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STRAND 1: DIVERSITY OF MATTER

Sub-strand 1: Materials

Content Standard: B7.1.1.1:

Recognise materials as important resources for providing human needs.

Indicator B7.1.1.1.1:

Classify materials into liquids, solids and gas

Materials

There are many materials around us and they come in different shapes, colours texture and sizes. **A material** is a substance or mixture of substances that constitute an object. ***A substance*** is anything that can be seen, touched or measured. Examples of materials; water, wood, oxygen, milk, table, chair, sand, alcohol, soft drink, pito, lemon juice, cooking oil, soap, computer, 'sobolo', water vapour, palm wine, vinegar, carbon dioxide, diesel, Dettol, petrol, kerosene, gravel, etc. Materials can be classified based on their state (solid, liquid and gas).

Classification of materials Into Solids, Liquids And Liquids.

The above listed materials have been classified or grouped into solids, liquids and gases

SOLIDS	***LIQUIDS***	***GASES***
Wood Table Chair Soap Sand Computer Gravel	Water Milk Soft drink Palm wine 'Sobolo' Lemon juice Cooking oil "Pito" Vinegar Dettol Kerosene Petrol, alcohol, diesel	Water vapour Oxygen Carbon dioxide

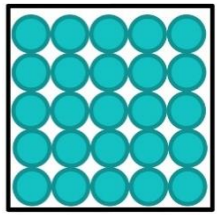
Difference between solids, liquids and gases

SOLIDS	1.Have a definite shape
	2.Can be held in the hand
	3.Solids do not flow

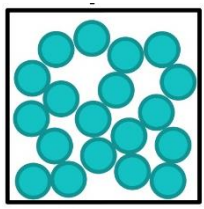
	4.They have fixed shape.
	5.They have fixed volume
	6.They are difficult to compress.
	7.Particles in solids are closely packed
LIQUIDS	1.They do not have fixed shape. They take the shape of a container.
	2.Liquids flow
	3.They have definite volume
	4.They cannot be compressed
	5.Particles in liquids are quite closely packed.
GASES	1.Gases flow
	2.They do not have fixed shape. They take the shape of their container.
	3.They do not have fixed volume, they expand to fill any available space
	4.They can be compressed or squeezed easily
	5.Particles in gases are widely spread or scattered

Arrangement of Particles in Solids, Liquids and Gases.

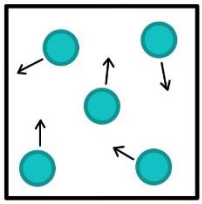
SOLIDS: The particles of solids are closely packed in a fixed pattern due to low kinetic energy between the particles. The particles are held together by very strong bonds. The strong bonds prevent the particles from moving about freely, they can only vibrate about their mean positions. It is difficult to compress solids because the particles are closely packed. They maintain their shape because their particles cannot move about freely. This means that solids have fixed shape and fixed volume.



LIQUIDS: The particles of liquids are closely packed but not as much solids. The particles have higher kinetic energy than solids because they are free to move about independently. The bonds between the particles are weaker than those in solids.



GASES: The particles of gases are scattered and they move about freely. The bounding forces between the particles are very weak. Gases are easily compressible because the particles are not closely packed.



Indicator: B7.1.1.1.2
Discuss the importance of liquids in the life of humans.

Liquids are important to human lives; we drink water every day and use water for a lot of daily activities such as washing, bathing, watering of crops, etc. Other liquids include cooking oils, engine oil, gentian violet, Dettol, cough mixture, 'pito', 'sobolo', etc. Water like any other liquid needs to be preserved because of its importance for the survival of human lives.

Importance of Water to Humans

i. It helps prevent constipation.
ii. It helps prevent overall dehydration.
iii. It helps keep the skin bright.
iv. It helps in nutrient absorption.
v. It improves blood oxygen circulation.
vi. It helps fight off illness e.g. urinary tract infections, kidney stone, etc.

Importance of Gentian violet

1. Gentian violet is used to treat fungal infections of the skin.
2. It is used on minor cuts and scrapes to prevent infection.

Importance of Dettol

Dettol is an effective concentrated antiseptic solution that kills bacteria and provides protection against germs which can cause infection and illness.

1. It often added to water for bathing in order to kill germs on the skin.
2. It is used as a household disinfectant on surfaces.

Experiment To Demonstrate The Presence Of Air.
Apparatus: water, empty bottle and a bucket
Procedure:

i. Fill the bucket with water.
ii. Take the empty bottle and turn it upside down.

iii. Dip the open end of the bottle into the bucket filled with water as shown in **figure.1** below and observe the bottle closely.
iv. Now tilt the bottle slightly and see what happens in **figure 2.**

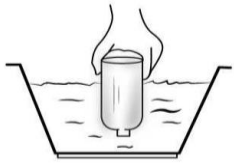


Fig.1

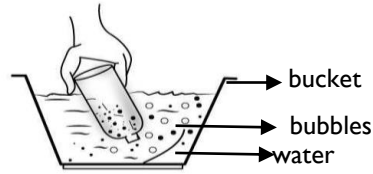


Fig. 2

Observation: Bubbles were seen coming out of the bottle.

Discussion: The bottle was not empty. It was filled completely with air even when you turned it upside down. That is why you noticed that water did not enter the bottle when it was in an inverted position because there was no space for the air to escape. When the bottle was tilted, the air was able to come out in the form of bubbles, and water filled up the empty space that the air occupied. This activity shows that air is everywhere around us even in bottles. It also shows that air occupies space.

Activity 2: wave a piece of paper across your face to feel the presence of air.

Indicator(s): B7.1.1.1.3
Discuss the importance of specific solids to life

There are several examples of solid materials from the environment that are important for survival of human beings. Examples include iron bars, tables, chair, table salt, sugar, ice block, frozen carbon dioxide (dry ice), glass, rock, metallic objects, wood, tree, land, Clay, empty bottles, palms nuts, palm fronds, cement block etc.

Importance Of Dry ice.
1. It is used in the food and agriculture sector to keep food from spoiling during transportation.
2. They are used to preserve human body until the time for the funeral.
3. Dry ice is used in broken/damaged freezers and refrigerators to keep its contents cold.

4. Dry ice is used to remove oxygen from flammable tanks when placed inside. This prevents flammable gases from catching spark and exploding.
5. Dry ice allows asphalt to stay at required temperatures during transportation from manufacturing plant to job site.

Self-Assessment Task

1. Examine the materials listed below:
a. Water, cooking oil, wood, carbon dioxide, table, soft drink, water vapour, chair, oxygen, milk, soap, lemon juice, computer.
b. In a tabular form classify the substances as solids, liquids and gases.

2.(a) Identify three vocations that use solids, liquids and gases.
(b). Put your answers on a sheet of paper
3. Name and write four liquids that are important to humans.
4. Write the importance of the liquids you have named in question 3 above.
5. In a tabular form write two differences between
a. solids and liquids
b. liquids and gases
c. solids and gases
6. Show with the help of a sketch the arrangement of solid, liquid and gas particles.
7. a) Explain why gases are compressible but solids are not.
b) Explain why solids have a fixed shape but liquids have no fixed shape.
8. Name a liquid, solid, and a gas in your environment. Describe their importance to humans

Indicator: B7.1.1.2

Understand the periodic table as different elements made up of metals and non-metals and noble gases arranged in an order.

An element is a chemical substance that consist of atoms of only one kind. An element cannot be broken down into any simpler substances by ordinary chemical means. Scientist have discovered more than one hundred (100) elements. Each element has its own chemical symbol. Alphabets are used to represent the chemical symbol of the elements. Some elements take the first letter of their name as their chemical symbol and it is written in capital letter.

Some elements have two letters as their chemical symbol in this case the first letter is written in capital letter and the second letter written in small letter. The symbols of the elements are taken

from either the English, Latin, Greek, or Hebrew name of the element. Example; sodium (its Latin name is Natrium and the chemical symbol is Na), potassium (Latin name is Kalium, symbol is K), Gold (Latin name is Aurum, its symbol is Au) Among the elements below are the first twenty (20).

The First twenty elements and their chemical symbols

Atomic number	Element	Chemical symbol	Mnemonic
1	Hydrogen	H	Hi
2	Helium	He	He
3	Lithium	Li	Lies
4	Beryllium	Be	Because
5	Boron	B	Boys
6	Carbon	C	Can
7	Nitrogen	N	Not
8	Oxygen	O	Operate
9	Fluorine	F	Fireplaces
10	Neon	Ne	New
11	Sodium	Na	Nation
12	Magnesium	Mg	Might
13	Aluminium	Al	Always
14	Silicon	Si	Sign
15	Phosphorus	P	Peace
16	Sulphur	S	Security
17	Chlorine	Cl	Clause
18	Argon	Ar	Ar
19	Potassium	K	King
20	Calcium	Ca	Can

Periodic table is the arrangement of elements according to their atomic numbers such that elements with similar properties are placed in vertical rows (called period) and horizontal columns (called group).

Periodic Table for the first Twenty Elements

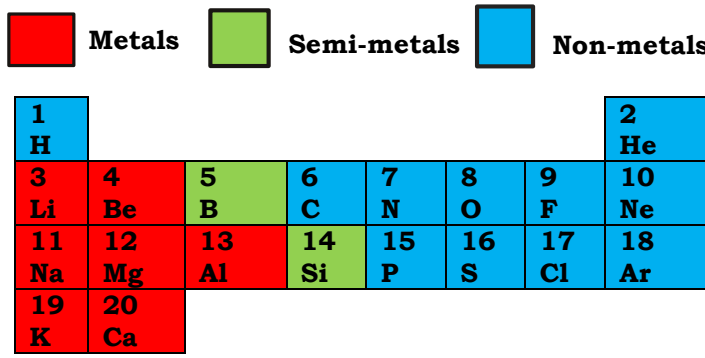
	Groups							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Period 1	**1 H**							**2 He**
Period 2	**3 Li**	**4 Be**	**5 B**	**6 C**	**7 N**	**8 O**	**9 F**	**10 Ne**
Period 3	**11 Na**	**12 Mg**	**13 Al**	**14 Si**	**15 P**	**16 S**	**17 Cl**	**18 Ar**
Period 4	**19 K**	**20 Ca**						

The Horizontal rows are called **periods.** Elements in the same period have the same number of shell or energy level.
The vertical columns are called **groups.** Elements in the same group have the same number of electrons in their outermost shell. Those outer electrons are also called **valence electrons.** They are the ones involved in chemical bonds with other elements

NOTE:

Group 1 elements are called **alkali metals:** They react readily (very fast) with water, producing metallic oxide and hydrogen gas. These metals become more reactive as you move down the group.
Group 2 elements are called the **alkaline earth metals:**
Group 7 elements are called **halogens**: Fluorine and chlorine are gases. They exist as diatomic molecules that is they have two atoms in each molecule. As you go down the group, halogens become less reactive.
Group 8 elements are called **noble or inert gases**. These elements are unreactive and exist as individual atoms (monoatomic).

Grouping Of The First Twenty Elements Of The Periodic Table Into Metals And Non-Metals.



Metals are element whose atoms donate or give out electron(s) in a chemical reaction. That is, they donate electrons in order to become stable**.** They are found on the left side of the periodic table.

Properties of metals

1. Metals are good conductors of heat.
2. Metals are good conductors of electricity.
3. Metals have high melting point
4. Metals have high density
5. Metals are malleable. They can be beaten into any shape
6. Metals are ductile. They can be drawn into a fine wire
7. Metals have high tensile strength. They resist breakage.

Uses Of metals

1. Gold is used for making ornament and jewellery
2. Mercury is used as a liquid in a thermometer
3. Magnesium is combined with Aluminium to make aircraft bodies
4. Silver is used for making cutlery
5. Iron is used for constructing building, bridges, car bodies and engines

Non-metals are elements whose elements accept electron(s) in a chemical reaction. That is, they gain electrons in order to become stable. They are found on the right-hand side of the periodic table.

Properties of non-metals

- ☑ Non-metals are poor conductors of heat.
- ☑ Non-metals are poor conductors of electricity except Carbon in the form of graphite

- ☑ Non-metals have low melting point.
- ☑ Non-metals have low density.
- ☑ Non-metals are brittle

Uses of non-metals

- ❖ Nitrogen is used in the manufacturing of ammonia.
- ❖ Helium is used to fill balloon.
- ❖ Phosphorus is used to make fertilizer.
- ❖ Chlorine is used in the treatment of water.
- ❖ Oxygen is used for combustion(burning).
- ❖ Argon is used to in fluorescent lamp.
- ❖ Carbon is used as a clue to determine the age of an object.

Some elements have the properties of both metals and non-metals. These elements are called **semi-metals or metalloids**. Examples are Boron and Silicon

STARND 1: DIVERSITY OF MATTER
Sub-Strand 2: Living Cells

Content Standard: B7.1.2.1:

Demonstrate an understanding of the structure of organisms and functions of cells in living systems.

Indicator: B7.1.2.1.1

Describe the structure and function of living cells of an animal.

Structure of Plant and Animal Cells.

A cell is the basic unit of structure and function in a living thing. In other words, a cell is the basic unit of life. Our body is composed of trillions of cells. We have skin cells, muscle cells, nerve cells, blood cells, and many other types as well. Each type of cell has a unique structure and function, but they all share similar characteristics. The similar characteristics include:

1. **All cells are surrounded by a cell membrane:** The cell membrane is a barrier between the inside of the cell and its environment. It also controls the movement of materials into and out of the cell.
2. **All cells contain organelles:** An organelle is a structure inside of a cell that helps the cell perform its functions. Although all cells contain organelles, they don't all contain the same kinds.
3. **All cells contain cytoplasm**: The cytoplasm is a fluid mixture that contains the organelles. It also contains the compounds cells need to survive such as water, salts, enzymes, and other carbon compounds.

4. **All cells contain DNA:** The cell theory states that all cells come from other cells. When cells reproduce, they make copies of their deoxyribonucleic acid (DNA) and pass it on to the new cells. DNA contains the instructions for making new cells and controls all cell functions.

Classifications of cells.

Based on the organization of their structures, all living cells can be classified into two groups: **prokaryotic and eukaryotic**. Animals, plants, fungi, and protozoans all have eukaryotic cells**. Only bacteria** have prokaryotic cells.

Prokaryotic cells: A prokaryotic cell is a cell that does not have a nucleus or membrane-covered organelles. The deoxyribonucleic acid (DNA) in a prokaryotic cell is bunched up in the centre of the cell. The organelles are not covered with a membrane. All prokaryotic cells are much smaller than eukaryotic cells.

Eukaryotic cells: A eukaryotic cell has a nucleus and membrane-covered organelles. There is more DNA in these types of cells and it is found in the nucleus. These cells have membrane-covered organelles. They tend to be about ten times larger than prokaryotic cells.

