3. derive the formula, f = ma, where f is the force, m the mass of the object, and a, the acceleration, from Newton's three Laws of Motion and use the formula to calculate the force that a moving mass of body exerts when moving with known acceleration.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: Newton's laws of motion, inertia, momentum, force, acceleration

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- There are three Newton's laws of motion.
- Newton's First Law of Motion states that everybody continues in its state of rest, or once in motion, continues to move with a constant speed in a straight line unless an unbalanced (or net) force acts on it.

- Newton's Second Law of motion states that the time rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the force.
- Momentum is the product of mass and velocity of an object, that is:
- Newton's Third Law of motion states that to every action, there is an equal but opposite reaction.

Progress Assessment
Check prior knowledge by asking the learners of Newton's Laws of motion and their applications to daily life.
Ask the learners to think-pair -share on the following:

- What is the relationship between force, mass and acceleration?

Take feedback from around the room.

Activity Guide 1:
See Page 229 of Learner's Book 9
The activities are designed to enable learners explain Newton's Laws of motion and their applications to daily life.

- Guide learners to carry out the Activity 1 to demonstrate the applications of Newton's laws of motion in everyday life.

Think and Discuss
Learners in pairs should discuss Newton's Laws of motion and their applications in daily life. Take feedback from the various groups. Ensure that the less abled learners participate actively in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Are there any reasons for these types of response?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. d
2. d
3. d
4. a
5. b
6. a
7. c
8. a

Answers to Essay Type Questions

1. Inertia is the reluctance of a body to move when at rest or to stop when in motion. Newton's First Law of Motion states that everybody continues in its state of rest, or once in motion, continues to move with a constant speed in a straight line unless an unbalanced (or net) force acts on it. Thus inertia is the tendency of an object to resist force.

2. The action and reaction forces are equal and opposite in direction.

3. Change in momentum, force, acceleration.
   $F = \frac{mv - mu}{t}$

4. The mass should be doubled.

5. i. The initial momentum = mu = 5 x 20 = 100 kg ms^{-1}
   ii. The final momentum = mv = 5 x 80 = 400 kg ms^{-1}
   iii. The change in momentum = final momentum – initial momentum
   = 400 – 100 = 300 kg ms^{-1}

   iv. The acceleration = Acceleration,
   $a = \frac{v - u}{t}$
   $= \frac{80 - 20}{10}$
   $= \frac{60}{10}$
   $= 6\ ms^{-2}$

   v. The force acting
   a = ma
   = 5 × 6
   = 30 N

Home Work/Project
Let learners carry out a project to use the internet, multimedia sources, books or any available resource on the Newton's laws of motion and its applications in life.

4 Sub-Strand 5: Agricultural Tools

CONTENT STANDARDS: B9.4.5.1 Demonstrate knowledge and skills in making simple agricultural tools for on-farm activities

Indicator: B9.4.5.1.1 Identify materials used in making simple agricultural tools.

LESSON 1: SIMPLE AGRICULTURAL TOOLS

Teaching and Learning Resources:

- Simple Agricultural tools e.g. cutlass, hoe, hammer, hand trowel mattock, pick axe, spade, sickle.

Learner's Book 9: Pages 236-239

Learning Expectations:

By the end of the lesson, the learner will:

1. describe simple agricultural tools assembled from their environment.
2. identify the materials used to make tools and show how the parts are connected.
3. describe the activities and processes involved in making different agricultural tools.
4. explain the materials, processes, constraints and precautions involved in manufacturing simple agricultural tools.
5. manufacture a simple Agricultural tool

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: metallic, non-metallic, ferrous, non-ferrous, susceptible

INTRODUCTION

One week, that is, four periods will be enough to teach this lesson. Ensure that all the materials for the practical activities are available.

Main Points of the Lesson

- Agricultural activities cannot be performed without tools. This because it is labour-intensive which cannot be done with bare hands. Therefore, the need for simple agricultural tools.
- There are two main types of materials usually used in making agricultural Tools.
- These are metallic and non-metallic materials.
- The metallic materials are ferrous and non-ferrous materials.
- The non-metallic materials include wood, plastic and rubber.

You may visit the following links for more information:

- Fmexim.com
- Ecoursesonlin.iasri.res.in
- www.nationalmaterial.com

Hand Fork

Hand Trowel

Hoe

Rake

Axe

Fig. 10 - Simple Agricultural Tools

Progress Assessment

Check prior knowledge by asking the learners of materials used in making simple agricultural tools. Ask the learners to think-pair -share on the following:

- Mention some simple agricultural tools.
- What are they used for?

Take feedback from around the room.

Activity Guide 1
See Page 236 of Learner's Book 9
The activities are designed to enable learners identify materials used in making simple agricultural tools.

- Guide learners to carry out the Activity 1 to find out materials used in making agricultural tools.
- Engage learners to assemble different agricultural tools used in the community and describe the use of each tool.
- Engage the learners to describe each tool in terms of shape, size, thickness and length and also find out materials used in making each tool.
- Guide the learners to visit a blacksmith's shop to see how simple agricultural tools are made.
- Ask them to observe the activities and processes involve in making a tool and also find out the type of material use.
- Engage the learners to find out the constraints and precautions involve in tools making.
- Engage the learners to decide on the tool you want make and should sketch the tool on a sheet of paper.
- Ask the learners to look for the materials to be used, e.g. iron scrap, empty milo tin and make the required measurements.
- Engage the learners to gather all your tools.eg. hammer, knife or hack saw and produce the tool according to their measurement.

Think and Discuss
Learners in groups should discuss materials used in making simple agricultural tools. Take feedback from the various groups. Ensure that the less able learners participate in the discussion.

Diagnostic Assessment
Let learners provide answers to questions at the end of the lesson in their exercise books.

Reflection
At the end of the lesson make a self-assessment to see if the teaching was effective and how you can improve in later delivery.

- Were the activities interesting and stimulating?
- Was the majority of the class responding as you would expect them to?
- Are there any reasons for these types of response?
- If you were to facilitate this lesson again, what measures will you take to improve the learners understanding of the topic?
- To what extent did you cater for learners with disability and below average learners?

ANSWERS TO END OF LESSON EXERCISE

Objectives

1. c
2. c
3. c
4. a

Answers to Essay Type Questions

1. i. Hoe —— Metal and wood
   ii. Cutlass —— Metal and wood
   iii. Mattock —— Metal and wood
   iv. Hand trowel —— Metal and wood
   v. Knapsack sprayer —— Metal or plastic
   vi. Sickle —— Metal and wood

2. i. The non-metallic materials are poor conductor of heat
   ii. They provide firm grips on to the tool.

3. i. Stainless steel does not rust easily.
   ii. It provides a shiny finish that makes it easy to clean.

4. Draw and label

i. Rake

ii. Watering Can

iii. Hand Fork

STRAND 5

HUMANS AND THE ENVIRONMENT

Unit 1: Waste Management

CONTENT STANDARD:
B9.5.1.1 Demonstrate an understanding of the scientific ways of waste management.
B9.5.1.2 Demonstrate an understanding of the impact of waste on an environment, innovative waste management technologies for sustainable development and waste management practices in Ghana.

Indicator:
B9. 5.1.1.1 Investigate the scientific methods used in waste management.
B9.5.1.2.1 Describe innovative ways of waste manage sustainable development.

LESSON 1: THE SCIENTIFIC METHODS USED IN WASTE MANAGEMENT
LESSON 2: INNOVATIVE WAYS OF WASTE MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

Teaching and Learning Resources:
- Pictures or videos of showing different materials of waste management.

Learner's Book 9: Pages 245-247, 248-254

Learning Expectations:
By the end of the lesson, the learner will:
1. identify scientific methods such as recycling, composting used in waste management.
2. explain the scientific principles underlying the methods used in waste management.
3. conduct an audit of waste management methods in schools and assess the effectiveness of each.