Some living things are made up of only one cell. These living things are called **unicellular organisms.** Examples are amoeba, euglena, blue green algae, spirogyra and paramecium. Other living things(organisms) are made up of two or more cells. These organisms are called **multicellular organisms.** Examples are humans, dogs, cows, cats, coconut, maize, horse, rabbit, rat, birds, insects, etc.

Structure of Animal Cell

An animal cell usually has an irregular or a round shape. This is primarily due to the absence of **the cell wall**, which is a characteristic feature of plant cells.

The animal cell consists of a **cell membrane, nucleus** and a fluid called **cytoplasm.** The cytoplasm of a cell has many organelles. Other organelles which can be found in the cytoplasm of an animal cell are mitochondrion, vacuole, ribosome, endoplasmic reticulum, Golgi body, lysosome, and cytoskeleton.

An organelle is a structure inside of a cell that helps the cell to perform its functions. Although all cells contain organelles, they don't all contain the same kinds**.**

Observing Cells Under A Microscope

To make cell parts visible under a microscope, you can apply a stain to the cells. A stain is a dye that binds to certain compounds in cells. Some stains bind to proteins while others bind to carbohydrates. Methylene blue is a stain often used to look at animal cells. It binds to proteins and makes the nucleus of the cell stand out. It also makes individual cells stand out by staining the cell membrane.

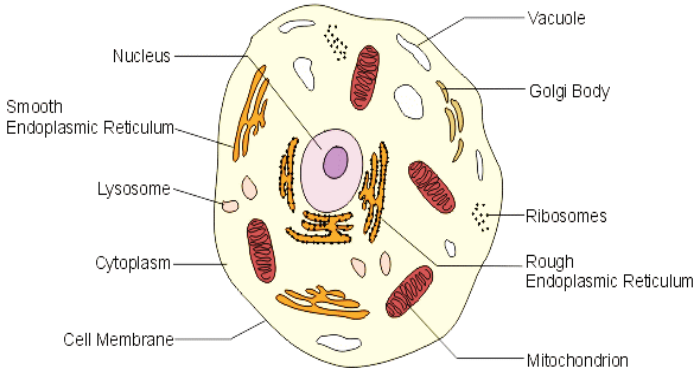
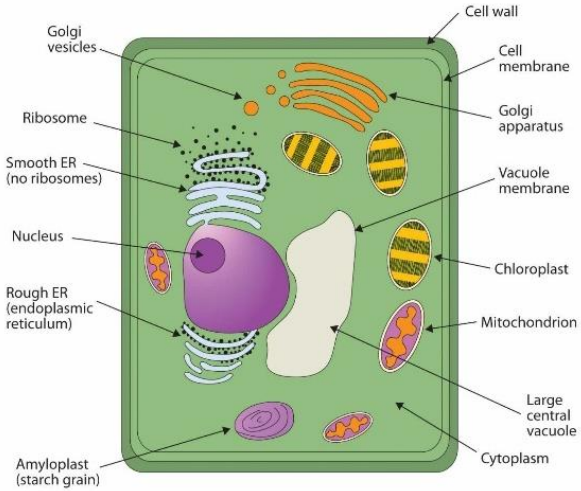


Diagram of an animal cell observed under a microscope

Structure of Plant Cell

Plant cells have definite shape (**rectangular shape)** due to the presence of ***cell wall***, as well as a ***cell membrane.*** The cell wall surrounds the cell membrane. The organelles found in plant cells are cell wall, cell membrane, chloroplast, cytoplasm**,** central vacuole**,** nucleus, mitochondrion.



Indicator: B7.1.2.1.2:

Examine the functions of organelles in a plant cell

Functions of the Organelles Found in Plant and Animal cells.

1. **Cell wall (in plant only):** The cell wall is made of a carbohydrate called **cellulose**. It acts as a barrier to substances moving in and out of the cell. It performs the following functions:

1. It gives definite shape to the cell.
2. It supports and protect the cell.
3. It protects the internal structures from pathogenic attack

2. **The cell membrane:** The cell membrane is a thin layer that separates the inside of the cell from its outside environment.

1. It keeps the cytoplasm inside while letting waste products out.
2. It also lets nutrients into the cell.
3. It is made out of lipids and proteins.

A cell membrane is like your skin. It allows water and other materials pass through and separates your internal parts from the outside environment.

3. **The nucleus (the control centre)**: The most visible organelle in a eukaryotic cell is the nucleus.

The nucleus is covered with a membrane that allows materials to pass in and out. It's often called the "control centre" of the cell because it contains deoxyribonucleic acid (DNA). DNA is the hereditary material that carries all the information on how the cell make proteins.

4. **Nucleolus**: The darker spot in the nucleus seen under a microscope is called the nucleolus. ***It acts as a storage area for materials that are used by other organelles.***

5. **Cytoplasm:** The cytoplasm is present in both plant and animal cells. They are jelly-like substances found between the ***cell membrane*** and the ***nucleus***. They are mainly composed of water, organic and inorganic compounds. The cytoplasm is one of the essential components of the cell, where all the cell organelles are embedded. These organelles contain enzymes, which are ***responsible for controlling all metabolic activities taking place within the cell*** and ***are the site for most of the chemical reactions within the cell.***

6. **Mitochondria** (the powerhouse of the cell)**:**
Mitochondria are called the **"powerhouses"** of ***cells because they produce much of the energy a cell needs to carry out its functions***.
They are rod-shaped organelles surrounded by two membranes. The inner membrane contains many folds**, where chemical reactions take place**.
Mitochondria can only work if they have oxygen. The reason you breathe air is to get enough oxygen for your mitochondria. Cells in active tissues like muscle and liver cells have most mitochondria.
7. **Vacuole (**storage areas of the cell)**:** Vacuole is sac, which contains fluids (watery liquid). The vacuole in plant is found at the centre of the cell whiles in animal cell, it is found around the nucleus in the centre. It performs the following functions.

1. A vacuole is the storage area of the cell. It stores water, food, and waste.
2. Plant cells usually have one large vacuole that stores most of the water they need.

8. **Chloroplast:**
Plant cells have chloroplasts, but animal cells do not. A chloroplast is an organelle that contains a pigment called **chlorophyll.**
Chloroplasts are organelles that convert light energy into chemical energy in the form of molecules. This process is called **photosynthesis.**

9. **Endoplasmic reticulum:** The endoplasmic reticulum (ER) is a tubular network of membranes found within the cytoplasm of eukaryotic cell. There are two types of endoplasmic reticulum namely; rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER). The main differences between RER and SER is the presence of the ribosomes. When ribosomes attach to the surface of an endoplasmic reticulum, it gives it a characteristic of rough appearance hence it is called **rough endoplasmic reticulum** on the other hand a smooth endoplasmic reticulum does not have ribosomes on its surface. ***They are responsible for the production and transportation of protein, fats and other essential molecules required for the functioning of cells.***

10. **Ribosomes:** Ribosomes are little round grains all around the ER. Each of those tiny grains is an individual ribosome. ***Ribosomes are the protein factories of the cell. When ribosomes make proteins, they release them into the ER***.

Some ribosomes are not attached to the ER, but float in the cytoplasm.

11. **Golgi apparatus(bodies)**:

Golgi bodies receive proteins and other compounds from the ER. They package these materials and distribute them to other parts of the cell.

They also release materials outside of the cell. The number and size of Golgi bodies found in a cell depends on the quantity of compounds produced in the cell. The more compounds produced, the more and larger Golgi bodies there are. For example, a large number of Golgi bodies are found in cells that produce digestive enzymes.

12. **Lysosomes:** Lysosomes contains enzymes that break things down to be reused by the cell. Lysosomes pick up foreign invaders such as bacteria, food, and old organelles and break them into small pieces that can be reused.

13. **Cytoskeleton:** Cytoskeleton is a series of protein fibres inside a cell that give structure and shape to the cell.

Difference Between Plant and Animal Cell.

Plant cells	**Animal cell**
i)Plant cells have cellulose cell wall	i) Animal cells do not have cellulose well wall
ii)Plant cells have definite shape	ii) Animal cells do not have a definite shape
iii)Plant cells have chloroplast	iii) Animal cells do not have chloroplast
iv)Plant cells are bigger in size	iv) Animal cells are smaller in size
v)Store food in the form of starch.	v)Store food in the glycogen.

Similarities Between Plant and animal cells

- ☑ They both have cell membrane.
- ☑ They both have nucleus.
- ☑ They both vacuoles.
- ☑ They both mitochondria.
- ☑ They both have cytoplasm.

- ➢ Note that both plant and animal cells are living cells, whiles; batteries are examples of dry cells.

Self-Assessment task

1. In which of the following is cellulose found?
a. Cell membrane b. Cell wall
c. Chloroplast d. Mitochondrion

2.The plant cell wall is made of:
a. glucose b. protein
c. cellulose d. lipids

3. Which of the following structures is present in a plant cell, but absent from an animal cell?
a. Cell Membrane b. Cell Wall
c. Cytoplasm d. Nucleus

4. What cell organelle is responsible for release of energy?
a. Centrioles b. Lysosome
c. Mitochondria d. Ribosome

5. Which of the following is present in all living cells?
a. Cellulose b. Chloroplast
c. Cytoplasm d. Starch

6. The statements below are about the cell membrane of an animal. Which one is NOT correct?
a. It allows certain substances from leaving the cell.
b. It is surrounded by a cellulose cell wall.
c. It prevents certain substances from leaving the cell.
d. It surrounds the cell

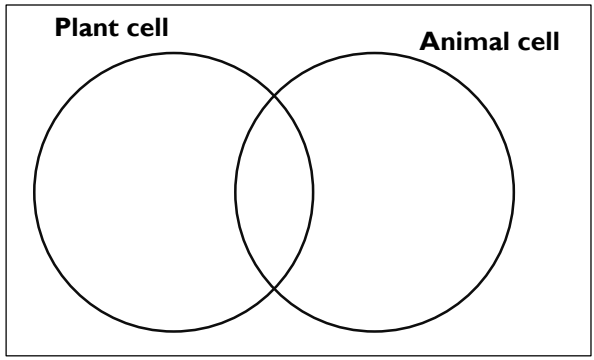
Essay Questions

1. Name the correct organelle for each function in the table below.

Organelle	Function
	Produces much of the energy a cell needs to carry out its functions.
	Makes proteins.
	Controls all activities of the cell and contains the hereditary material
	Packages proteins and distributes them to other parts of the cell

	Let materials pass into or out of the cell
	Stores water, food, and wastes
	Transports proteins inside of the cell

2. A Venn diagram shows how two or more things are similar or different. Place the organelles into the Venn diagram below.
[cell membrane, ribosome, lysosome, vacuole, mitochondria, chloroplast, vacuole, ER, Golgi body, Cytoskeleton]



(b) What do your results tell you about the differences between plant and animal cells?

3. What effect on the function of a cell would occur if one of the following organelles is missing? Write a sentence for each organelle.

(i). ribosome (ii). lysosome (iii). vacuole
(iv). Mitochondria (v)chloroplast (vi) cell membrane

4. Draw a labelled diagram of a plant cell, showing the following parts: cellulose cell wall, cell membrane, cytoplasm, ribosomes, mitochondrion, vacuole, chloroplast and nucleus.

5. In a form of a table, state four differences between plant and animal cells.

STRAND 2: CYCLE
Sub-strand 1: Earth Science

Content Standard: B7.2.1.1:

Recognise that the water cycle is an example of repeated patterns of change in nature and understand how it occurs.

Origin Of Earth Water.

Water is essential to life on Earth. It is one of the conditions that makes life possible on this planet (earth). Scientists have long debated whether the Earth's water was here when the planet formed or whether it arrived later. A study suggests that water ***originated in rocks from which the Earth was built.*** Water is now everywhere on earth. That is, in the clouds, the oceans and rivers, even in our bodies. Earth water is always in movement and this natural process is known as **water cycle or hydrological cycle.**

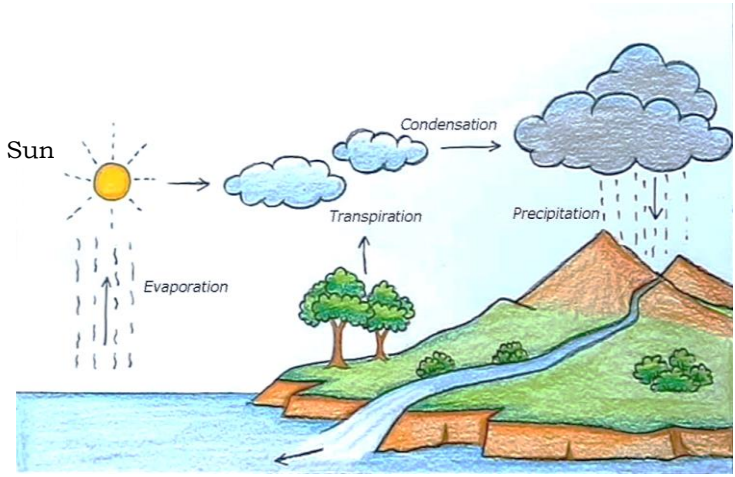
Indicator: B7.2.1.1.1:

Know how water cycle occurs as a repeated pattern in nature.

A cycle is an event that takes place regularly and repeatedly. Water cycle shows the continuous movement of water within the Earth and the atmosphere. It can be defined as the continuous movement of water from the earth's surface to the atmosphere and then back to the ground (earth). Water is always changing states between solid, liquid and gas(vapour) with all these processes happening within a short period of time.

Stages of Water Cycle

A complete water cycle has four stages namely; evaporation, condensation, precipitation and collection.



Stage I: Evaporation. This is the initial stage of water cycle. It is the process by which water in its liquid state changes to vapour, a gaseous state. This occurs when the warmth (heat energy) from the sun causes water from oceans, lakes, streams, ice, and soils to increase in temperature and as a result some of the water evaporates into the air and turn into water vapour(gas) which goes up in the sky. This process include transpiration from plants. The process by which plants lose water to the atmosphere in a form of vapour through their stomata.

Stage II: Condensation. Condensation is the process by which a gas (water vapour) is changed into liquid by loss of heat. As the water vapours rise higher, the cooler temperatures make them cool down and turn back into liquid. Wind and air current move the moisture around, leading to the formation of clouds and fog.

Stage III: Precipitation. Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the earth with the help of gravity in the form of rain, hail, sleet or snow.

Stage IV: Collection. The precipitation either runs off into water bodies such as oceans, rivers, lakes, and even on the ground which in turns becomes part of the groundwater. After this stage, water is evaporated again and resume stage I. This shows how water cycle has been going on for millions of years, thus bringing fresh water to people, animals, and plants, helping them to survive on earth.