Learning Skills
- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: Scientific method, incinerator, recycle, reuse, composting, innovative, sustainable, waste management.

BACKGROUND

We discussed about the actions and steps that go into manufacturing simple agricultural equipment in the previous lesson. The materials, steps, restrictions, and precautions involved in manufacturing simple agricultural tools were discussed once more. We will make our own simple agricultural implement with all we have on hand.

In Ghana, the majority of open garbage dumps are found on the outskirts of big cities, in open spaces, wetland areas, or near surface water sources. Some garbage will decay eventually, but not all, and while doing so, it may emit odours, contaminating the environment, or produce explosive methane gas, which contributes to the greenhouse effect. Landfills that aren't well-managed might attract pests and litter. In this session, we'll look for new strategies to manage waste for long-term development.

Group Activity: Refer to pages 248 and 250 of Learners Book 9.

- Investigating scientific methods used in waste management
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Encourage learners to work in groups.
- Engage the learners to do the following:
- Watch a video clip on the scientific methods of waste management shown by the teacher.
- List down and discuss the scientific methods of waste management.
- Discuss the scientific principles underlying the methods used in waste management.
- Investigating the types of waste generated in Ghana
- Let learners work in groups
- Engage the learners to do the following:
- List down the types of waste produced in Ghana, the source of the waste and the example of waste produced.
- Use the table below to present your group work on a provided manila card

Type of Waste produced	Source	Example of waste

Reflection

Use group discussion to help learners what they have learnt.

Review Question

- What type of waste do you generate in your homes?
- What do you to these wastes in your homes?
- List down things that pollute the environment.

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. c
2. d
3. d
4. b
5. b

Answers to Essay Type Questions

1. Environmental trash is any unnecessary resource use or release of substance into the water, land or air that could be harm the human health or the environment.

2. Garbage produced have the following effects on the environment
   i. Pollution
   ii. Spreading of litter
   iii. Disappearance of biodiversity
   iv. Increase in the population of pests
   v. Climate change

3. Creative waste management strategies for long-term development include
   i. Going for paperless transactions.
   ii. Incinerate waste.
   iii. Donate anything useful.
   iv. Reduce, reuse, and recycle.
   v. Compost your lunches.

vi. Anaerobic digestion of waste.
vii. Waste collection.
viii. Educating the public

4. Answers will vary.
5. Answers will vary.

Research Work/Project Work

1. Using the internet, find other scientific methods of waste management.
2. Conduct an audit of waste management methods in schools and assess the effectiveness of each.
3. Use the internet to learn more on innovative ways of waste management.
4. Examine and critique the waste management practices in Ghana identifying positives and negatives and opportunities for improvement.

5 Sub-Strand 2: Human Health

CONTENT STANDARD: B9.5.2.1 Demonstrate knowledge of common non-communicable diseases of humans, their causes, symptoms, effects and prevention

Indicator: B9.5.2.1.1 Explain the symptoms, effects and prevention of some non-communicable diseases and analyse the risk factors associated with them.

LESSON 1: THE SYMPTOMS, EFFECTS AND PREVENTION OF SOME NON-COMMUNICABLE DISEASES

Teaching and Learning Resources:

- Pictures or videos or charts on non-communicable diseases.

Learner's Book 9: Pages 255-262

Learning Expectations:

By the end of the lesson, the learner will:

1. describe what non-communicable diseases are and determine their common causes.
2. identify symptoms, eff ects and prevention of non-communicable diseases that are
3. associated with malnutrition, poor working environment and exposure to drugs.
4. explain the causes, symptoms, eff ects and prevention of cancer.
5. identify common cancers that aff ect humans and link them to life style

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: non-communicable diseases, malnutrition

BACKGROUND

There are diseases that can be spread from one person to another person. These diseases are known as communicable diseases. Other diseases that cannot be passes from one person to another person Is known as non-communicable diseases. Non-communicable diseases (NCDs) are the top causes of death worldwide and a major public health concern in the present and future. Health promotion, prevention, and medical interventions can all help with NCDs. Improved social circumstances, diet

quality, body weight, avoidance of smoking, and greater physical activity can all help to lower the burden of NCDs.

Group Activity 1: Refer to Learner's Book 9 page 255.

- Investigating the symptoms, effects and prevention of some non-communicable diseases and analyse the risk factors associated with them.
- Let learners work in groups
- Engage learners to do the following:
- Discuss to find out what non-communicable diseases are and determine their common causes.
- Your teacher will show you a video clip.
- Watch the video clip on non-communicable diseases.
- Identify symptoms, effects and prevention of non-communicable diseases that are associated with malnutrition, poor working environment and exposure to drugs.
- Discuss the causes, symptoms, effects and prevention of cancer.
- Identify common cancers that affect humans and link them to life style.
- Present a report for discussion in class.

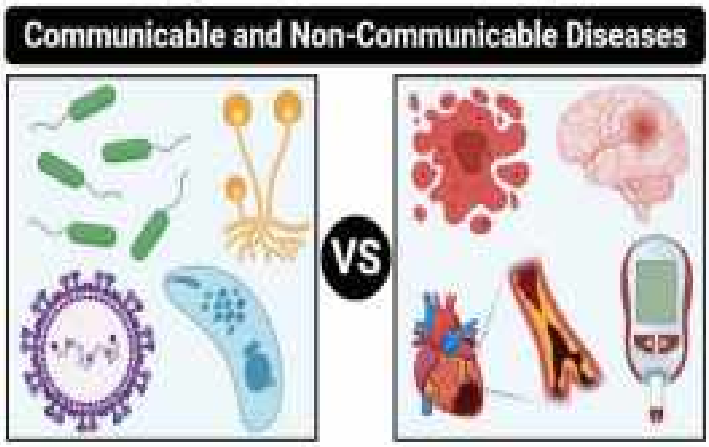


Fig. 1 - Communicable and non-communicable diseases

Reflection

Use group discussion to help learners what they have learnt.

Review Question

- Encourage/Guide/Let learners to answer the following:
- Have you heard of cancer?
- What is it about?
- Name any types of cancer.

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. d
2. a
3. a
4. d
5. b

Answers to Essay Type Questions

1. This means that it is a disorder that is not contagious and cannot be passed from one person to another

2. i. Cardiovascular diseases - heart attack, stroke
   ii. Cancer
   iii. Chronic respiratory disease - Asthma, cystic fibrosis
   iv. Diabetes - Type 1, Type 2

3. Changes in the Deoxyribonucleic Acid (DNA) within cells cause cancer.

4. Refer to Learner's Book 9 pages 258 and 259.

Research Work/Project Work
Using the internet or any source of knowledge, find out common cancers that affect humans and link them to life style.

CONTENT STANDARD: B9.5.2.2 Demonstrate understanding of the relationship of health and disease, the concept of common diseases in the environment and how to control them

Indicator: B9.5.2.2.1 Explain the concepts of health and disease and show their relationship.

LESSON 2: THE CONCEPTS OF HEALTH AND DISEASE

Teaching and Learning Resources:

- Posters and videos on health diseases and illness.

Learner's Book 9: Pages 263-265

Learning Expectations:

By the end of the lesson, the learner will:

1. define health and show the relationship between health and disease.
2. desscribe what non-communicable diseases are and determine their common causes.
3. identify symptoms, effects and prevention of non-communicable diseases that are associated with malnutrition, poor working environment and exposure to drugs.
4. explain the causes, symptoms, effects and prevention of cancer.
5. identify common cancers that affect humans and link them to life style.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: non-communicable diseases, malnutrition.

BACKGROUND

In defining health and sickness, medicine and health professional should be taking into consideration. As a result, understanding them and their interaction is crucial. However, there appears to be a separation between medicine and health-care professionals in terms of these concepts

Group Activity: Refer to Learner's Book 9 page 263.

- Investigating the concepts of health and disease and their relationship.
- Let learner work in groups.
- Engage the learners to do the following:
- Watch a video clip on health and diseases.
- Discuss in your group the differences between health and diseases.
- Discuss the relationship between health and disease.

Reflection

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?
8. Use group discussion to help learners review what they have learnt.

Review Question

How different is sickness from diseases?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. c
2. b
3. c
4. d
5. b

Answers to Essay Type Questions

1. Health is a condition of physical and mental well-being and disease is a condition that affects an organism's health by affecting its body, organs, tissues, or cell.
2. Physical health are risks that reduces diseases but mental health refers to a person's emotional, social, and psychological well-being.
3. Health is a condition of physical and mental well-being and disease is a condition that affects an organism's health by affecting its body, organs, tissues, or cells.

Research Work/Project Work

Using the internet to investigating the concepts of health and disease and their relationship by using the chart below.

Fig. 2 - Health and diseases and their relationship

INDICATOR: B9.5.2.2.2 Explain the concept of common diseases in an environment.

LESSON 3: COMMON DISEASES IN THE ENVIRONMENT

Teaching and Learning Resources:

- Pictures or charts on common diseases.

Learner's Book 9: pages 223-229

Learning Expectations:

By the end of the lesson, tthe learner will:

1. conduct a survey about common diseases and analyse the findingsto show what constitutes a common disease in a comunity.
2. identify causes, symptoms and prevention of common diseases.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: Contagious, diseases, tuberculosis, symptoms, hepatitis B

BACKGROUND

There is a substantial probability of disease outbreak in every community where people reside. Every disease has its own set of problems to deal with, as well as how it spreads. We will discuss several common diseases in our communities in this lesson.

Group Activity: Refer to Learner's Book 9 page 223.

- Investigating common diseases in the environment.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Let learners work in groups.

Engage the learners to do the following:

- Discuss the following questions and write their answer on a given manila card for class discussion. What do we mean by communicable diseases?
- List down any communicable disease that your community experienced.

- Discuss the mood of the spread of the named communicable disease and how the community handled the case.
- Present a report for discussion in class.

Reflection
Use group discussion to help learners reflect on what they have learnt.

Review Question
Classify the following diseases as contagious and non-contagious:
Foot root, Tuberculosis, cholera, malaria, ringworm

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. d
2. d
3. a
4. a
5. a

Answers to Essay Type Questions

1.

Disease	Causes	Symptoms	Prevention
Tuberculosis	a bacterial infection that primarily attacks the lungs	• A cough continuing for more than 3 weeks. • Loss of appetite. • Unintentional weight loss. • Fever. • Chills. • Night sweats.	• Good ventilation • Covering of nose and mouth when coughing or sneezing • Keep the immune system healthy.
Ebola	Caused by virus	• High fever, Headache. joint and muscle pains, sore throat.	• Vaccination, • Avoid contact with bats and monkeys.
Malaria	Caused by the plasmodium parasite. Mosquito bites	• fever and chills • headaches • vomiting • diarrhoea • muscle pains	• Avoid mosquito bite

2.

Contagious disease	Non-contagious disease
Foot rot	Cholera
Ringworm	Malaria
	tuberculosis

Research Work/Project Work

Using the internet or from the health officers in your community, find out the causes, symptoms and prevention of the following diseases:

- Foot root
- Ringworm
- COVID-19
- Ebola

CONTENT STANDARD: B9.5.2.2 Demonstrate knowledge of selected fungal, diseases of humans, their causes, symptoms, effects and prevention

Indicator: B9.5.2.2.1 Explain the nature of fungal diseases with special emphasis on Ringworm/ candidiasis/fingernail, and toe nail infection, their causes, symptoms, effects on humans and its prevention.

LESSON 4: THE NATURE OF FUNGAL DISEASES

Teaching and Learning Resources:

- Charts, pictures or videos showing symptoms of common fungal diseases.

Learner's Book 9: Pages 273-277

Learning Expectations:

By the end of the lesson, the learner will:

1. discuss the nature of fungal disease.
2. search for information and make presentations on ringworm, candidiasis and fungal eye infection diseases their mode of transmission from person to person, community to community and form country to country.
3. design and produce a psoter on the incidence and control of named fungal diseases: ringworm, candidiasis and fungsl eye infection.

Learning Skills

- Making observations
- Communicating information
- Grouping objects
- Carrying out investigations
- Making comparisons
- Making and using simple models

Keywords: fungal diseases, ringworm, candidiasis, bacterial diseases, athlete's foot

BACKGROUND

Infections caused by fungi are frequent in many parts of the natural world. Fungal infections in humans occur when an invasive fungus takes over an area of the body and overwhelms the immune system. Fungi can live in a variety of environments, including the air, soil, water, and plants. Some fungus can also be found naturally in the human body. We will study about fungi-caused diseases in this lesson.

Group Activity

- Investigating the nature of fungal diseases.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Let learners work in groups.

Engage the learners to do the following:

- Watch a video clip on the nature of fungal diseases such as ringworm, candidiasis and fungal eye infection diseases.
- Discuss the nature of fungal diseases.
- Discuss the mode of transmission, symptoms, effects and prevention of ringworm, candidiasis and fungal eye infection diseases.
- Present reports on your discussions in class.

Reflection

Use group discussion and the pictures below to help learners talk about what they have learnt.

Review Question

- Mention two each of the following diseases.
- Air-borne
- Water-borne

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Were assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. b
2. a
3. a
4. d
5. a

Answers to Essay Type Questions

1. Fungal diseases are diseases frequently caused by fungi that are found in nature

2.

Disease	Causes	Prevention
Ringworm	caused by a fungus that grows on dead tissues such as the skin, hair, and nails.	Refer to Learner's Book 9 page 274.
Candidiasis	caused by a fungus that grows on dead tissues such as the skin, hair, and nails.	Refer to Learner's Book 9 page 275.
Nail infection	cause by overgrow of fungus in fingernail or toenail	Refer to Learner's Book 9 pages 275 and 276.

3. i. Refer to page 273 Learner's Book 9.
   ii. Refer to page 273 Learner's Book 9.
   iii. Refer to page 273 Learner's Book 9.

Research Work/Project Work
Using the internet, design and produce a poster to educate the community on the incidence and control of named fungal diseases: ringworm, candidiasis and fungal eye infection.

5 Sub-Strand 3: Science and Industry

CONTENT STANDARD: B9.5.3.1 Analyse the scientific concepts, principles and processes applied in industries in and outside their community

Indicator: B9.5.3.1.1 Investigate the scientific concepts, principles and processes involved in industries in their environment.

LESSON 1: INDUSTRIES IN THE ENVIRONMENT

Teaching and Leaarning Resources:

- Charts showing various industries in the Ghanaian society.

Learner's Book 9: Pages 278-283

Learning Expectations:

By the end of the lesson, the learner will:

1. identify products of industries within and outside their community and describe the process of production.
2. investigate and outline scientific concepts, priciples and processes underlying the production of common everyday industrial products.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: Industries, products, manufacture, principles, automotive

BACKGROUND

The action of making or manufacturing from components or raw materials, as well as the process of being thus created, is referred to as industry. In the creation of goods and services, these industries employ scientific concepts, principles, and methods.

Fig. 3 - Industrial products

Group Activity: Refer to Learner's Book 9 page 278

- Researching into the scientific concepts, principles and processes underlying the production of common everyday industrial products.
- Ask learners to mention industrial products from the picture.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Let learners work in groups.

Engage the learners to do the following:

- Assemble products of industries within and outside their community such as salt, soap, fruit drinks, gari, plastic bags and textiles and describe the process of production.
- Watch a video clip on the manufacturing processes such as salt, soap, gari, textile, fruit juice production.
- Visit any soap and gari industries in the community with their teacher.
- Write down and discuss in your group how gari is processed and how soap in made.
- Investigate and outline scientific concepts, principles and processes underlying the production of common everyday industrial products.
- Present your report to class for discussion.