What will happen if there were no water cycle?
If there were no water cycle, lakes, rivers, and underground water source would dry up. All freshwater resources would be negatively affected, and life on Earth would completely cease.
The lack of water would make it impossible to grow crops for food. The leaves of plants will fall because of lack of water in the soil. The plants will in the end die. The death of plants would mark the end of photosynthesis, halting the steady production of oxygen and consumption of excess atmospheric carbon dioxide.
No plant life would also mean the destruction of all food chains, as photosynthesizing plant form the nutritional backbone for vast majority of life. Carbon dioxide content in the atmosphere would continue to increase. Air would become less breathable, making it poisonous or harmful.
The increase in carbon dioxide would also magnify the greenhouse effect, causing the climate to change rapidly for the worse. More

infrared radiation would be trapped in the atmosphere, temperature around the globe would continue to rise making life on earth unbearable.

Indicator(s): B7.2.1.1.2

Describe the importance of the water cycle in nature.

- ☑ Provision of clean water: Water cycle make freshwater available in a form of rain.
- ☑ Water cycle keeps the amount of water on the earth's surface constant:

Water removed from the earth during evaporation and transpiration condense and return to the earth in a form of rain and snow.

- ☑ Carrier of nutrients: As water moves through and across the soil, it carries valuable nutrients.
- ☑ Improving water table.
- ☑ Regulating weather pattern.

STRAND 2: CYCLE
Sub-Strand 2: Life Cycle of Life Organisms

Content Standard: B7.2.2.1:

Demonstrate The Skills Of Carrying Out Activities To Show The Stages Of The Life Cycle Of Housefly, Effects Of Its Activities On Humans And How To Reduce Them.

Indicator: B7.2.2.1.1:

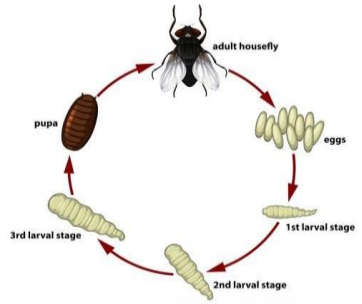
Describe the life cycle of the housefly

The housefly, ***Musca domestica*** is the most common fly species in our homes. It lives in close association with people all over the world. The insect feed on human foodstuffs and wastes where they can pick up and transport various disease agents.

Developmental Stages of Housefly

There are four distinct stages in the life of a housefly. They are

1. Egg (Female lay eggs).
2. larva or maggot (Egg hatches to give larva (**maggot).**
3. Pupa (Maggot transform into pupa)
4. Adult (Adult emerges from pupa).



Egg stage: The female housefly lays its white eggs singly into mass on organic material such as manure and garbage. Hatching occurs within a few hours.

Larva stage: After hatching, the young larvae burrow(dig) into a breeding matter where they obtain oxygen from the atmosphere. They only survive in places where sufficient fresh air is available. When the breeding medium is very wet, they can live on its surface only, whereas in drier medium they penetrate to a depth of several centimetres. The larvae are **slender or slim, white, legless maggots with broad back and a narrow head.** They develop rapidly by passing through three instars. The time needed for development varies from minimum of three days to several weeks depending on the species, temperature, the type and quantity of food available. After the feeding stage is completed the larvae migrate to a drier place and burrow into the soil or hide under objects offering protection and and transform to the pupal stage.

Pupa stage: They form a dark maroon capsule-like case called the **puparium,** within which the transformation from larva to pupa takes place. This usually takes 2–10 days, at the end of which the fly pushes open the top of the case and works its way out and up to a surface.

Adult stage: Soon after emergence the housefly spreads its wings and the body dries and hardens. The adult fly is grey, 6–9mm long and has four dark stripes running lengthwise on the back. After a few days the adult housefly is capable of reproduction.

How housefly feeds

Both male and female flies feed on all kinds of foods including; feeding on dead animals, rotten food, garbage and excreta, including sweat, and on animal dung, manure, solid and liquid wastes**.**

NOTE: Under natural conditions flies seek a wide variety of food substances because of the structure of their mouthparts, food must be either in the liquid state or slightly moist form.
Liquid food is sucked up and solid food is wetted with saliva, to be dissolved before ingestion.
Water is an essential part of a fly's diet and flies do not ordinarily live more than 48 hours without access to it.
Other common sources of food are milk, sugar, syrup, blood, meat broth and many other materials found in human settlements.

Indicator: B7.2.2.1.2:
Discuss the activities of the housefly as a menace on humans and show how to reduce the activities e.g. feeding, reproduction and any other.

How the Activities of The Housefly Affect Humans

The activities of housefly affect humans in the following ways;
1.**Transfer of pathogens:** The flies pick-up disease-causing organisms(pathogens) while crawling and feeding on filthy matters. Transmission takes place when the fly contacts people or their food. The diseases that houseflies can transmit include:
(a) **enteric infections:** An infection caused by microorganism such as viruses, bacteria, and parasites that cause intestinal illness. These diseases mostly result from consuming contaminated food or dinking contaminated water. Examples include dysentery, diarrhoea, typhoid, cholera, etc.
(b) **eye infections** such as trachoma and epidemic conjunctivitis.
(c) **skin infections** such as yaws, and leprosy.
2. **Food poisoning:** Food poisoning is the illness resulting from eating contaminated food. Most of the diseases are contracted through eating contaminated food and drinking contaminated water. Examples nausea, vomiting, diarrhoea, headache, mild fever, abdominal cramps, etc.
3. **Nuisance in the environment:** A large numbers of flies can be very annoying because they disturb people at work and at their leisure time. Flies soil the inside and outside of houses with their faeces. They can also have a negative psychological impact because their presence is considered a sign of unhygienic conditions

How to reduce the activities of housefly
Below are four strategies that can be employed to reduce the activities of houseflies:

1. Reduction or elimination of flies breeding sites
2. Reduction of sources that attract flies from other areas.

3. Prevention of contact between flies and disease-causing germs
4. Protection of food, eating utensils and people from coming into contact with flies

STRAND 2: CYCLE
Sub-Strand 3: Crop Production

Content Standard: B7.2.3.1:

Demonstrate An Understanding Of The Different Plant Nutrients (Organic, And Inorganic Fertilizers) And Their Application In School Farming.

Crop production is one of the major divisions of agriculture that deals with the production of most staple food that humans rely on for their sustenance. It also involves the production of crops which are used as animal feed and those which are exported for foreign exchange. Examples of crops cultivated in Ghana include are cassava, maize, rice, millet, wheat, sugarcane, tobacco, cotton, jute, oilseeds, coffee, coconut, tea, rubber, fruits and vegetables. All plants need nutrients to grow and survive.

Indicator: B7.2.3.1.1:
Observe and list all plant nutrients sources available in a community and categorise them into organic and inorganic nutrient sources.

Nutrient is a substance used by an organism to grow, survive and reproduce. Plant nutrients are usually applied to the soil to;
(i) increase the nutrient content in the soil.
(ii) replace the nutrient lost from the soil as a result of erosion, leaching, bush burning, overgrazing, over cropping, etc. Plant nutrients can be grouped into two based on their sources. They are

1.Organic or natural nutrients: They are nutrients obtained from plants and animals. They are natural and therefore not made artificially in chemical industries.
Examples are compost, green manure, farm droppings, fish meal, treated human excreta, etc.
Compost: It is decayed matter of plant and animal sources that have been heaped together for some time.

Compost

cow dung

2.Inorganic nutrients:
These are nutrients synthesized artificially in the laboratory using chemical substances. E.g. NPK, fertilizer.

Fertilizers: They are substances which are applied to the soil or plant to supply nutrients for plant growth.

Types of fertilizers
There are two types of fertilizers namely; organic fertilizers and inorganic fertilizers.
1.Organic fertilizers.
They are fertilizers obtained from plants and animal sources. They are natural and therefore not made artificially in chemical industries. Examples are compost, green manure, farm droppings, fish meal, human excreta, etc.

2.Inorganic fertilizers
They are fertilizers or chemical substances synthesized from inorganic substances by using chemical procedures or processes. Examples are NPK, Urea, Sulphate of ammonia, Muriate of potash.
Types of Inorganic Fertilizers
There two types of inorganic fertilizers namely; straight or single fertilizer and compound fertilizers.

Straight/Simple/Single fertilizer: These are fertilizers consisting of only one of the major plant nutrients. The nutrient may be ***Nitrogen (N) or Phosphorous(P) or Potassium(K).*** Examples: Muriate of potash, Sodium nitrate, urea and ammonium sulphate**.**

Compound or Mixed fertilizers
These are fertilizers that are made up of two or more major plant nutrients present in their appropriate percentages. Examples: NPK 15:15:15, NPK 20:20:20 and NPK 10:20:10.

Indicator B7.2.3.1.2:

Describe the physical characteristics of different plant nutrients (organic and inorganic) and how each is applied to plants in the field.

Characteristics Of organic fertilizers.

1. Organic nutrients are made up of different plant residue.
2. Organic fertilizers have no effect on soil microorganisms.
3. They are rich in humus.
4. They are bulky.
5. They improve the structure of the soil.
6. They improve soil aeration.
7. Protect the soil against wind and water erosion.

Characteristics of Inorganic fertilizers.

1. They usually contain few nutrients-nitrogen, phosphorus, potassium and sometimes micronutrients either singly or in a combined form.
2. They do not improve the structure of the soil.
3. They do not check erosion.

Methods of fertilizer application

Fertilizer comes in different forms. There is liquid, powder, and granular fertilizers. Liquid fertilizers are often diluted with water and sprayed in a similar way as watering crops. Powdered fertilizers also need water to be productive. Granular fertilizers can easily be spread on top of the soil. The method used in the application of granular fertilizer include:

1.Broadcasting: It is the application of fertilizer uniformly over a piece of land either by hand or by machine before planting or at the time of planting.

2.Drilling: It is the application of fertilizer into holes close to seeds at the time of sowing.

3.Ringing: It is when fertilizers are placed in a circular way around a plant so that it is equidistant from the plant.

4.Side dressing: This involves applying fertilizers at the sides of a crop's base**.**

Effects of Nutrient Deficiency in Crop Production

1. Low yield of crops.
2. Poor quality of harvested crops.
3. Crops become susceptible to diseases.
4. Loss of market value of crops.

Differences between Organic fertilizers and Inorganic fertilizers

Organic fertilizers	**Inorganic fertilizers**
1.They are cheap	1.They are expensive to buy
2. Improve soil structure and texture	2.Do not improve the structure of the soil.
3.Absorbs and hold water	3.They cannot absorb or hold water
4.Not easy to control the amount of nutrients added.	4.Easy to control the amount of specific nutrient added.
5.They help to check soil erosion.	5.Do not help to check erosion.

STRAND 2: CYCLE
Sub-Strand 4: Animal Production

Content Standard: B7.2.4.1

Demonstrate understanding of the differences among domestic animals such as ruminants, monogastric and poultry (monogastric herbivore).

Indicator: B7.2.4.1.1: Examine and list domestic animals in the community

There are many animals around us. Some animals are found in our homes and in the forest. They have different shapes, colours, sizes and ways of feeding. Animals that live with us in our homes or communities are called **domestic animals**. Examples are **cow, sheep, hens, goats, ducks,** etc. These animals give us meat, eggs, milk, leather and fur etc. Animals in the forest or the jungle are called **wild animals**. They find their own food, shelter, water, and

all other needs. Examples include lions, tigers, leopard, wild dog, etc. Some animals feed on only plants (herbivores). Some also feed on the flesh of other animals (carnivores). There are also some animals that feed on both plants and on flesh of other animals (omnivores).

Animals can be classified according to the type of stomach they have. Animals with a simple, one- chamber stomach are called non-ruminant or monogastric animals. Examples of monogastric herbivore include pigs, rabbits, horses, and hamsters. Other animals or mammals like cattle, sheep, goats, deer, antelope, giraffes, and camels have stomach which have four chambers (rumen, reticulum, omasum and abomasum) and they are called ruminants.

The word ruminant is derived from the Latin word "ruminare" which means to ***chew again.*** Ruminants bring up food from their stomach to chew more thoroughly when they are resting. This habitat is known as **chewing the cud.** Cud-chewing is an adaptation that enables many hoofed mammals (ruminants) to break down the cellulose of plant cell walls into nutrients before they can absorb them.

Characteristics /Features of domestic Aanimals.

i. They grow and mature quickly, making them efficient to farm.
ii. They eat plant-based diet, which makes them inexpensive to feed.
iii. They breed easily in captivity and undergo multiple periods of fertility in a single year.

Indicator: B7.2.4.1.2: Show the differences among domestic animals

Difference between Among Domestic Animals

(Considering sheep and goats).

Both sheep and goats are domestic animals. The table below gives some differences between sheep and goats.

Sheep	Goats
1. The tail of sheep usually hangs down	1. The tail of goats usually points up.
2. They are grazers. They ramble slowly eating short	2. They are browsers. They look for leaves, twigs, vines, and

plants close to the ground.	shrubs
3. Sheep don't have beard	3. Some goats have beard
4. Sheep have upper lip that is divided by distinct philtrum	4. Goats don't have philtrum.
5. Sheep have thick and curved horns.	5. Goats have narrow and straight horns.

Indicator: B7.2.4.1.3 Show similarities among domestic animals.
The following are some of the similarities between sheep and goats

i. Both are domestic animals.
ii. Both are ruminants.
iii. Both have horns.

What will happen if there are no animals?
If there are no animals, there will be lack of carbon dioxide which is required by plants for photosynthesis**.** If plants are unable to prepare their food due to lack of carbon dioxide, they will die, resulting in lack of oxygen. Humans beings will also die because of lack of oxygen.

Indicators: B7.2.4.2.1: Discuss and write the domestic and commercial uses of different types of animals.

Domestic species are raised for food, work, clothing, medicine and many other uses. Domestic animals help humans in many ways. For example;

1. Cows and goats give us milk and meat.
2. Cattle also help in the ploughing of the field.
3. Animals are used to do physical work like carrying things.
4. Cattle and sheep are kept for their wool, skins, meat and milk.

Commercial uses of animals.
Leather from cattle, pigs, and other species is widely used to make shoes, handbags, belts, and many other items.

Self-Assessment Task
Match the list of the following animals in column A against the list of animal products in column B.

Column A	**Column B**
Hen	(a) honey
Bees	(b) musk
Silkworm	(c) egg

Silkworm	(d) wool
Sheep	(e) silk
	(f) Keratin
	(g)stearicacid

1. Explain the following terms
    a. ruminants
    b. non-ruminants
    c. monogastric herbivores
2.Give two examples of animals classified as i). ruminants, ii). monogastric, and iii). monogastric herbivores
3.Explain what will happen if there are no animals.
4. Write three uses of domestic animals
5. Describe domestic uses of; i) Ruminants ii) Monogastric

STRAND 3: SYSTEMS.
Sub-Strand 1: The Human Body System

Content Standard: B7.3.1.1 Show An Understanding Of The Concept Of Food, The Process Of Digestion And Appreciate Its Importance In Humans.

Indicator: B7.3.1.1.1 Explain the concept of food and the needs for humans to eat.

Food is any substance, solid or liquid which provides the body with materials for

- heat and energy
- growth and repair
- regulation of body processes such as metabolic activities examples excretion, respiration, reproduction, nutrition and movement.