Reflection

Use group discussion to help learners what they have learnt.

Review Question
List down any three industries that you know.

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Answers to Essay Type Questions

1. Responses will depend on learner's community

2. i. Salt —— Evaporation and crystallization
   ii. Gari —— Fermentation
   iii. Kenkey —— Fermentation
   iv. Bread —— Anaerobic respiration

Objectives

1. a
2. a
3. c
4. d
5. d

Research Work/Project Work
Using internet, investigate and outline scientific concepts, principles and processes underlying the production of

i. pomade
ii. oil
iii. paper
iv. cement

CONTENT STANDARD: B9.5.3.2 Demonstrate an understanding of the concept of industry, the science underpinning the processes of production in industries the technologies in indigenous industries and western industries

Indicator:
B9 5.3.2.1 Explain the concept of industry and distinguish between modern and indigenous industries.
B9.5.3.2.2 Examine indigenous industries in their communities and show the scientific processes in the stages of production.

LESSON 2: MODERN AND INDIGENOUS INDUSTRIES

Teaching and Learning Resources:
Pictures showing modern and indigenous industries.
Learner's Book 9: Pages 284-290

Learning Expectations:
By the end of the lesson, the learner will:

1. identify an industry as individual firms producing the same commodity and give examples of industries in their community.
2. describe how technology affects industry and compare the technologies in indigenous and modern industries.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: industry, indigenous industry, modern industry, technology, scientific concepts, indegenous technology

BACKGROUND

In our previous lesson, we discussed industry and examples of different industries in Ghana, as well as what they manufacture. In this section, we'll dig further into the industry as a whole, as well as how technology affects it.

Group Activity

- Investigating the differences between modern and indigenous industries.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Let learners work in groups.

Engage the learners to do the following:

- Discuss what is meant by the term industry.
- Discuss what is meant by indigenous industry and give examples in your community.
- Discuss the differences between indigenous industries and modern industries.

Fig. 4 - Modern and indigenous industry

- Watch video clips on indigenous and modern industries and watch their products.
- Discuss the application of science and technology to modernize indigenous industries.
- Make a visit with your teacher to a number of them in your locality.
- Observe the scientific processes in the production of goods in the indigenous industry.
- Watch video clips on some indigenous industries and identify the scientific processes involved in the production.
- Present a report for class discussion.

Reflection

Use group discussion to help learners reflect on what they have learnt.

Review Question
Ask learners:
What good and bad do industries have?

Think And Discuss
Learners in pairs should discuss the formation of shadows. Take feedback from the various groups. Ensure that the less abled learners participate in the discussion.

Reflections Questions for the Teacher

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK
Objectives

1. b
2. d
3. c
4. d
5. b

Answers to Essay Type Questions

1. a. Answers will vary.
   b. Answers will vary.
2. a. Answers will vary.
   b. Answers will vary.
3. a. Answers will vary.
   b. Answers will vary.
   c. Answers will vary.

Research Work / Project Work
Using the internet and other sources, describe how technology affects industry and compare the technologies in indigenous and modern industries.
Using the internet, let learners identify indigenous practices at home, school and the community and the science involved in the practices.

CONTENT STANDARD: B9.5.3.2 Demonstrate an understanding of the concept of industry, the science underpinning the processes of production in industries the technologies in indigenous industries and western industries.

Indicator: B9.5.3.2.2 Examine indigenous industries in their communities and show the scientific processes in the stages of production.

LESSON 3: INDIGENOUS INDUSTRIES IN THE COMMUNITY AND THE SCIENTIFIC PROCESSES IN THEIR OPERATIONS

Teaching and Learning Resources

- Indigenous Artisans
- natural dye extraction from plants for textiles
- the physics of shaping clay for pottery
- pictures or videos of indigenous industries

Learner's Book 9: Pages 291-298

Learning Expectations:

By the end of the lesson, learners are to:

1. discuss indigenous industries in their communities and identify the scientific processes, concepts and principles underlying the stages of production in the industries.
2. identify indigenous practices at home, school and the community and the science involved in the practices.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: Innovative, sustainable, Waste management

Prior Preparation

- Understanding the scientific basis of indigenous practices requires a multidisciplinary approach. Teachers may need to explore topics such as plant biology, environmental science, traditional medicine, or sustainable resource management. By grounding their teaching in scientific principles, teachers can help learners appreciate the empirical knowledge embedded in indigenous traditions.

- Respectful engagement with indigenous practices necessitates a commitment to ethical conduct and cultural sensitivity. Teachers should be mindful of potential issues related to cultural appropriation and ensure that their teaching approach honors and respects the origins of the practices. It is important to involve members of the indigenous community in the teaching process whenever possible. This could take the form of guest lectures, collaborative projects, or inviting community members to share their perspectives directly with learners. By centering indigenous voices and perspectives, teachers can foster a more inclusive and authentic learning experience.

- The first step in preparing to teach indigenous practices is to gain a deep understanding of their cultural significance. This involves researching the history, traditions, and beliefs of the indigenous community from which the practices originate. It is essential to approach this research with respect and sensitivity, recognizing that these practices are often deeply intertwined with spiritual and communal aspects of indigenous cultures.

BACKGROUND INFORMATION

Indigenous industries are an integral part of many communities, providing economic opportunities and preserving cultural heritage. Engaging learners in activities that explore indigenous industries can be a valuable way to teach scientific processes, concepts, and principles. The teacher-learner activities that can be conducted to understand indigenous industries and the scientific processes underlying their production stages should be carried out for better understanding of the concepts.

Additional Information

- Indigenous practices are deeply rooted in the traditions, beliefs, and knowledge systems of various indigenous communities around the world. These practices are often passed down through generations and play a significant role in shaping the cultural identity of indigenous peoples. The integration of indigenous practices at home, school, and within the community is essential for preserving cultural heritage and promoting a holistic approach to education and well-being.

- At Home Indigenous practices at home encompass a wide range of traditional activities, rituals, and customs that are integral to the daily lives of indigenous families. These may

include traditional cooking methods, storytelling, language preservation, and the use of traditional medicines. For example, in many indigenous cultures, the preparation of food is considered a sacred practice that involves using locally sourced ingredients and following specific cooking techniques that have been passed down through generations. Additionally, storytelling serves as a means of preserving oral history and passing on cultural knowledge from elders to younger generations within the household.

- At School Integrating indigenous practices within the school environment is crucial for creating an inclusive and culturally responsive educational experience for indigenous learners. This can involve incorporating indigenous languages into the curriculum, teaching traditional arts and crafts, and organizing cultural events that celebrate indigenous heritage. Furthermore, some schools may offer courses or workshops on traditional ecological knowledge, which encompasses the scientific understanding of local ecosystems based on indigenous perspectives. By integrating these practices into the school curriculum, teachers can help learners develop a deeper appreciation for their cultural heritage while also fostering respect for diverse knowledge systems.

- In the Community Indigenous practices within the community extend beyond individual households and schools to encompass collective rituals, ceremonies, and community-based initiatives. These practices often revolve around seasonal celebrations, spiritual ceremonies, and communal gatherings that reinforce social cohesion and interconnectedness among community members. For instance, traditional healing practices such as herbal medicine preparations or sweat lodge ceremonies are often conducted within the community under the guidance of knowledgeable elders. These practices not only contribute to physical well-being but also promote a sense of belonging and unity within the indigenous community.

- The Science Involved in Indigenous Practices Many indigenous practices are deeply rooted in scientific principles that have been developed over centuries through careful observation of the natural world. Traditional ecological knowledge (TEK) held by indigenous communities encompasses a sophisticated understanding of local ecosystems, including plant identification, animal behavior patterns, weather forecasting, and sustainable resource management. This knowledge is often based on empirical evidence gathered through direct interactions with the environment and is passed down orally from one generation to another.

- Moreover, indigenous medicinal practices often involve the use of plants with known pharmacological properties for treating various ailments. While these practices may be described in spiritual or cultural terms, they are underpinned by a profound understanding of plant chemistry and their therapeutic effects. In recent years, scientific research has increasingly recognized the value of traditional medicinal knowledge held by indigenous communities and has sought to validate the efficacy of certain traditional remedies through rigorous scientific studies.

Teacher - Learner Activities
Engage learners through these activities to help them comprehend the concepts of indigenous industries. Involve every learner in all the activities. The language of instruction should not be stereotyping.

1. **Field Trips to Indigenous Industries:** Organize field trips to local indigenous industries such as traditional textile weaving, pottery making, or food processing. Learners can observe the entire production process, from raw materials to the finished products. This hands-on experience will help them understand the scientific principles involved in each stage of production.

2. **Interviews with Indigenous Artisans:** Invite indigenous artisans to the classroom for interactive sessions. Learners can interview them to gain insights into the scientific knowledge and techniques they use in their craft. This can include discussions on plant dyes used in textiles, clay properties in pottery making, or fermentation processes in traditional food production.

3. **Hands-On Workshops:** Conduct hands-on workshops where learners can actively participate in the production processes. For example, they can learn about natural dye extraction from plants for textiles, or the physics of shaping clay for pottery. These activities will allow learners to directly engage with the scientific concepts underlying indigenous industries.

4. **Research Projects on Indigenous Techniques:** Assign research projects where learners investigate the scientific principles behind specific indigenous techniques. For instance, they can explore the chemistry of natural dyes, the physics of weaving patterns, or the biology of fermentation in traditional food preservation. Encouraging learners to present their findings will enhance their communication skills.

5. **Documentation and Presentation:** Encourage learners to document their learning experiences through written reports, presentations, or visual displays. This documentation can include scientific explanations of the processes involved in indigenous industries and their cultural significance.

Progressive Assessment

- Let learners identify indigenous practices at home, school and the community and the science involved in the practices.
- Ask learners to present their responses for discussion.

Main Points of the Lesson

1. **Plant medicine and pharmacology:** Many indigenous cultures have developed sophisticated systems of plant medicine, using plants and other natural substances to treat a wide range of ailments. These practices are often based on a deep understanding of the chemical properties of plants and their effects on the human body. For example, the use of willow bark to treat fever is based on the scientific principle that salicylic acid, a compound found in willow bark, has analgesic and anti-inflammatory properties. Similarly, the use of echinacea to boost the immune system is based on the scientific principle that the plant contains compounds that have antioxidant and immune-stimulating properties.

2. **Astronomy and seasonal forecasting:** Many indigenous cultures have developed sophisticated systems of astronomy and seasonal forecasting, which are based on careful observation of the stars, moon, and other celestial bodies. These practices are often used to predict seasonal changes, planting and harvesting times, and other important events. For example, the Inca Empire developed a sophisticated system of astronomy that allowed them to predict solar and lunar eclipses, as well as the movement of the stars and planets. This knowledge was used to plan agricultural cycles, religious ceremonies, and other important events.

3. **Ecological sustainability:** Many indigenous cultures have developed sustainable practices that are based on a deep understanding of ecological principles. These practices are often designed to maintain the balance of nature and ensure the long-term health of the environment. For example, the use of permaculture techniques in many indigenous cultures is based on the scientific principle that diverse ecosystems are more resilient and productive than monocultures. Similarly, the use of traditional farming techniques, such as crop rotation and polyculture, is based on the scientific principle that these practices can improve soil health and reduce the need for synthetic fertilizers and pesticides.

Diagnostic Assessment for the Teacher

The following ideas should help the teacher find out whether the lesson was successfully carried out as expected by the learning outcomes, skills, knowledge , values and attitudes
Did the teacher do the following ?

1. Student Understanding and Engagement
   One key aspect of the assessment is to evaluate the learners' understanding of indigenous practices and the related scientific concepts. This can be done through various means, such as quizzes, discussions, or projects that require learners to apply their knowledge. Observing how learners interact with the material and each other can also provide valuable insights into their engagement with the subject matter.

2. Cultural Sensitivity and Respect
   Another important component of the assessment is to gauge how effectively the teacher

conveyed respect for indigenous cultures while teaching about their practices. This involves assessing whether the teacher presented the information in a culturally sensitive manner, acknowledging the significance of indigenous knowledge and traditions. It also entails evaluating whether learners demonstrated an understanding of and respect for indigenous perspectives.

3. Integration of Science and Indigenous Knowledge
   The assessment should also consider how well the teacher integrated scientific principles with indigenous practices. This involves examining whether learners were able to make connections between scientific concepts and traditional knowledge, as well as evaluating the depth of understanding demonstrated by learners in this regard.

4. Teacher Delivery and Communication
   Assessing the teacher's delivery of the content is crucial. This includes evaluating clarity of explanations, use of relevant examples, and ability to facilitate discussions that encourage critical thinking about both scientific and indigenous perspectives. Additionally, assessing how effectively the teacher responded to student questions and facilitated meaningful dialogue can provide valuable insights into their instructional effectiveness.

5. Feedback from Learners
   Gathering feedback from learners about their learning experience can offer valuable perspectives on how well the teacher conveyed information about indigenous practices and related science. This feedback can be collected through surveys or class discussions, allowing learners to express their thoughts on what they found effective or challenging in their learning process.

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

1. Dry cocoa pod
   Plantain peels
   Palm oil
   Salt

2. Odour
   Colour
   Texture
   Ability to mould

3. i. Refer to page 293 in Learners' Book 9.
   ii. Refer to page 294 in Learners' Book 9.
   iii. Refer to page 293 in Learners' Book 9.

5 Sub-Strand 4: Climate Change and Green Economy

CONTENT STANDARD:
B9.5.4.1 Demonstrate an understanding of the natural and human factors that influence climate change and a green economy
B9.5.4.2 Evaluate the effectiveness of initiatives that address the issue of climate change and green economy in Ghana and the world at large

Indicator:
B9.5.4.1.1 Examine various natural and human factors that influence climate change and green economy in their localities.
B9.5.4.2.1 Assess data on climate change and green economy actions/ activities globally including Ghana and other countries.

LESSON 1: FACTORS THAT INFLUENCE CLIMATE CHANGE AND GREEN ECONOMY

Teaching and Learning Resources:
Pictures showing effects of climate change and green economy
Learner's Book 9: Pages 299-303

Learning Expectations:
By the end of the lesson, the learner will:
1. identify the natural factors that influence climate change.
2. describe ways of minimising human activities that influence climate change.
3. compare natural and human factors that influence climate change and green economy.

Learning Skills
- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: Climate change, green economy, deforestation, pollution, wild life

BACKGROUND

Climate change, we learned in Basic 8, is a major or abnormal difference in the long-term, average weather pattern for a specific region or the entire Earth, which has consequences for the Earth. We will look at several natural and human elements that influence climate change and the green economy in their communities in this lesson. We will also examine facts on climate change and green economy projects from throughout the world, including Ghana and other countries, in this lesson.

Group Activities 1 and 2: Refer to Learner's Book 9 pages 299 and 300

- Finding out natural and human factors that influence climate change
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Let learners work in groups.

Engage the learners to do the following:

- Watch video clip on both natural and human activities that influence climate change.
- Search from journals, magazines and pictures factors that influence climate change.

Fig. 5 - Factors that influence climate change

- Using a pair of scissors cut from journals, magazines and pictures factors that influence climate change.
- Using cooked starch, paste them in an exercise book to make an album.
- Suggest methods that can reduce human activities that influence climate change.
- Compare natural and human activities that influence climate change and green economy.
- Present your findings and suggestions for class discussion.