These food substances include; cassava, bread, meat, milk, yam, plantain, eggs, ground nut, butter, salmon, sardine, vegetables, orange, “kontomire”, beans, etc. The useful materials that food provide to the body are known as **nutrients**.

Classification of nutrients

All the different kinds of foods that we eat can be classified into the following on the bases of the type of nutrient they contain:

i. Carbohydrates (starch and sugar)
ii. Protein
iii. Mineral salts
iv. Fats and oils
v. Vitamins

Importance of food to human.

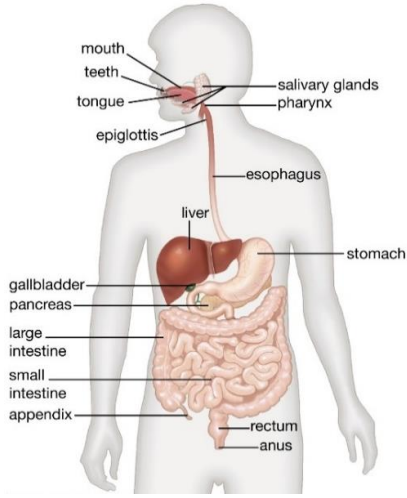
- **i.** Food helps the body to acquire energy.
- **ii.** Food helps the body to grow and develop.
- iii. Food helps the body to maintain and repair worn out tissue.
- iv. Food helps to protect the body against diseases**.**

The Processes of Digestion

After feeding or eating, the food has to be broken down into simpler forms that can be absorbed into the bloodstream. For example, the rice you take into your body is carbohydrate; the human system does not need the rice or carbohydrate to function. The end product of carbohydrate is glucose. The human system needs this glucose to perform its function. The process by which carbohydrate (rice) changes to glucose or protein changes to amino acids is known as **digestion**.

What is digestion?

Digestion is the breakdown of food into smaller components which can easily be absorbed and assimilated into the body. Digestion of food begins in the *mouth* and ends in *the small intestine.* The organ that carry out these processes is called the **digestive system.** The human digestive system consists of the ***gastrointestinal tract*** *plus* ***the accessory organs of digestion.*** The main organs of the digestive systems are: ***the mouth, gullet, stomach, small intestine, large intestine, rectum and anus.*** The accessory organs of digestion are ***liver, pancreas and gallbladder.***



Digestive System in Humans

Functions of the organs of the digestive system.

Mouth: The mouth is the beginning of the digestive tract. It contains teeth and tongue. The teeth breakdown(chew) the food into smaller pieces. During the process of chewing, saliva is produced in the mouth by the **salivary amylase**. The saliva moistens the food and make it slippery for easier to swallow. The tongue also rolls the chewed food in a form of a ball before it is swallowed. Digestion of carbohydrate food starts in the mouth. The food gets into the stomach through the **oesophagus.** The oesophagus is a muscular tube through which food passes before it gets into the stomach. The oesophagus contracts and relaxes as it pushes the food along and this process is called ***peristalsis.***

Stomach: The stomach is a pear-shaped structure in which food is mixed with hydrochloric acid and other digestive juices. Muscles in the wall of the stomach squeeze the food and mix it up. The hydrochloric acid and other digestive juices perform three main functions during digestion. These are:

The hydrochloric acid stops the function of the ptyalin in the stomach. Starch do not continue digestion in the stomach.

The acid in the stomach helps to kill bacteria that are in the food.

It contains an enzyme called **pepsin** that breaks down ***proteins*** into ***smaller peptides.*** From the stomach, the food then moves into the first part of the small intestine called the ***duodenum***

Duodenum: In the duodenum more digestive juices are produced, bile produced by the ***liver,*** and pancreatic juice released by the ***pancreas*** are released to continue digestion. The pancreas is located behind the stomach, produces a juice containing several enzymes that break down carbohydrates, fats and oil and proteins. They are:

Pancreatic amylase: This breaks down starch and converts it to maltose.

Pancreatic lipase: This breaks fat and oil, it converts it to fatty acid and glycerol. In the duodenum, bile is also produced here from the liver. This bile aids the digestion of the lipids in the small intestine. The fat and oil are broken down into tiny droplets for easy digestion.

Small intestine *(Ileum*): It is located between the stomach and the large intestine. Here, the walls also release intestinal juice containing various enzymes which completes the digestion process. Digestion ends in the ***small intestines*** and the end-products are absorbed through its walls into the body.

Large intestine(colon): After absorption of the end product of digestion, any water left in the food is absorbed into the body, and then what is left of the food goes to the rectum to be stored as faeces for some time and passed out of the body through the anus.

The end products of digestion of various food substances are as follows:

1. Carbohydrates → **glucose**
2. Proteins → **amino acids**
3. Fats and oils → **fatty acids and glycerol**.

Uses of the End Products of Digestion

1.Glucose

1. It is the common source of energy for cells
2. Glucose is used for respiration to release energy for the plant cells to use.

2.Fatty acids and glycerol

It is a source of energy to the body.

3.Amino acids

They are important for every metabolic process.
It is used in the production of drugs

The Role of the Liver in Digestion

1. It produces bile. This bile helps in the digestion of fats and oil in the small intestine.
2. It also processes the nutrients absorbed from the small intestine

Egestion of Undigested Food

Egestion is the discharge of undigested food from the body through the anus. During digestion, all the wanted parts (nutrients) of the food are absorbed. The unwanted parts (faeces) must also be brought out from the body. The large intestine is made up of rectum and colon. The rectum connects the colon to the anus. The rectum receives the faeces from the colon. It holds the faeces for some period of time. The faeces leave the body through an opening at the end of the alimentary canal called the **anus**.

How the End-Products Are Absorbed into the Blood Stream.

The nutrients obtained from digestion are absorbed by the body. The use of these absorbed end-products of digestion by the body (cells, tissues and organs) is known as **assimilation**. The nutrients enter the blood stream through diffusion. This is done by the villus which is a small, finger-like projections that extends into the lumen of the small intestine. The villus helps in the absorption in

the small intestine. It has a thin wall, one cell thick which helps in the absorption of fatty acids and glycerol into the blood stream.

Uses of the end-products of digestion.

Glucose provide our body cells with energy. Cells need energy for growth, movement of muscles, for the transport of certain materials and also to keep the body warm.

Fatty acids and glycerol provide energy for the cell. It protects vital organs of the body. Examples eye, heart and skin.

Amino acids are used for growth and repair of worn out tissues, to form proteins (including enzymes and hormones), and to build new substances or other tissues.

Self-Assessment Task

Circle the most appropriate of each of the options.

1. What is the digestive system?
   A. The body's blood-transporting system.
   B. The body's breathing system.
   C. The body's food-processing system.
   D. The body's system nerves.

2. Digestion begins in the mouth. Which of the following statement is INCORRECT?
   A. The digestive juices can react more easily with the food when chewed.
   B. The saliva changes some of the starches in the food to sugar.
   C. The tongue aids in the digestion of the food.
   D. The tongue keeps the food in place in the mouth while the food is being chewed.

3. Where does food pass through between the mouth and the stomach?
   A. The gullet
   B. The large intestine
   C. The rectum
   D. The small intestine

4. What happens when food reaches the stomach?
   A. Juices mix with the food and the stomach muscles squeeze it.
   B. Nothing. No digestion occurs in the stomach.
   C. The food is completely digested and is absorbed by tiny blood vessels in the walls of the stomach.
   D. The food moves quickly into the small intestine.

5. Where does the partly-digested food (in liquid form) go after it leaves the stomach?

A. The appendix
B. The gullet
C. The large intestine
D. The small intestine

6. How does digested food finally reach the bloodstream?

A. It is absorbed into the blood through blood vessels.
B. It is absorbed into the blood through the walls of the lungs.
C. It passes from the small intestine into the large intestine, then into the blood.
D. It passes through the gullet into the blood.

7. The digestive system processes food into usable and unusable material. The usable materials are sent to the body's cells as food. What happens to unusable materials?

A. It goes into the large intestine to await disposal.
B. It goes into the pancreas to await disposal.
C. It goes into the small intestine to await disposal.
D. It goes to the right ventricle to await disposal.

8. Digestion takes place in a long tube-like canal called the alimentary canal, or the digest tract. Food travels through these organs in the following order:

A. Mouth, gullet, stomach, small intestine, large intestine and rectum;
B. Mouth, oesophagus, stomach, large intestine, small intestine and rectum;
C. Mouth, stomach, gullet, small intestine, large intestine and rectum;
D. Mouth, stomach, oesophagus, small intestine, large intestine and rectum.

9. Which of the following does **NOT** manufacture digestive juices?

A. Kidneys
B. Liver
C. Pancreas
D. Stomach

10. The liver is located in the abdomen and performs many functions. Which of the following is **NOT** a function of the liver?

A. Healing itself when it is damaged
B. Manufacturing insulin
C. Producing digestive juices

D. Storing food

ESSAY QUESTION.

Write a short essay on following questions.

1.Describe what happens to a meal of 'gari' and beans mixed with palm oil as it travels from the mouth to the anus.

2.State the uses of the end products of digestion in the body of mammals.

Describe how you can mould and design the digestive system using locally available materials from the environment.

3a) What is the end product of each of the following food substances: Carbohydrate, protein and fats and oils.

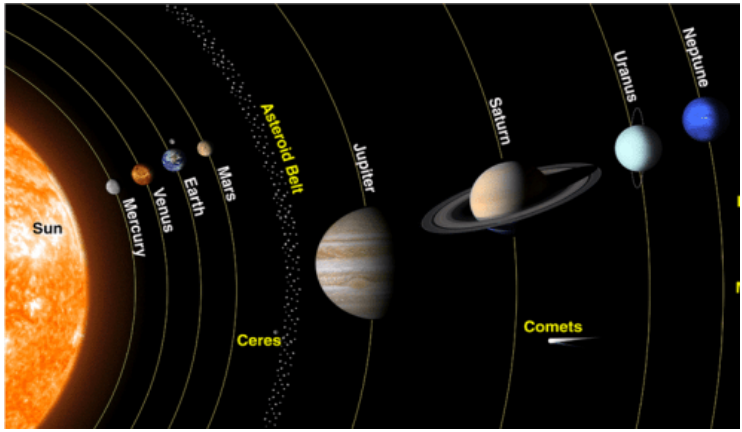
3b) State one use of each of the end products to humans.

4. Give one function each of the following organs of the digestion system: i. Mouth ii. Liver iii. Stomach iv. Small intestine

STAND 3: SYSTEMS
Sub-Strand 2: Solar System

Content Standard: B7.3.2.1 Know The Inner Planets Of The Solar System And Understand Their Movement In The System.

The solar system is made up of the ***sun, the eight planets, the moon, and other heavenly bodies such as comets, asteroids, meteors and meteoroids.*** The eight planets revolving around the sun in sequence are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. These planets rotate around the sun in an elliptical orbit/path. There is an **asteroid belt** between Mars and Jupiter. It serves as a dividing line between the inner rocky planets and other gas giants.



The solar system

Indicator: B7.3.2.1.1: Identify the inner planets of the solar system and describe their properties**.**

The Four Inner Planets
The four inner planets are **Mercury**, **Venus**, **Earth** and **Mars.** They are made of **rocks**.

Mercury: Mercury is the closest planets to the Sun. The temperature on it is too high to support life. It takes 88days to orbit the Sun.

Venus: Venus is the second planet from the Sun. It is surrounded by an atmosphere of thick gases that traps heat from the Sun, so it is even hotter than Mercury. The distance between the Sun and Venus is **108 million km**. It takes **225 days** to orbit the Sun.

Earth: It is the third planet from the sun**.** The Earth is planet we live on. The distance from the Sun to the Earth is **150 million km**. It takes **365 quarter days** to orbit the Sun. It is the **only** planet that has the ability support/sustain life because of;
1.the presence of oxygen
2. the presence of water
3. suitable temperature
4.the presence of the ozone layer that protect plants and animals including humans from the harmful ultra-violet rays from the sun.

Mars: Mars has a reddish, rocky surface and is sometimes called the **red planet**. It is the second smallest planet in the solar system after Mercury.

Features of the inner planets
1. All the inner planets are made of rocks.
2. The inner planets do not have rings around them.
3. They do not have moon around them.
4. The inner planets have shorter orbits around the Sun, so they spin very fast.

STRAND 3: SYSTEMS
Sub-Strand 3: Ecosystem

Content Standard: B7.3.3.1

Recognise the components and their interdependence in an ecosystem and appreciate their interactions.

Indicator: B7.3.3.1.1: Analyse the components of ecosystems and identify the interactions within.

Ecology is the study of relationships between organisms and their physical surroundings. This includes how organisms interact with each other and how organisms interact with their physical environment. The environment of an organism refers to everything that surrounds the organism.

Some Key Ecology Terms to Know
Within the scientific study of ecology, here are a few important terms to know:
Population: A population refers the total number of a particular species living in a habitat. **Community:** A community refers to all of the populations of different species that live in a particular habitat.
Ecosystem: An ecosystem is defined as the interactions between living and non-living things in a given area.

Components of An Ecosystem.
An ecosystem can be split into two main components namely: biotic components and abiotic components or factors.
Biotic factors refer to living organisms in a particular environment. These could be things like: trees, grass, animals, fungi, bacteria, etc.

Abiotic factors are the non-living components of the environment that living things need for their survival. These include: air, water, light, wind, soil, temperature, rock and sunlight. Both biotic and abiotic factors are important components of ecosystem as they can affect how organisms live in certain environments.

Air: All living things require oxygen for respiration. Without respiration, they cannot utilize food to produce energy. Air contains 21% oxygen, which is released by green plants during photosynthesis. Carbon dioxide, which forms 0.03% of air, is used as a raw material for photosynthesis.

Water: We all need water to live. About three –fourth parts of the earth's surface are covered with water. About 70% of our body weight is due to water. Plants would dry if they did not get water.

Sunlight: Plants use light to prepare their food. Animals and human beings depend on plants for their food. Thus, the life of all organisms is made possible because of sunlight. Therefore, light is an important abiotic component.

Soil: The soil is the basic medium for growth in plants. Some animals and microorganisms also live in the soil. Soil also provides necessary minerals like sodium, potassium, calcium, phosphorus, and water. Animals such as earthworm and snail also make the soil loose by turning it.

Temperature: The temperature of a place determines the type of animals or plants that live there.

Interactions Between Abiotic and Biotic Factors
Living organisms adapt to their abiotic environment to survive. Mammals in cold environments need thick fur to stay warm.

1. Reptiles sit on hot rocks in the sunlight to warm their bodies.

2. Animals such as termites, ants and rabbits dig or burrow in the ground for shelter.

3. One of the most critical interactions in an ecosystem between the biotic and abiotic environment is photosynthesis. Plants and algae use sunlight, water and carbon dioxide to create the energy they need to grow and live via photosynthesis. An important by-

product of photosynthesis is oxygen; which animals need to breathe.