Engage the learners to do the following:

i. Find out from internet, journals or magazines research made into climate change and green economy actions in Ghana.
ii. Access climate change and green economy actions in other countries.
iii. Compare and contrast climate change and green economy actions in Ghana and other countries.
iv. Identify and write the effective initiatives that address climate change and green economy issues in Ghana and other countries.
v. Prescribe with reasons best practices to serve as possible solutions to address climate change and green economy issues in Ghana.

Reflection

Use group discussion to help learners revise what they have learnt.

Review Question

- Why are people advocating for the use of other sources of energy other than fossil fuels?
- Identify four natural causes of climate change.
- List two activities of humans that contribute to the pro

Diagnostic Assessment/Application

1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. c
2. d
3. c
4. b

Answers to Essay Type Questions

1. a. Strength of the Sun
   b. Changes in the Earth's orbit, axial tilt and precession
   c. Quantity of greenhouse gasses in the atmosphere
   d. Ocean currents and carbon dioxide content
   e. Plate tectonics and volcanic eruptions
   f. Changes in land cover
   g. Meteorite impacts.

2. a. Burning fossil fuels, e.g. oil, gas and coal.
   b. Deforestation
   c. Agriculture
   d. Industrial activities

3. Carbon dioxide, methane, and water vapour

4. a. Make your community green
   b. Encourage the use of renewable energies
   c. Be more conservative with energy usage
   d. Avoid the burning of vegetation

5. To reduce the release of greenhouse gases into the atmosphere

6. Answers will vary.

7. Green economy actions are aimed at protecting the environment to reduce climate change and its effects.

8. Refer to page 301 in the Learner's Book 9.

Research Work/Project Work

- Search from journals, magazines and pictures factors that influence climate change.
- Using a pair of scissors cut from journals, magazines and pictures factors that influence climate change.

Encourage/Guide/Let learners

- Read more on climate change and green economy on the internet.

CONTENT STANDARD: B9.5.4.2 Evaluate the effectiveness of initiatives that address the issue of climate change and green economy in Ghana and the world at large

Indicator: B9.5.4.2.1 Assess data on climate change and green economy actions/ activities globally including Ghana and other
countries.

LESSON 2: ASSESSING DATA ON CLIMATE CHANGE AND GREEN ECONOMY ACTIONS / ACTIVITIES GLOBALLY INCLUDING GHANA AND OTHER COUNTRIES

Teaching and Learning Resources:
Pictures or videos of materials in the environment
Learner's Book 9: Pages 304-309

Learning Expectations:
By the end of the lesson, the learner will:

1. research into climate change and green economy actions in Ghana.
2. access climate change and green economy actions in other countries.
3. compare and contrast climate change and green economy actions in Ghana and other countries.
4. identify and write the effective initiatives that address climate change and green economy issues in Ghana and other countries
5. prescribe with reasons best practices to serve as possible solutions to address climate change and green economy issues in Ghana.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: Climate change, green economy

Prior Preparation
Prior to teaching about effective initiatives that address climate change and green economy issues in Ghana and other countries, teachers should engage in thorough preparation to ensure the delivery of accurate, relevant, and impactful content. This preparation involves several key steps and considerations.

Understanding Climate Change and Green Economy Issues Before teaching about effective initiatives, it is crucial for teachers to have a deep understanding of climate change and green economy issues. This includes comprehending the scientific basis of climate change, its impacts on the environment and society, as well as the principles of a green economy. Teachers should familiarize themselves with the latest research, reports, and data related to climate change and green economy issues to provide students with up-to-date and accurate information.

Researching Country-Specific Contexts Teachers should also conduct research on country-specific contexts, particularly focusing on Ghana and other relevant countries. This involves understanding the unique environmental challenges, policy frameworks, economic structures, and cultural aspects that shape the approach to addressing climate change and promoting green economy initiatives in these regions. By gaining insights into specific national or regional circumstances, teachers can tailor their teaching to resonate with the realities of their students.

BACKGROUND INFORMATION
In the previous session, we looked at numerous natural and human factors that influence climate change and the green economy in our communities. We also learnt about ways for reducing the human-caused climate change. We will examine facts on climate change and green economy projects from throughout the world, including Ghana and other countries, in this lesson.

Additional Information
In recent years, there has been a growing global focus on addressing climate change and promoting green economy initiatives. Ghana, like many other countries, has been actively involved in implementing effective measures to combat climate change and promote sustainable development. One of the key initiatives in Ghana is the National Climate Change Policy Framework, which provides a comprehensive roadmap for addressing climate change challenges and promoting a green economy.

Ghana's National Climate Change Policy Framework The National Climate Change Policy Framework in Ghana outlines strategies for mitigating the impacts of climate change and promoting sustainable development. It emphasizes the need for integrating climate change considerations into national development planning and decision-making processes. The framework

also focuses on enhancing adaptive capacity, strengthening resilience, and promoting low-carbon development pathways. Additionally, it prioritizes the conservation and sustainable management of natural resources, including forests, water, and biodiversity.
Renewable Energy Development Ghana has also made significant strides in promoting renewable energy development as part of its efforts to address climate change and transition towards a green economy. The country has implemented various initiatives to harness its renewable energy potential, including solar, wind, and hydroelectric power. For instance, the government has launched the Renewable Energy Master Plan to guide the expansion of renewable energy sources and reduce reliance on fossil fuels.

International Collaborations Furthermore, Ghana actively participates in international collaborations aimed at addressing climate change and promoting sustainable development. The country is a signatory to international agreements such as the Paris Agreement, demonstrating its commitment to reducing greenhouse gas emissions and transitioning towards a low-carbon economy. Through these partnerships, Ghana gains access to technical expertise, financial support, and knowledge sharing opportunities that contribute to its efforts in combating climate change.

Community-Based Initiatives At the grassroots level, community-based initiatives play a crucial role in addressing climate change and promoting sustainable practices. In Ghana, various community-led projects focus on reforestation, sustainable agriculture, waste management, and environmental conservation. These initiatives not only contribute to mitigating the impacts of climate change but also empower local communities to actively participate in sustainable development efforts.

Other Countries' Effective Initiatives Beyond Ghana, numerous countries have implemented effective initiatives to address climate change and promote green economy issues. For example, Germany has been a global leader in renewable energy deployment through its Energiewende (energy transition) policy. The country has significantly increased its share of renewable energy sources in electricity generation while phasing out nuclear power.

Similarly, Costa Rica has made remarkable progress in environmental conservation and sustainable development. The country has set ambitious targets for carbon neutrality and has invested in reforestation efforts to offset carbon emissions. Costa Rica's emphasis on ecotourism and biodiversity protection further demonstrates its commitment to green economy principles.

In addition, Denmark's strong focus on wind energy has positioned it as a pioneer in offshore wind power technology. The country's investments in renewable energy infrastructure have contributed to reducing carbon emissions and advancing its transition towards a greener economy.
These examples highlight how countries around the world are implementing diverse strategies to address climate change and promote sustainable development.

Overall, effective initiatives addressing climate change and green economy issues encompass a wide range of approaches, including policy frameworks, renewable energy development, international collaborations, community-based initiatives, and innovative strategies adopted by various countries.

Teacher - Learner Activities
Activity
Finding out some research made into climate change and green economy actions in Ghana. Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.

1. Let learners work in groups.
2. Engage the learners to do the following:
    i. Find out from internet, journals or magazines research made into climate change and green economy actions in Ghana.
    ii. Access climate change and green economy actions in other countries.
    iii. Compare and contrast climate change and green economy actions in Ghana and other countries.
    iv. Identify and write the effective initiatives that address climate change and green economy issues in Ghana and other countries.
    v. Prescribe with reasons best practices to serve as possible solutions to address climate change and green economy issues in Ghana.