4. Plants and algae also absorb the essential vitamins and minerals they need to live from their environment.
Animals eat plants and algae and absorb these vitamins and minerals. Predators eat other animals and obtain the energy and nutrients from them. This is how nutrients are cycle from the abiotic environment through the biotic world.

NOTE: Within an ecosystem, there are three different categories of organisms namely; producers, consumers and decomposers.
Producers are organisms(plants) that prepare their own food to obtain energy through photosynthesis.
Consumers are organisms that eat other organisms for their energy.
Decomposers are organisms that break down dead plants and animals and return nutrients to the soil.

Interdependence of Living Organisms in The Ecosystem.
Living organisms may not be of the same species but can still dependent on each other for their survival. It is important to understand the interdependence of organisms within the ecosystem in order to obtain a clearer understanding of biological life.
1. Food chains involve producers, consumers and decomposers. Without the producers, the consumers would not be able to obtain their food. Without the consumers, the decomposers would not be able to return the nutrients to the ecosystem. Without the decomposers, the producers would not have the needed nutrients to facilitate the process of growth.
2. Snakes rely on the leaves and ground coloration to camouflage themselves from predators.
3. Animals use plants as a form of shelter within their environment. For example, many birds reside within nests on the trees. They build their nests from twigs and sticks.
4. Plants are stationary organisms; their fruits and seeds are dispersed by natural elements, such as wind and animals. For example, the seeds of some plants can become attached to the fur of animals. When the animals move from one location to another, the seeds become deposited in that new location.
5. Some animals are herbivores, so they need to eat plants in order to survive. Carnivores eat meat in order to survive. Omnivores eat both plants and animals.

Interactions Between Organisms

There are four main types of species interactions that occur between organisms in an ecosystem:

1.**Predation** (parasitism and herbivory): In these interactions, one organism benefits while the other is negatively affected. Red fox and hare interactions is an excellent example of predator-prey dynamics. The hares consume grasses, then the red foxes predate the hares. The grasses are negatively impacted by the hares while the hares benefit by getting a meal. Foxes then benefit by eating the hares.

•**Parasitism** is a relationship in which one organism is helped while the other is harmed. An example is the tape worm. The tape worm obtains its nutrients while residing within the host, while the host is harmed because the tape worm absorbs all of the nutrients.

2.**Competition**: Both organisms are negatively affected in some way due to their interactions.

3.**Commensalism**: In this interaction one organism benefits while the other is neither harmed nor gains. Commensalism examples are more difficult as it is hard to prove whether the other animal benefits or is negatively impacted. For example, Remora fish ride other fish and sharks and then eat their leftover food. The sharks and large fish are said not to be affected by the presence of the Remora as they ride them and then eat the leftover food. This interaction would be classed as competitive if Remora fought their hosts for food instead of waiting until they were finished.

4.**Mutualism:** Both organisms benefit from their interactions. Plants with bird or butterfly pollinators are good examples of mutualistic interactions. Plants benefit by having their flowers pollinated so they can reproduce. The butterflies and birds also benefit as they get nectar from the plant. Another example is the ants and the acacia tree which form a symbiotic relationship of mutualism. The ants benefit by living in the acacia tree, and the tree benefits when the ants consume the insects that eat the leaves of the trees.

HABITAT

A habitat is the natural dwelling place of an organism. This is where the organism meets its basic need for its survival: food, water, shelter from the weather and place to breed its young ones. The geographical features and environmental conditions on earth

differ from one place to another. Some areas of the earth are mountains while others are covered by water. We also find snow, desert, forest, grassland, pond, rivers and lakes. There are many organisms that live in extreme environmental conditions.

Types of Habitat

There are two main types of habitats. These are

- ☑ Aquatic(water) habitats
- ☑ Terrestrial (land) habitats

1.Aquatic habitat: This refers to water as the natural dwelling place of an organism. The water bodies like rivers, lakes, seas, oceans. The organisms that live in water are aquatic animals. It is mainly of three kinds: freshwater, marine, coastal and estuarine

Freshwater habitat: This refers to salt free water as the natural dwelling place of an organism. Examples of salt free water habitats include; rivers, lakes, ponds, and streams. Fish, frog, duck, lotus, and water lily are found in fresh water.

Marine water habitat: This refers to salty water as the natural dwelling place of an organism. Oceans and seas form the largest marine habitat on the planet. Some commonly found organisms are whale, dolphins, sharks, octopus, starfish, jellyfish, seahorse, herrings, tuna, seaweeds.

Coastal habitat: Coastal habitat refers to the region where the land meets the sea.

Estuaries: These places where the saline water of sea or ocean mixes with the fresh water of rivers. It is the home of marine animals like crab, oyster, worms, and waterfowl. Mangroves seaweeds and marsh grasses are plants found here.

NB: A fish that survives in sea water cannot survive in fresh water because it will absorb so much water into its body and die. In the same way, freshwater fish cannot live in sea water because it will get dehydrated.

2.Terrestrial habitat: This refers to the land as the natural home of an organism. Examples of terrestrial habitats include rainforest, grassland, dessert and arboreal.

Forest habitat: Forest is a large area covered with plants. Forest covers about one-third of our planet. Most of the different types of plants and animals have the forest as their habitat. Examples of plants and animals found in the forest.

Plants: Orchid, vine, moss, and fern.

Animals: snakes, birds, bat, gorilla, monkey, sloth, macaw, and variety of insects.

2. Grassland habitat: Grassland is regions dominated by grasses. There are too many trees and shrubs here. Temperature ranges between-20 degree and -30 degree. The annual rainfall varies between 50 cm and 90 cm. Some animals commonly in this habitat are giraffe, deer, zebra, lion, elephant, etc.

3.Dessert Habitat: Deserts are areas that receive very little rainfall less than 25 cm rains annually. Organisms such as cactus, camel, rat and kangaroo are found here. Plants found here include**;** grass, corms, shrubs, rhizomes, and small trees.

4.Arboreal habitats: This refers to the places in trees where organisms are able to live and feed. These habitats include the root of trees, canopies of rainforest, the branches of delicious and coniferous trees and even holes within the tree. Examples of such animals include lizards, woodpeckers, squirrel chameleons, green tree pythons, tree snails, parrots, monkeys, cats, sloth and a variety of insects.

ADAPTATION

The soil and climatic conditions on land are different in different parts of the earth. It is necessary for organisms to adjust to the conditions and environment they live in. The special characteristics possessed by plants and animals that enable them to successfully survive in a particular environment is called **adaptation.**

Adaptations of Aquatic Habitats

Plants:

i. These plants have long, narrow stems. This prevents the plants from being carried away with the water current.
ii. Stems have air chambers that allow the aquatic plants to float in water leaves of plants such as lotus and water lily have a waxy coating that prevents them from rotting.

Animals:

i. Ducks have webbed feet that help them in swimming. They also have hollow bones that help them to stay afloat.
ii. Gills are special organs that help fish to breath underwater.
iii. They have streamlined body which allows them to swim fast by reducing resistance due to flowing water.
iv. Dolphins and whale have blowholes at the upper parts of their heads. They come to the water surface and breathe in air through the blowholes from time to time.

Adaptation of Forest habitat

Plants: The following adaptation is shown by rainforest plants:
Leaves of tropical rainforest trees have specialized tips.
Due to the dense vegetation of rainforest, very little light is able to reach the forest floor. Plants growing in lower levels have big leaves to absorb as much sunlight as possible.

Animals: There is a huge variety of animals in rain forests. Many animals have adapted by learning to eat a particular food, which is eaten by no other animals.

Adaptation of Boreal Forests

Plants:

i. Trees have a conical shape that allows the snow to slide off easily.
ii. Trees have needle-like leaves. This kind of structure protects the leaves from damage.

Animals:

i. Many animals migrate to warmer regions during winter. Some animals hibernate during winter months.
ii. Some animals have a thick layer of fur or feather to protect them from cold.

Adaptation of Grasslands

Plants:

i. Grassland plants usually have flexible stems that bend instead of breaking when the wind is strong.
ii. Plants have strong roots that prevent winds from uprooting them.
iii. Plants have narrow or tiny leaves to reduce water loss.
iv. Some plants have roots that extend deep into the soil to absorb as much water as possible.

Animals:

i. Most grassland animals are able to run very fast. This ability also protects them grassland fire.
ii. Many grassland animals have skin shades of brown that makes them hard to spot among the dry, brown grass.

Adaptation of Deserts habitats

Plants:

i. The leaves are modified as spines to minimize water loss.
ii. The stem is green, to make food for the plant.
iii. The stem is swollen and fleshy to store water.

iv. Cactus plant has a thick, waxy coating that prevents water loss and helps it to retain water.

Animals:

i. Desert animals have thick skin to prevent the loss of water from the body.
ii. Most of the desert animals have the capacity to store water and food. For example, a camel can tolerate extremely hot temperature due to the stored water in its body, which helps in cooling.
iii. Most of the small desert animals live in burrows to save themselves from fluctuation in temperature.
iv. Reptiles are well-suited to the desert climates. They get most of the water through their food and lose hardly any moisture from their skin.

Adaptation and Acclimatization

Adaptation refers to change in an organism over a long period of time. There are certain changes that can occur in an organism over a short period of time, which help the organisms adjust to the changes in its surrounding. This is ***acclimatization.***

STRAND 3: SYSTEMS
Sub-Strand 4: Farming System

Content Standard: B7.3.4.1

Demonstrate an understanding of the differences among the various farming systems: land rotation, crop rotation, mixed cropping, mixed farming, and organic farming.

Indicator: B7.3.4.1.1 Examine and discuss the differences among the various farming systems.

Farming system is used to describe an enterprise which may be entirely animal- based, crop-based or a mixture of the two. The different types of farming systems practiced in Ghana include:

1. Shifting cultivation
2. Land Rotation
3. Crop Rotation
4. Mixed Cropping
5. Mixed Farming
6. Organic Farming.

Shifting cultivation. This is a system of farming in which the farmer cultivates a piece of land for some time, the land when it loses its fertility together with his settlement. The farmer may come back to cultivate the old land later.

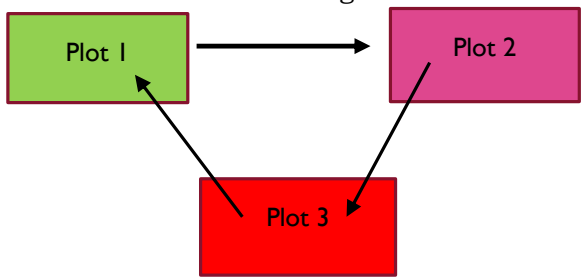
Advantages of Shifting cultivation

1. Land previously used is allowed to fallow so as regain its fertility.
2. Farmer spends little or nothing in improving the soil fertility.
3. The farmer could grow crops on any new land he moves to.

Disadvantages of Shifting cultivation

1. Due to increasing population and resultant pressure on land, this system is difficult to practice.
2. The would always have to move or relocate his household.
3. This type of farming system is expensive because of the constant clearing of new land.
4. Erosion can start on abandoned soil.
5. It destroys the natural forest
6. Yield is very low because farm inputs which improve yields are not used.

Land rotation. This is a system of farming in which a farmer cultivates a piece of land for some time and leaves it to clear a new land when the old land becomes less fertile. The farmer moves to the new land without moving his settlement.



Advantages of Land rotation

1. The land regains its fertility after the fallow period.
2. Disease build up is reduced.
3. Pest attack is reduced.

4. It is a cheaper method of farming because of the use of simple farm tools.

Disadvantages of land rotation

1. It destroys the virgin forest.
2. Land rotation cannot be practiced in areas where the land is scarce.
3. Commercial production is discouraged.

Crop rotation is the practice of growing a series of dissimilar or different types of crops in the same area in sequenced seasons.

Three-year crop rotational programme

Year	Plot		
	1	2	3
1	Yam	Cowpea	Maize
2	Maize	Yam	Cowpea
3	Cowpea	Maize	Yam

Advantages of crop rotation

1. There is reduction of total crop failure
2. Soil fertility is maintained because of the inclusion of leguminous plants
3. Crop rotation controls soil erosion.
4. It breaks pest cycle
5. It breaks disease cycle
6. It ensures effective use of labour.

Disadvantages of crop rotation

1. Special skill is required in carrying out this type of farming system.
2. Cultural practices are difficult to carry out on the same piece of land because different crops are involved.

Differences between Land rotation and Crop rotation.

Land rotation	Crop rotation
1.Crops are grown in a random manner	1.Crops are grown in a definite order or cycle.
2.Crops are cultivated on different pieces of land.	2. crops are cultivated on the same piece of land.

3.The inclusion of legumes is not necessary.	3. legumes must be included

Mixed cropping, also known as ***inter-cropping or co-cultivation,*** is a type of farming that involves planting two or more of plants(crops) simultaneously in the same field.

Advantages of mixed cropping

1. Different crops may be harvested at different times. This helps the farmer to get food over a long period.
2. Since different crops are grown, pests and diseases may not spread easily.
3. Where cover crops or legumes are grown, they soil fertility.

Disadvantages of mixed cropping.

1. The crops may compete for nutrients, water, light and space for survival.
2. Different fertilizers may be needed in some cases, for different crops. This could increase the cost of production.
3. Mechanization is difficult.
4. Improper spacing may lead to shading of other crops.

Mixed farming is the cultivation of crops along with rearing of animals for meat or milk on the same farm.

Advantages of mixed farming.

1. The is regular supply of food for the farmer and his family.
2. The fertility of the soil is improved by the use of farm yard manure.
3. There is no need for the farmer to shift to a new piece of land since there is less likelihood of low soil fertility.
4. Plant matter may be used to feed animals while animal dung or droppings may also be used to fertilize crops field. This reduces the cost of production since less feed is purchased for animals while the soil is also fertilized with manure from animals.

Disadvantages of mixed farming.

1. The farmer may have divided attention for keeping both crops and animals.
2. It requires a lot of skills in managing crops and animals.
3. Animals usually destroy crops when they are not well confined.

Difference between mixed cropping and mixed farming.

Mixed cropping	Mixed farming
Two or more different crops are grown the same piece of land.	Crops and animals are raised on the same piece of land.

Organic farming is defined as production of crop, animal, and other products without the use of synthetic chemical fertilizers and pesticides, transgenic species, or antibiotics and growth-enhancing steroids, or other chemicals.

Advantages of organic farming.

i. Organic produce attracts high price in foreign markets.
ii. Food produced are free from harmful chemicals.
iii. Organic farming is labour intensive.
iv. Organic farming cannot be used to produce food on large scale.

Indicator: B7.3.4.1.3 Importance of farming systems

1. Farming system serves as a source of lively-hood.
2. It provides employment opportunities.
3. It contributes to the development of the economy.
4. It provides industries with raw materials to the such cocoa, rubber, cotton, tobacco, etc.