Progressive Assessment
Use group discussion to help learners talk about what they have learnt by asking the following questions

1. Identify four natural causes of climate change.
2. List two activities of human that contribute to the production of greenhouse gasses.

Diagnostic Assessment for the Teacher
1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Research Work / Project Work
Encourage/Guide/Let learners
Use the internet, read more on climate change and green economy and make presentations.

Main Points of the Lesson

Best Practices to Address Climate Change and Green Economy Issues in Ghana

Climate change and the transition to a green economy are critical global challenges that require comprehensive and sustainable solutions. In the context of Ghana, several best practices can be implemented to address these issues effectively.

1. Promoting Renewable Energy Sources: One of the key strategies to address climate change and promote a green economy in Ghana is to prioritize the development and utilization of renewable energy sources. Ghana has abundant solar, wind, and hydroelectric potential, which can be harnessed to reduce reliance on fossil fuels and mitigate greenhouse gas emissions. Implementing policies and incentives to encourage investment in renewable energy infrastructure, such as solar farms and wind turbines, can significantly contribute to reducing carbon emissions and promoting sustainable economic growth.

2. Sustainable Agriculture and Forestry Practices: Another crucial aspect of addressing climate change in Ghana is the adoption of sustainable agriculture and forestry practices. Encouraging agroforestry techniques, reforestation efforts, and sustainable land management can help sequester carbon dioxide from the atmosphere while promoting biodiversity and ecosystem resilience. Additionally, promoting sustainable agricultural practices such as organic farming, efficient irrigation methods, and agroecology can contribute to reducing deforestation, preserving natural habitats, and enhancing food security in the face of climate variability.

3. Strengthening Climate Resilience and Adaptation: Building climate resilience and enhancing adaptation measures are essential components of addressing climate change in Ghana. This involves investing in climate-resilient infrastructure, improving water resource management, implementing early warning systems for extreme weather events, and integrating climate considerations into urban planning and development projects. By prioritizing climate adaptation strategies, Ghana can better cope with the impacts of climate change while safeguarding communities, ecosystems, and livelihoods.

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

1. Refer to page 305 of Learners' Book 9.

2. Green economy are actions aim at protecting the environment to reduce the climate change and its effects.

3. Refer to pages 306-308 of Learners' Book 9.

5 Sub-Strand 5: Understanding the Environment

CONTENT STANDARD: B9.5.5.1 Demonstrate knowledge and skills in the use of plant roots, stems, leaves, flowers, and fruits for agricultural and non-agricultural purposes

Indicator:
B9.5.5.1.1: Show and list the uses of different plant parts for agricultural and non-agricultural purposes.
B9.5.5.1.2: Demonstrate the use of different plant parts for agricultural and non-agricultural purposes.

LESSON 1: THE USES OF DIFFERENT PLANT PARTS

Teaching and Learning Resources:
- different youn plants, pictures showing different plant parts.

Learner's Book 9: Pages 310-315

Learning Expectations:
By the end of the lesson, the learner will:
1. identify plant parts that are used for agricultural and non-agricultural purpose.
2. describe how plant parts are used for agricultural and non-agricultural purposes.
3. list the uses of palnt parts for agricultural purposes.
4. list the uses of plant parts for non-agricultural purposes.

Learning Skills
- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: aesthetic, enthusiasm, propagation, medicinal, plant parts, herbal medicine

BACKGROUND

Human uses of plants include both practical uses, such as food, clothing and medicine, and symbolic uses such as art, mythology and literature. The reliable provision of food through agriculture is the basis of civilization. Human has used plant to cure diseases, build houses, making furniture, for fuel for cooking food and many other things. Our uses of plant can be classified as Agricultural and non -agricultural purposes. This lesson will take us to look at parts of the plant or plants that are used for agricultural and non-agricultural purposes.

A plant is made up of many different parts. The three main parts are: the roots, the leaves, and the stem. Each part has a set of jobs to do to keep the plant healthy. The roots absorb water and minerals from the soil and anchor the plant in the ground.

Activity 1: Refer to Learner's Book 9 page 310.

Fig. 6

Engage the learners to do the following:

- Make a nature walk around the school compound.
- Observe the different parts of the various plants.
- Brink to class the following parts of plant –root, stem, leaves, flower, fruit, bark.
- Suggest the use of these parts for Agricultural and non-agricultural purposes.
- Present your suggestions for class discussion.
- Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
- Guide learners to name the parts of plants.
- Engage the learners to discuss the uses of plants parts.
- Guide learners to watch videos parts of plants for agriculture purposes and non-agriculture purposes.

Reflection
Use group discussion to help learners revise what they have learnt.

Review Question
- In what ways has plants contribute to genetics?
- Describe the economic importance of parts of plants.

Diagnostic Assessment/Application
1. Can the learners explain potential misconceptions about the lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?
7. What was the reaction of the learners of my integration of ICT activities?

Reflection
Use the diagram below and the questions to help you think of ways of improving your lesson.

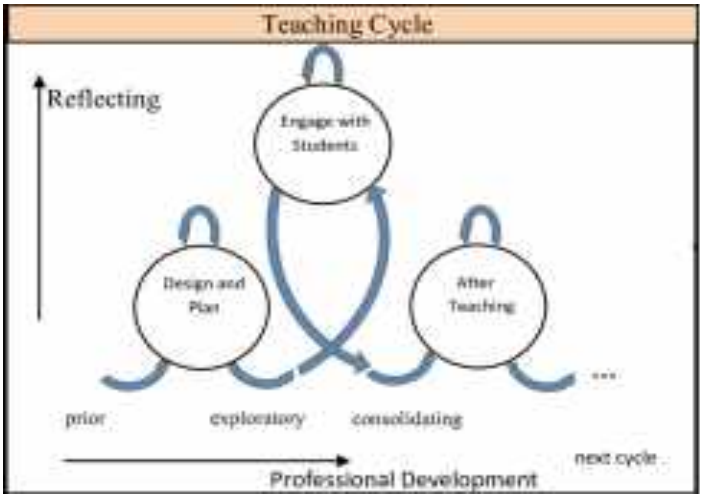


Fig. 7 - Teaching Cycle

1. Were you able to design and plan appropriate activities for your lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?

5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

Objectives

1. d
2. a
3. b
4. b
5. d

Answers to Essay Type Questions

1. Four uses of plants
   a. Food
   b. Clothing
   c. Medicine
   d. Raw material for industries

2. doors - mahogany
   basket - oil palm
   bucket - rubber plant

3. Refer to Learner's Book 9 pages 311-314.

4. cocoa, kola, coconut, raffia

5. neem, tobacco, barbados nut, rosary pea
6. leaves of creals, legumes of groundnut, fruits of maize

7. caassava, hibiscus, bitter leaf

8. Raw material sources of
   i. vehicle tyres - rubber tree
   ii. chocolate - cocoa
   iii. alcoholic beverages - palm tree
   iv. milo - millet
   v. table soap - oil and cocoa pod
   vi. jute sack - jute plant

Research Work/Project Work

- Let learners to use the internet to finding out the use of plant parts.
- Let learners work in a groups.

Each group should fabricate or manufacture one of the following using part of a plant part:

- Kitchen stool
- Toy car/bicycle
- Handle of cooking utensils
- Musical instrument

CONTENT STANDARD: B9.5.5.1 Demonstrate knowledge and skills in the use of plant roots, stems, leaves, flowers, and fruits for agricultural and non-agricultural purpose

Indicator: B9.5.5.1.2 Demonstrate the use of different plant parts for agricultural and non-agricultural purposes.