STRAND 4: FORCES AND ENERGY
Sub-Strand 1: Energy

Content Standard: B7.4.1.1:

Demonstrate an understanding of forms of energy and their daily applications.

Indicator: B7.4.1.1.1 Identify the various forms of energy and show how they are related.

Energy is the ability or the capacity to do work. It is measured in joules (J). The following are some forms of energy:

i. Mechanical energy (potential and kinetic energy)
ii. Chemical energy
iii. Light energy
iv. Sound energy
v. Nuclear energy
vi. Electrical energy

vii. Thermal energy
viii. Solar energy

Mechanical Energy: It is the energy that a body has due to its position or its states of motion. There are two forms of mechanical energy: These are potential and kinetic energy. Mechanical energy = kinetic energy (KE.) + potential energy (PE.).

Potential energy: Potential energy (PE) is calculated by using the formula mass (m) x acceleration due to gravity(g) x height (h) of the object.

Factors that affect potential energy:

1. Objects of larger masses have greater potential energy than objects of smaller masses
2. The higher the acceleration due to gravity, the greater the potential energy and vice versa.
3. The higher the height of an object, the greater the potential energy and vice versa.

Kinetic energy: Kinetic energy is the energy that a body has by virtue of its motion. It is calculated by using the formula, (K.E) = $1/2 \times mv^2$

Factors that affect kinetic energy:

1.The greater the mass of an object the greater the kinetic energy and vice versa.

2.The higher the velocity of the object, the greater the kinetic energy and vice versa.

Self-Assessment Task

1. A body of mass 14.0 kg is placed on an orange tree 17.0m above the ground. Calculate its potential energy with respect to the ground. [g = $10m/s^2$].

Answers:

Given that; mass of the of object, (m) = 14kg, height (h) of the tree = 17m acceleration due to gravity, g = $10m/s^2$

Potential energy ((P.E) = m x g x h

= 14kg x 10m/s2 x 17m

= 2380J

2.The potential energy of a body 5 m above the ground is 200 J. Calculate the mass of the body if g = 10 m/s^2.

ANSWER:

Potential energy (P.E) = 200J height (h) = 5m g= 10m/s^2
mass(m) =?

Mass(m) = P.E / g x h

= 200/ 10 x 5

= 200/ 50

= 4kg

The mass of the body = 4kg.

3.The body of mass 5 kg has a potential energy of 400 J. Calculate the height of the body above the ground if g = 10 m/s^2

Answers:

Mass(m)= 5Kg, Potential energy ((P.E) = 400J, g=10m/s^2 height (h) =? height (h) = P. E / m x g

h = 400J / 5 x 10

h = 400/ 50

h = 8m

The height of the body above the ground is 8m

4.Three objects X, Y and Z with masses 30 kg, 55 kg and 27 kg respectively are placed on top of a building of height 35 m from the ground. State with reasons, which of the objects:

Has the least potential energy?

Has the greatest potential energy?

Will have the greatest kinetic energy when rolled to fall?

Answers:

Mass of object X, m (X) =30kg, mass of object Y, m(Y) = 55kg, mass of object Z, m(Z) = 27kg

The height of all the three objects from the ground (h) =35m.

Object Z has the least potential energy because it has the least mass. The smaller the mass of an object the smaller its potential energy.

Potential energy for Z = 27kg x 10m/s2 x 35m

= 9,450J

Object Y has the greatest potential energy because it has the greatest mass. The greater the mass of an object the greater its potential energy.

Potential energy for Y = 55kg x 10m/s2 x 35m

= 19,250J

Object Y will have the greatest kinetic energy when rolled because it has the greatest mass. The greater the mass of an object the greater the kinetic energy and vice versa.

Chemical energy: Chemical energy is energy stored in the bonds of chemical compounds (atoms and molecules). Chemical energy is released in a chemical reaction, often in the form of heat.

Electrical Energy: Electrical energy is the energy carried by moving electrons in an electric conductor. Other forms of energy are also converted to electrical energy.

Thermal energy: Thermal energy is the energy a substance or system has related to its temperature, that is, the energy of moving or vibrating molecules.

Nuclear energy: Nuclear energy is the energy that is trapped inside an atom. Nuclear energy can be produced either by the fusion (combining atoms) or fission (splitting of atoms) process. The fission process is the widely used method. Uranium is the key raw material. Uranium is mined from many places around the world. **Indicator: B7.4.1.1.2** Explain daily application of forms of energy.
Energy is now part of our human life. Almost everything we do requires energy ranging from preparing food to doing work to even just relaxing at home watching TV, listening to music, playing computer games, etc. Here are a few more examples of how we use energy in our daily lives.

Applications/ Uses Of Light Energy
Light energy is a source of electromagnetic radiation that is visible to the human eye. However, there are several industrial and science applications of light energy, some of them are:
1. Food: Light is the only source of food generation for all living thigs. Every organism depends on light for their energy and food except for few chemotrophic species such as bacteria.

2. Vision: Many living organisms are able to see things around them due to the presence of the eye, which could be useless

without light. Our eyes create an image as light falls on them and this information goes to the brain. This light energy helps us to see things around us.

3. Health: The sunlight also provides vitamin D which help in increasing bone strength.

4. Colours: The world is so colourful and all these colours are possible because of the sunlight. The light consists of several spectra, and each spectrum has a specific colour. That is ROYGBIV-Red, Orange, Yellow, Green, Blue, Indigo and Violet.

5. Electronics: Solar panels use the sunlight to store light energy and convert it into electrical energy. This electrical energy is applicable for domestic purposes as it eco-friendly and cost - effective.

Applications/ Uses Of Kinetic Energy

1. Hydropower plant: Hydropower plants are places where generation of electricity takes place with the help of moving water. The moving water possess kinetic energy which hits the turbine present in the dam. The kinetic energy of the water gets converted into mechanical energy. This mechanical energy moves the turbines and then ultimately, it leads to the production of electricity.

2. Wind mills: In a wind mill, when the wind (air in motion) hits the blades, it causes the blade to rotates which leads to the generation of electricity. The moving air has kinetic energy that causes the rotation of the blades. The kinetic energy is converted into mechanical energy.

3. Moving car: Moving car possess some amount of kinetic energy. This is because they have mass and velocity.

4. Bullet from a gun: A bullet from a gun has very high kinetic energy. This makes it possible to penetrate many objects. The penetration is possible because the high amount of velocity possessed by the bullet. Although the mass of the bullet is small, its high-speed double the amount of kinetic energy.

5. Walking and running: When walking or running, we possess some amount of kinetic energy. That is why we feel warm while running or after walking some distance. While walking or running there is a conversion of chemical energy into kinetic energy.

6. Cycling: A moving bicycles possess kinetic energy. The mechanism behind it is that when we start pedalling, we are converting our bodies into mechanical form, which was initially the potential energy. The potential energy is converted into kinetic energy due to the motion of the wheels. In order to stop the

bicycle, we need to apply the brakes, opposite to the force in order to decelerate the bike and get back to zero energy.

Applications/ Uses Of Nuclear Energy

Nuclear energy is widely used because it improves air quality by producing huge amount of carbon-free electricity. It has several uses, not only in the creation of power and weapons but also for medicine, space exploration, food treatments, etc.

1. Electricity: Nuclear fission is widely used to generate electricity using the power created during the reaction. This is done in nuclear power plant, where uranium is spilt within a reactor. The energy created is used to heat water to spin turbines. The spinning turbines produce electricity. Nuclear power is generally reliable and less costly.

2. Nuclear weapons: Nuclear is used to create atomic and hydrogen bombs which are capable of demolishing large areas in seconds. The explosion can create toxic levels of radiation. A very powerful explosion is created when both nuclear fission and fusion are used.

3. Space exploration: Nuclear energy is used in generators to for exploring deep space.

4. Nuclear medicine: Some byproducts created during nuclear fission reaction are necessary for the field of medicine. For instance, cobalt-60 can be used to sanitize hospitals equipment like implants, catheters and scalpels as well as complex medical devices and other technology. It can also be used in medical radiotherapy for cancer treatment.

5. Food treatments: Nuclear energy technologies are also used to test foods to ensure that there are no contaminants in them.

Thermal Energy.

1. Thermal energy is used for cook food
2. Thermal energy is used to generate electricity.

Self-Assessment Task

Read the following questions carefully and circle the correct option.

1.What type of energy does the SUN give?

a. Electrical b. Mechanicall

c. Solar d. Sound

2.What kind of energy do stereos have?

a. Nuclear b. Mechanical

c. Thermal d. Sound

3.What type of energy do flashlights start with?

a. Chemical b. Electrical

c. Solar d. Sound

4. What energy do plants have?

a. Chemical b. Nuclear

c. Mechanical d. Thermal

5.What energy do you have when you eat?

a. Chemical b. Kinetic

c. Potential d. Sound

6. What type of energy do missiles have?

a. Chemical b. Nuclear

c. Sound d. Thermal

7. What energy does fire have?

a. Chemical b. Kinetic

c. Nuclear d. Thermal

8. Using the pedals on your bike is what type of energy?

a. Chemical b. Nuclear

c. Mechanical d. Radiant

9.Light bulbs show off what type of energy?

a. Chemical b. Electrical

c. Radiant d. Sound

10. During the day the sun gives off what?

a. Chemical b. Radiant

c. Sound d. Thermal

11. What are the two categories that form mechanical energy?

a. Light and Gravity b. Light and Kinetic

c. Potential and Kinetic d. Potential and Light

Classify the following as a type of potential energy or kinetic energy by writing (K or P) at the end of each statement.

A bicyclist pedalling up a hill_____

An archer with his bow drawn _____

A volleyball player spiking a ball_____

A baseball thrown to second base _____

Walking down the street _____

Sitting in the top of a tree _____

ESSAY QUESTIONS

1. A helicopter drops a 25 kg bag of rice from rest at a height of 120 m from the ground.

How much initial potential energy is stored by the bag of rice?

What is the kinetic energy of the bag of rice just before it hits the ground?

2.Three objects X, Y and Z with masses 60 kg, 55 kg and 27 kg respectively are placed on top of a building of height 40 m from the ground. State with reasons, which of the objects
have the least potential energy?
have the greatest potential energy?
will have the greatest kinetic energy when rolled to fall?

STRAND 4: FORCES AND ENERGY
Sub-Strand 1: Energy

Content Standard: B7.4.1.2

Demonstrate an understanding of the concept of heat transfer and its applications in life.

Indicator: B7.4.1.2.1: Explain and demonstrate how heat is transferred in various media.

Transfer of heat energy

When an object is heated, it becomes hot. The heat in it can be transferred from one place to another. This process is known as **heat transfer**. Heat transfer is the method by which heat energy moves through different media. There are three modes of heat transfer:

1. **Conduction:** Conduction is the transfer of heat energy through solids.
2. **Convection:** Convection is the transfer of heat energy through fluids (liquids and gases).

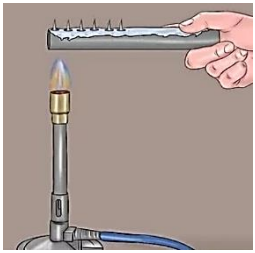
3. **Radiation:** Radiation is the transfer of heat energy through empty space(vacuum)

Experiment to demonstrate the conduction of heat

Materials needed: metal objects **(iron** rod), retort stand, drawing pins, shea butter or candle wax, ruler, and Bunsen burner

Procedure:

1. Clamp the metal rod horizontally as shown in the diagram below.
2. Use melted candle wax or shear butter to attach the drawing pins at equal intervals on the rod.
3. Leave the wax or shear butter to cool.
4. Heat the other end of the rod with the Bunsen burner
5. Observe and record the time taken for each of the drawing pins to fall off the rod.



Observation: It was observed that after sometime, the drawing pins begins to fall off from the rod. The pins closest to the heat source fell off first, because the heat reached the wax holding it first before the second and the third pin. This happens because the heated molecules gain energy and vibrate vigorously. They pass on the vibrations to molecules near them which result in the spread of heat through the solid. The particles of the solid do not move from one place to another.

Conclusion: The fall off of the drawing pins shows that conduction has taken place as heat is being transferred from a region of high temperature to a region of lower temperature.

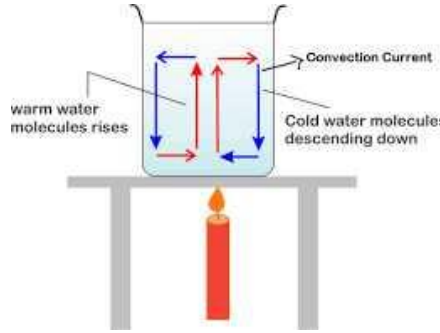
Convection: Convection is the process by which heat energy is transmitted in a fluid (liquids and gases) by the actual movement of heated molecules. Land and sea breeze are formed due to convection. It also plays an important role in ventilation, functioning of air conditioners and refrigerators.

Experiment To Demonstrate Convection In A Liquid

Materials needed: Beaker, Water, tripod stand and Bunsen burner

Procedure:

1. Half-fill the beaker with water
2. Place the beaker on the tripod stand
3. Heat the beaker at the base and closely observe the movement of the convection current in the beaker.



Observation: From the figure above you can clearly see convection current. When the water was heated the molecules nearest to the source gain energy and move faster leading to fluid expansion. The heated molecules become lighter and moves upwards. As heated molecules of the water move upwards, the denser and colder molecules begin to move downwards. This means that the warm water rises and the colder molecules of water descend.

Conclusion: The upward and downward movements of the convection current shows that convection has taken place.

Radiation: Radiation is the process by which heat energy is transferred through a vacuum (empty space). Heat from the sun is transmitted to the earth by radiation. Radiation can also take place through transparent materials such as glass and air. In radiation, heat is transmitted in a form of wave. It does not require any material medium. For example, if you bring your hand near a lighted candle, you feel the heat from the candle. The heat is not transferred to your hand by conduction, because air is a good insulator and does not conduct heat. The heat didn't reach the hands by convection, because convection occurs in fluids.

STRAND 4: FORCES AND ENERGY
Sub-Strand 1: Energy

Content Standard: B7.4.1.3:

Demonstrate an understanding of characteristics of light, such as travelling in a straight line, reflection, refraction and dispersion.

Indicator: B7.4.1.3.1 Demonstrate how light travels in a straight line

Light Energy.
Light is a form of energy that makes vision possible. Light is an important source of energy. Without light, we will not be able to see.

Types of light Energy
Light energy is of various forms. They are

1. Visible light: This light can only be seen through the naked eye. It is a form of electromagnetic energy. The source of visible light is the sun. It can also emit from lanterns, flashlight, light bulbs, etc.

2. Infrared light: This is a form of electromagnetic energy that produce heat. TV remotes use infrared light. They travel from the remote to the TV.

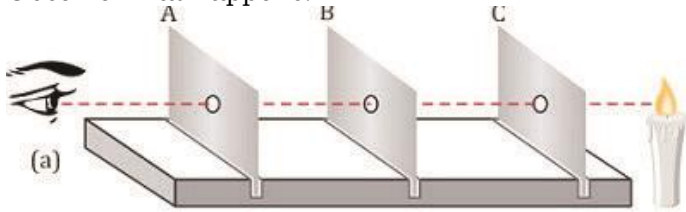
3. X ray and Ultraviolet light: They are short light waves used by doctors to capture images within our bodies and spot fractures in our bones. Also, dentist use x-ray to monitor the extent of the deterioration of the teeth.

Properties of light

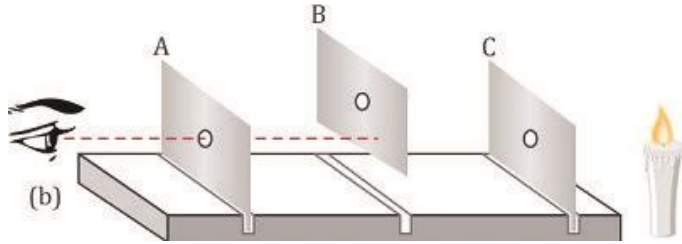
i. Light travels in a straight line.
ii. Light can be reflected from shiny surfaces.
iii. Light traveling in straight line can bend as it moves through different media (refraction).
iv. Light can be dispersed into different colours (dispersion).

Experiment to show that light travels in a straight line
Materials needed: Three (3) Cardboards, source of light, string/thread, glass prism, stick, flashlight
Procedure:
1. Arrange the three card boards A, B, and C with a hole in their centres in a straight line by passing a string:

2. Through the holes, as in diagram (**a)** below.
3. Remove the string.
4. Place the source of light behind the first cardboard.
Observe what happens.



In the diagram (a) above, the observer can see the candlelight through the holes made on the cardboards A, B and C.
6. Displace the cardboard **B** slightly so that the card boards are no longer in a straight line as in diagram (**b**) below.



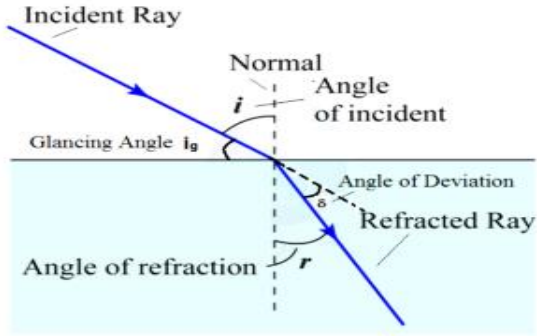
6.Observe what happens
When cardboard B is shifted, the observer can no longer see the candlelight as before. Examine the figure below.

Discussion: The light can be seen through the third cardboard when the cardboards were in line. However, upon shifting one of the cardboards slightly, the light is cut off from reaching the observer behind the third cardboard (C).

Conclusion: This shows that light travels in a straight line.

Refraction of light
Refraction is the change in direction or bending of light when it travels from one medium to another due the difference in the speed of light in the two media. This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows. Even our eyes depend upon this bending of light. Without refraction, we wouldn't be able to focus light onto our retina. Refraction of light occurs when light travels from a less dense medium to a denser medium and vice versa.

The boundary that separate the two media is called the **refracting surface**.

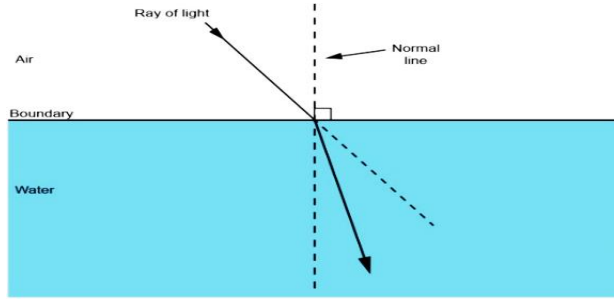


Terms Associated with Refraction.

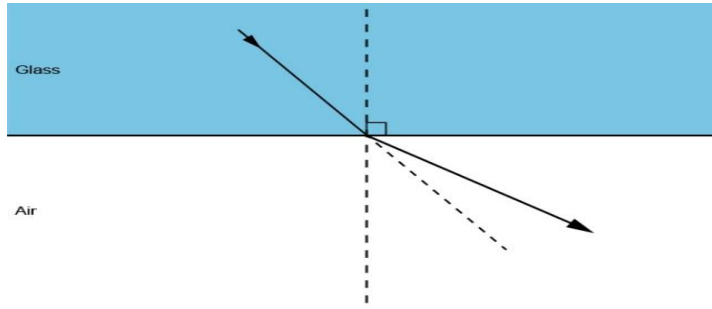
1. **Incident ray:** The incident ray is the ray which falls on the surface of separation to enter into the new medium.
2. **Refracted ray:** The refracted ray is the ray in the second medium, obtained after refraction.
3. **Normal:** The normal is an imaginary straight line perpendicular to the refracting surface at the point of refraction.
4. **Angle of incidence (i):** The angle of incidence is the angle between the incident ray and the normal.
5. **Angle of refraction (r):** The angle of refraction is the angle between the refracted ray and the normal.
6. **Glancing angle(Ig):** The glancing angle is the angle between the ray of the incident and the plane surface.

All angles are measured from an imaginary line drawn at 90° to the surface of the two substances. This line is drawn with dotted lines and it is called the **normal.**

If light enters any substance with a higher refractive index (such as from air into glass) it slows down. The light bends towards the normal.



If light enters into a substance with a lower refractive index (such as from glass or water into air) it speeds up. The light bends away from the normal line.



A higher refractive index shows that light will slow down and change direction more as it enters the substance.

Dispersion Of Light

Dispersion is the separation of white light into its components colours when it passes through a medium (glass or water).

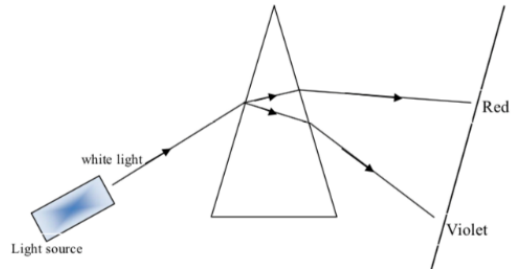
White light is simply the light from the sun, stars, torchlight, and electric lamps. White light is made up of seven colours namely; ***red, orange, yellow, green, blue, indigo, and violet*** (ROYGBIV). These different colours forming white light can be seen in a rainbow or when a white light passes through a prism (a triangular block of glass or plastic).

Experiment to demonstrate dispersion of light using triangular prism.

Materials needed: Triangular prism, an arrow beam of light, a screen

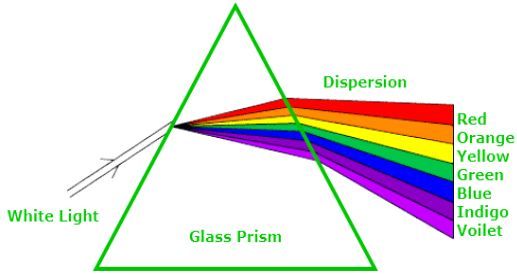
Procedure:

1. Set up the experiment as shown in the diagram below.
2. Switch on your light source
3. Regulate the position of the light source until a clear and sharp image of the components of light is seen on the screen.



Experimental Setup for investigating the dispersion of white light.

Observation: All the components of white colours are seen on the screen as shown below.



Conclusion: Dispersion of white light has occurred.

NOTE:

- When the white colours pass through a prism, it is refracted or bent as it leaves the prism.
- Each colour of the spectrum of the white light is refracted at different amount due to the speed at which each colour travels in a media (air, water and glass)
- The colour that refract most is **violet** and the colour that refracts least is **red**

Self-Assessment Task.

1.Describe a simple experiment to demonstrate that light travels in a straight line.

2.Draw a labelled diagram to show dispersion of light through a triangular glass prism and explain what accounts for the position of the different colours.

3.Explain the difference between reflection, refraction, and dispersion.

4.Use a ray diagram to show the path of light travelling from air into water.

SRAND 4: FORCES AND ENERGY
Sub-Strand 2: Electricity and Electronics.

Content Standard: B7.4.2.1

Demonstrate understanding of forms of electricity, its generation and effects on the environment.

Indicator: B7.4.2.1.1:
Describe the various forms of electricity generation

Electricity generation is the process of converting some form of energy into electrical energy. Thermal and nuclear energy can be used to produce electricity.

Thermal Energy: Thermal energy is a form of energy that is associated with heat. All objects are made up of tiny particles called molecules. In cold things, like ice cubes, the molecules move very slowly. In hot things, like a hot drink, the molecules move very fast. The faster the molecules are moving inside an object, the hotter the object will be. Therefore, hot objects are objects which have high thermal energy.

How Thermal Energy is Generated
Thermal Energy is a key source of electricity. Thermal energy can be produced from fossil fuels such as crude oil and gas. In Ghana the Aboadze Thermal Plant uses crude oil and gas to generate electricity.

Nuclear Energy: Nuclear energy is the type of energy which is produced from atoms of various elements through chemical reactions. Scientists have learnt to capture energy from the atoms of some elements which can be used to generate electricity**.**

How Nuclear Energy is Generated
When an atom is split a huge amount of energy is released. This energy is used to generate electricity for industries and homes. This takes place at nuclear power plants. At the nuclear power plant, the heat from the nuclear reaction is used to create steam from water which in turns powers electrical generators.

Indicator: B7.4.2.1.2 Explain the impact of electricity generation on the environment

Almost all part of the electricity system affects the environment and the size of these impact will depend on how and where the

electricity is generated. In general, the environmental effect includes:

1. Emission of greenhouse gases and other pollutants, especially when a fuel is burnt.
2. Discharge of pollutants into water bodies, including thermal pollution, which makes water hotter than the original temperature of the water body.
3. Generation of solid waste, which may include hazardous waste.
4. Lands used for fuel production, power generation, and transmission and distribution lines.
5. Effects on plants, animals and ecosystem that result from the air, water, waste and land.

Self-Assessment Task.

1.Briefly distinguish between nuclear and thermal energy.
2.Write any two applications of thermal energy.
3.Describe how nuclear energy is generated in your own words.

STRAND 4: FORCES AND ENERGY
Sub-Strand 2: Electricity and Electronics

Content Standard: B7.4.2.2
Demonstrate knowledge of how to assemble and explain the functions of basic electronic components and their interdependence in an electronic circuit.

Indicator: B7.4.2.2.1 Demonstrate how to assemble basic electronic components.

Electronic Components

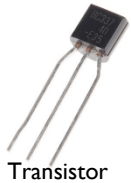
There are many different components that make up electronic circuits. The common components include the following:


capacitor


Diode


LED


Resistor


Transistor


switch


IC


capacitor

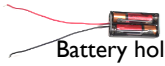
Relay


Inductor


Connecting wire


Battery


Alligator clips/Test leads


Battery holder

Electronic Circuits

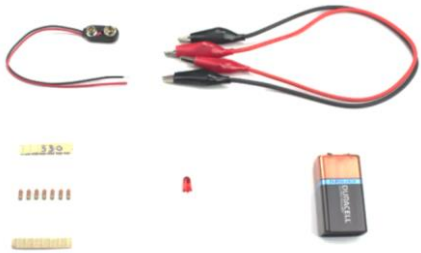
What is an electronic circuit?

An electronic circuit is the path through which electrical current flows. An electronic circuit is composed of individual components, such as battery, transistor, capacitor, inductors, light emitting diode (LED) and diodes, which are connected by conducting wires, through which electric current flows. A closed circuit is like a circle because it starts and ends at the same point forming a complete loop or circle. A closed circuit allows electricity to flow from the (+) power to the (-) ground uninterrupted. A circuit is open is there is a break in the flow of electricity/current.

All circuits need to have three basic components. These components are a voltage source, conductive path and a load. The voltage source, such as a battery, is needed in order to cause the current to flow through the circuit. In addition, there needs to be a conductive path that provides a route for the electricity to flow. Finally, a proper circuit needs a load that consumes the power.

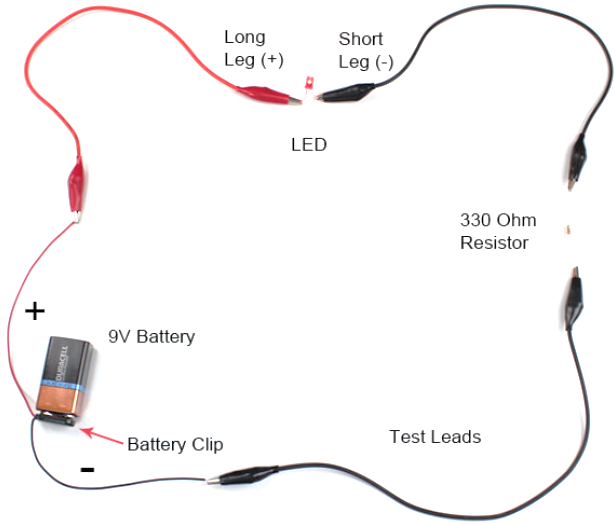
Assembling Components To Test LED

Components Needed: 9V Battery, Battery Snap-on Connector, Test Leads w/ Alligator Clips, 330 Ohm Resistor, LED – Basic Red 5mm



Steps:

1. Attach the battery clip to the top of the 9V battery.
2. Red wire from the battery clip is connected to one alligator clip on the red test lead.
3. The other end of the red test lead is connected to the long leg (+) of the LED.
4. Connect one alligator clip from black test lead to the short leg (-) of the LED.
5. The other end of the black test lead is clipped to one leg of the 330 Ω resistor.
6. Clip one side of the other black test lead to the other leg of the 330 Ω resistor.
7. The opposite end of the black test lead is connected to the black battery wire.



NOTE: Never connect an LED directly to a 9V battery without a resistor in the circuit. Doing so will damage/destroy the LED. You can however connect an LED to a 3V or smaller battery without a resistor.

Indicator: B7.4.2.2.2:
Discuss the function of each electronic component and their interdependence with each other.

Switch: Switches can come in many forms such as pushbutton, rocker, momentary and others. The switch it is used to either open or close a circuit. A close circuit provides a complete path for the flow of electric current. When a circuit is opened, a break is created so that current does not flow through the circuit.

Resistor: Resistors are used to regulate the flow of current of circuit. The amount of resistance that a resistor offers is measured in Ohms. Most resistors have coloured stripes on the outside and this code will tell you it's value of resistance

Variable Resistor (Potentiometer): A variable resistor is also known as a potentiometer. These components can be found in devices such as a light dimmer or volume control for a radio. When you turn the shaft of a potentiometer the resistance changes in the circuit.

Light-Dependent Resistor (LDR): A light-dependent resistor is also a variable resistor but is controlled by the light versus turning a knob. The resistance in the circuit changes with the intensity of the light. These are often found in exterior lights that automatically turn on at dusk and off at dawn.