LESSON 2: THE USE OF DIFFERENT PLANT PARTS FOR AGRICULTURAL AND NON-AGRICULTURAL PURPOSES

Teaching and Learning Resources:
Pictures or videos of materials in the environment
Learner's Book 9: Pages 316-319

Learning Expectations:
By the end of the lesson, learners are expected to:

1. create agricultural materials from different plant parts that are used to carry out agricultural activities.
2. create non-agricultural materials from different plant parts to carry out non-agricultural activities.

Learning Skills

- Making observations
- Communicating information
- Carrying out investigations
- Creativity and innovation
- Making and using simple models
- Problem solving
- Presentation
- Research skills
- Analytical skills
- Critical thinking
- Digital literacy

Keywords: Plant parts, herbal medicine

BACKGROUND INFORMATION

A plant is made up of many different parts. The three main parts are: the roots, the leaves, and the stem. Each part has a set of jobs to do to keep the plant healthy. The roots absorb water and minerals from the soil and anchor the plant in the ground.

Additional Information

Different Plant Parts for Agricultural and Non-Agricultural Purposes

Plants are valuable resources that provide a wide range of materials for both agricultural and non-agricultural purposes. Various parts of plants, including roots, stems, leaves, flowers, fruits, and seeds, are utilized in diverse applications, contributing to human sustenance, industry, medicine, and culture.

Roots Roots play a crucial role in the absorption of water and nutrients from the soil. In agriculture, certain root crops such as carrots, potatoes, and radishes are cultivated for their edible roots. Additionally, medicinal herbs like ginseng and turmeric are valued for their beneficial roots. Moreover, certain plant roots are used in traditional medicine and herbal remedies due to their therapeutic properties.

Stems Stems serve as supportive structures for plants and facilitate the transport of water and nutrients. In agriculture, stems of certain plants such as sugarcane and bamboo are utilized for their fibrous nature in the production of paper, textiles, and construction materials. Furthermore, some stems like rhubarb are consumed as food. In non-agricultural settings, stems of various plants are used in crafts, furniture making, and artistic arrangements.

Leaves Leaves are essential for photosynthesis and are often utilized for various purposes. In agriculture, leafy vegetables such as spinach, lettuce, and kale are cultivated for human consumption due to their high nutritional value. Leaves also have non-agricultural uses such as in traditional medicine, herbal teas, natural dyes, and packaging materials.

Flowers Flowers serve important roles in plant reproduction and have diverse applications beyond agriculture. Certain flowers like roses and lavender are cultivated for their ornamental value in gardens and floral arrangements. Moreover, flowers are used in perfumery to extract essential oils for fragrance production. Additionally, some flowers have culinary uses in the preparation of teas or as decorative elements in food presentation.

Fruits Fruits are an integral part of agriculture and human diet due to their nutritional content. Many fruits such as apples, oranges, bananas, and grapes are cultivated on a large scale for human consumption. In addition to being consumed fresh or processed into various food products like juices and jams, fruits also have non-agricultural uses in the production of natural dyes and cosmetics.

Seeds Seeds are vital for plant propagation and have numerous applications in both agricultural and non-agricultural contexts. In agriculture, seeds of various crops such as wheat, rice, maize, and soybeans are sown to grow staple food crops. Furthermore, seeds like flaxseeds and chia seeds are valued for their nutritional benefits. Non-agricultural uses of seeds include extraction of oils for cooking or industrial purposes and as raw materials for jewelry making.

Teacher - Learner Activities

Activity 1

1. Drill all the key words in the lesson with the learners. Let the learners use the key words in forming sentences.
2. Guide learners to name the parts of plants.
3. Engage the learners to discuss the uses of plants parts.
4. Guide learners to watch videos parts of plants for agriculture purposes and non-agriculture purposes.
5. Engage learners using different creative pedagogies to create agricultural materials from different plant parts that are used to carry out agricultural activities e.g.
   - Fiber crops: Crops like cotton, flax, and hemp can be used to create a range of agricultural materials, such as ropes, twines, and textiles. These crops can be grown specifically for their fiber content, and the fibers can be extracted and processed to create usable materials.
   - Stem materials: Plant stems can be used to create a range of agricultural materials, such as paper, cardboard, and building materials. For example, bamboo stems can be used to create sustainable building materials, while rice straw can be used to create biodegradable paper products.
   - Leaf materials: Leaves can be used to create a range of agricultural materials, such as mulch, compost, and biofuels. For example, corn leaves can be used to create biodegradable packaging materials, while tea leaves can be used to create natural pesticides

Activity 2:

Guide learners in creating non-agricultural materials using different plant parts, ion.

Materials:

- Various plant parts such as leaves, stems, roots, and seeds
- Scissors
- Glue
- Cardboard or paper
- Markers
- Other decorative materials (optional)
-

Procedure:

1. **Introduction to Plant Parts:** Begin by discussing the different parts of a plant and their functions. Explain how each part can be utilized in non-agricultural activities.
2. **Brainstorming Session:** Encourage students to brainstorm and discuss various non-agricultural activities where plant parts can be used to create materials. This could include making paper from plant fibers, creating art from leaves and flowers, or constructing structures using plant-based materials.

3. **Plant-Based Material Creation:** Divide the students into small groups and assign each group a specific plant part. Instruct them to create a non-agricultural material using the assigned plant part. For example, one group may work on creating paper from plant fibers, while another group may focus on making art from leaves.
4. **Presentation:** Once the materials are created, have each group present their creation to the class. Encourage them to explain the process, challenges faced, and the potential uses of their non-agricultural material.
5. **Discussion:** Facilitate a discussion on the importance of sustainable practices and utilizing natural resources for non-agricultural purposes. Discuss the environmental benefits of using plant-based materials.
6. **Reflection:** Conclude the activity with a reflection session where students share what they learned and how they can apply this knowledge in their daily lives.
7. **Assessment:** Assess students based on their creativity, understanding of plant parts, collaboration in group work, presentation skills, and participation in discussions.

Progressive Assessment

Let learners describe the economic importance of parts of plants and make presentations in class for discussion.

ANSWERS TO THE QUESTIONS FROM THE LEARNER'S BOOK

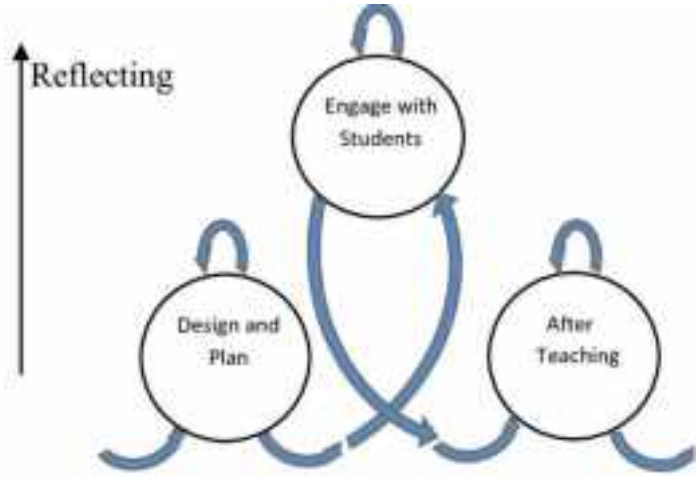
1. Responses will depend on the learner
2. Food
   Clothing
   Medicine
   Raw material for industries

Research Work / Project Work

1. Let learners work in a groups
2. Each group should fabricate or manufacture one of the following using part of a plant part:
   i. Kitchen stool
   ii. Toy car/bicycle
   iii. Handle of cooking utensils
   iv. Musical instrument

Diagnostic Assessment for the Teacher

Use the diagram below and the questions to help you consider ways of improving your lesson.



1. Were you able to design and plan appropriate activities for your lesson?
2. Where assessment for learning and assessment as learning strategies well used in the lesson?
3. Did the learners understand the lesson through my resources?
4. Did the learners systematically follow the progressiveness of the lesson?
5. Did the learners understand the creative pedagogies I used?
6. What can I do to improve the lesson?

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