Capacitor: Capacitors store electricity and then discharges it back into the circuit when there is a drop in voltage. A capacitor is like a rechargeable battery and can be charged and then discharged. The value is measured in F (Farad), nano Farad (nF) or pico Farad (pF) range.

Diode: A diode allows electricity to flow in one direction and blocks it from flowing the opposite way. The diode's primary role is to route electricity from taking an unwanted path within the circuit.

Light-Emitting Diode (LED): A light-emitting diode is like a standard diode in the fact that electrical current only flows in one direction. The main difference is an LED will emit light when electricity flows through it. Inside an LED there is an anode and cathode. Current always flows from the anode (+) to the cathode (-) and never in the opposite direction. The longer leg of the LED is the positive (anode) side.

Transistor: Transistor are tiny switches that turn a current on or off when triggered by an electric signal. In addition to being a switch, it can also be used to amplify electronic signals. A transistor is similar to a relay except with no moving parts.

Relay: A relay is an electrically operated switch that opens or closes when power is applied. Inside a relay is an electromagnet which controls a mechanical switch.

Integrated Circuit (IC): An integrated circuit is a circuit that's been reduced in size to fit inside a tiny chip. This circuit contains electronic components like resistors and capacitors but on a much smaller scale. Integrated circuits come in different variations such as 555 timers, voltage regulators, microcontrollers and many more. Each pin on an IC is unique in terms of its function.

STRAND 4: FORECS AND ENERGY
Sub-Strand 3: Conversion and Conservation of Energy

Content Standard: B7.4.3.1:
Demonstrate an understanding of the principle of conservation and conversion of energy and their application in real life situations.

Indicator: B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy**.**

Energy conservation also refers to the judicious and wise use of our sources of energy and replacing them whenever possible.
The law of conservation of energy states that energy can neither be created nor destroyed but only converted from one form of energy to another. This means that a system always has the same amount of energy, unless it's added from the outside.

Indicator: B7.4.3.1.2 Demonstrate the conversion of energy into useable forms.

There are many forms of energy. The most common forms are

1. Chemical energy (energy stored in the bonds between atoms).
2. Heat energy (energy of the motion of atoms).
3. Electrical energy (energy of moving electrons)
4. nuclear energy (energy stored in the nucleus of an atom).
5. Light energy (energy radiated in electromagnetic waves)
6. Mechanical energy (energy of motion).

All the above mentioned forms of energy are related and can be converted into any other forms. For example, the electrical energy in wires is converted to light energy when a light switch is turned on. Most often one form of energy can be converted to two or more

different forms. For example, the chemical energy found in wood is converted to light and heat energy when the wood is burnt.
Let's trace the conversion of light energy from the sun to heat and mechanical energy in the body of an organism. The sun's light energy is converted to chemical energy by plants during photosynthesis. When an animal consumes a plant, the chemical energy in the plant is converted to heat and mechanical energy during respiration. Energy is always conserved in energy conversions which means that energy is neither created nor destroyed.
Energy conversion/transformation refers to the change of energy from one form to another. The following some illustration of energy conversion:

In a torch, the ***chemical energy*** of the batteries is converted into ***electrical energy***, which is converted into ***light energy*** and ***heat energy***.
Chemical energy → Electrical energy →Light energy + heat energy.
When a wood burnt, its ***chemical energy*** is converted into ***heat energy*** and ***light energy***.
Chemical energy → heat energy + light energy

In an electric fan the ***electrical energy*** from the electricity is converted to ***kinetic energy.***
Electrical energy → Kinetic energy.

Dissolving calcium and carbide in water
Chemical energy → Heat energy.

An apple falling from a tree
Potential energy→ Kinetic energy → Sound energy + Heat energy.

Indicator: B7.4.3.1.3 Know how energy could be conserved for future use in life**.**

Ways Of Conserving Energy.
1.Use energy efficient light bulbs
2. Iron all dresses in bulk but not in bit.
3. Do not put your television in the standby mode.
4. Turn off your electrical gadgets when they are not in use.
5.Close all doors and windows when using an air conditioner.

Self-Assessment Task

Complete the statements below to describe energy transformation in each of the following devices.

In a torch, the chemical energy of the batteries is converted into _____ energy, which is converted into _____ energy and _____ energy.

In hydroelectric power plants, waterfalls on the turbines from a height. This, in turn, rotates the turbines and generates electricity. Hence, the _____energy of water is converted into the _____energy of the turbine, which is further converted into _____energy.

In a loudspeaker, _____energy is converted into _____energy.

In a microphone, sound_____ energy is converted into _____energy.

In a generator, _____energy is converted into _____energy.

When fuels are burnt, _____energy is converted into _____energy and _____energy.

Write four ways of conserving energy at home.

STRAND 4: FORCES AND ENERGY
Sub-Strand 4: Force and Motion

Content Standard: **B7.4.4.1** Examine the concept of motion, newton's first law of motion, magnetic force in relation to motion and understand their applications to life.

Indicator: B7.4.4.1.1:

Understand that unbalanced forces acting on an object cause it to move.

When forces on an object are balanced, there is no change in its position, speed or direction. So, what do you need to do to move something? If something starts to move, it must be because unbalanced forces are acting on it. To have unbalanced forces means that the force applied in one direction must be greater than the force applied in the opposite direction. When unbalanced forces are acting on an object, there is a change in its position, speed and direction of the object.

Example in figure 1. When you pushed the heavy bucket with a small push, the bucket did not move. The frictional force balanced the small pushing force. When a larger force was applied, the

bucket moved. The pushing force was now greater than the friction. Since the forces were unbalanced, the bucket moved.

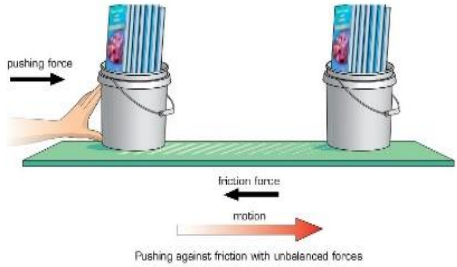


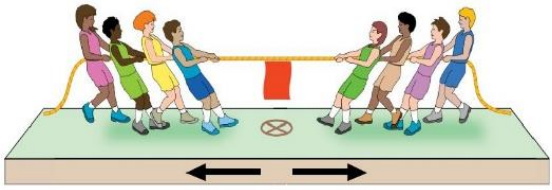
Figure.1

When one force is greater than another, the forces are said to be unbalanced. If the forces acting on an object are unbalanced, this is what happens:

- ☑ An object at rest start move.
- ☑ A moving object stop, or change the direction and speed of the object.

Let consider the game of tug-of-war below

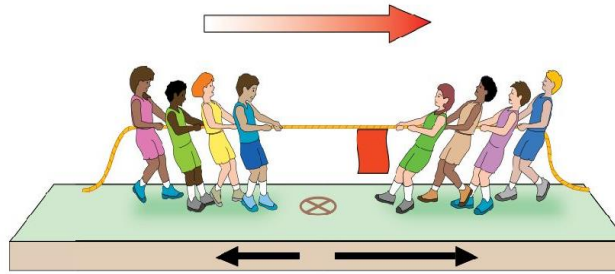
At the start of the game, both teams pulled equally hard on opposite ends of the rope. The two teams pulled with balanced forces. The flag in the middle of the rope did not move. The flag does not move because the force your team is pulling with is equal to the force applied by the other team but in the opposite direction. The forces on the rope are balanced. When the forces are balanced, the flag in the centre of the rope will not move. To win the game, one team must apply more force than the other.



Children playing tug-of-war

After a while, one team begins to be tired and it pulls with less force. The other team becomes excited and pulls with more force. Soon, the tired team is moving in the direction that the stronger team is pulling. The flag moves, and stronger team wins! What happened during the game? The flag in the middle of the rope moved toward the stronger team, because there were unbalanced forces acting on the rope. The force applied by the stronger team was greater than the force applied by the tired team. When the forces became unbalanced, the flag started to move in the

direction of the greater force. That direction was toward the stronger team, so they won.



NOTE:
Balanced forces are forces that are equal in size and opposite in direction. Balanced forces do not result in any change in motion.
Unbalanced forces are forces applied to an object in opposite directions that are not equal in size. Unbalanced forces result in a change in motion.
Friction. The force that opposes the motion of two objects that are in contact.

Indicator: B7.4.4.1.3 Examine the application of Newton' First Law of Motion in life.

Newton's First Law of motion states that an object at rest will stay at rest, and an object in motion will continues in a uniform motion in a straight line unless it is acted upon by some external force to act otherwise. Examples; a book kept on a table remains placed at its place unless it is displaced. Similarly, a ball rolling on a horizontal surface keeps on running unless an external force stops it.
This means that

With no external force
this ball will never move

With no external force
the ball will never stop

Newton's first law of motion is also called **the law of inertia.**

Types of Inertia
1. Inertia of rest: An object stays where it is placed, and it will stay there until you or something else moves it.

2. Inertia of motion: An object will continue at the same speed until a force act on it.
3. Inertia of direction: An object will stay moving in the same direction unless a force acts on it.

Indicator: B7.4.4.1.3 Examine the application of Newton' First Law of Motion in life.

The occurrence of some of the things around us can be explained using Newton's first law of motion. Let consider the following:

1. Car air bags: The function of the air bag is to inflate in an accident and prevent the driver's head from hitting the windshield. When a car with air bag is exposed to an accident, the sudden slowdown in its speed leads to the operation of an electrical switch and this start a chemical reaction that produces a gaseous substance that works to fill the air bag and protect the driver's head.
2. A book on a table stays in its place unless it is dislodged.
3. A hammer head tightened against the wooden handle by striking the bottom of the handle against a hard surface.
4. The motion a ball through the atmosphere or a model rocket launched into the atmosphere.

Indicator: B7.4.4.1.4
Demonstrate the behaviour of magnets and its use to life.
A magnet is any metallic substance which attracts magnetic materials and repels non-magnetic materials. Magnetic materials are materials that are attracted by magnets. Examples iron, nickel and cobalt. A magnet has a magnet field. A magnetic field is the area or region around a magnet where the magnetic force can be experienced or felt. The following are some of the behaviours or properties of magnets.

Properties/Behaviour of magnets:

1. They have poles at opposite ends.
2. Opposite poles of two magnets attract each other.
3. The force of attraction of a magnet is greater at the poles than at the middle.
4. If a bar magnet is suspended by a thread and free to rotate, the South pole will point to the North pole of the earth and vice versa.
5. A magnet creates an invisible area of magnetism all around it called a magnetic field.
6. If you break a bar magnet into two each half own its north and south pole

Uses of Magnets.

1. They are used in making electric meters.
2. They are used in making electric door bells.
3. They are used in fridges and freezers as doors seals.
4. They are used in loud speakers.
5. They are used in the construction of magnetic compasses which are in aeroplanes and ships to determine location or direction.
6. It is also used in food processing industries for separating small metallic pieces from grains etc.
7. Magnets are used in filtering machines which separates metallic ores from crushed rocks.
8. Magnets are used in magnetic resonance imaging(MRI) machines which are used to create an image of the bone structure, organs, and tissues. Even magnets are used to cure cancer.
9. We often use pocket compass to find out directions when we are on a trek. The pocket compass uses a magnetic needle to point north.
10. The dark strip on the back of debit and credit cards is of magnetic nature and are used to store data just like computers' hard drives.
11. Electrically charged magnets can help cranes to move large metal pieces.
12. Magnets can help collect all the nails which are scattered on the ground after a repair job.

Self-Assessment Task

Read the following questions carefully and circle the correct option**.**

1.Newton's first law of motion states than an object's motion will not change unless

A. a force continues to be applied to the object.
B. its inertia is stronger than the applied force.
C. the net force acting on it is greater than zero.
D. the object has no inertia.

2. Overcoming an object's inertia always requires a /an

A. large mass B. massive force
C. two of the above D. unbalanced force

3. It is more difficult to start a 50kg box sliding across the floor than a 5-kg box because the 50- kg box has greater

A. inertia B. size
C. velocity D. volume

4. Once an object starts moving along a clear path, it would keep moving at the same velocity if it were not for

A. an unbalanced force. B. friction.
C. inertia. D. two of the above

5. An object's velocity will not change unless it is acted on by a(n)

A. net force. B. opposite but equal force.
C. strong force. D. unbalanced force.

6. The direction of a moving object will not change if the net force acting on it is

A. greater than zero. B. less than zero
C. two of the above. D. zero

ESSAY QUESTIONS

Do the following self-assessment task on paper to know how much you have learnt.

1.Explain the concept of motion in terms of unbalanced forces acting on an object.

2.State Newton's First Law of Motion and explain its application to everyday life of humans.

3.State some everyday applications of magnets.

4.Explain how magnets cause motion in magnetic materials.

STRAND 4: FORCES AND ENERGY

Sub-strand 4: Force and Motion

Content Standard: B7.4.4.2:

Recognise some simple machines, and their application in doing work.

Indicator: B7.4.4.2.1: Identify simple machines.

A simple machine is any device that allows work to be done easier and faster. For example, a pair of scissors can be used to cut a piece of cloth easier and faster than tearing it with your hands. The use of the scissors saves us time and energy that can be used for other things as well. Again, sewing machine can be used to sew dresses or sacks faster and easier than using a thread and a hand needle. Other examples of simple machines include ***plier, spanner, hammer, wheelbarrow, screw driver, crow bar, etc.***

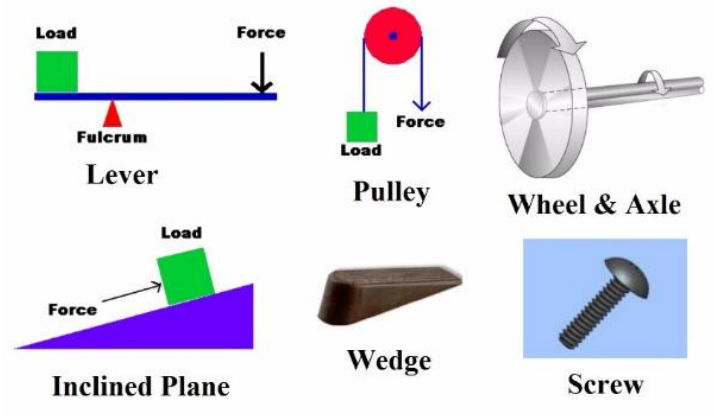
1.Hammer 2.Crowbar 3.Wheelbarrow



4.Screw driver 5.Plier 6.Spanner



Simple machines have been grouped into the following categories. *Lever, inclined Plane, Wedge, Pulley, Wheel and axle, Gears, Screws.*



Indicator: B7.4.4.2.2: Describe the types and functions of levers.

A lever is any rigid bar, which rotate at a certain fixed point called a **pivot or fulcrum**. Examples bottle opener, a pair of scissors and wheelbarrow.

Parts of a lever
A lever has three main parts namely ***effort, pivot and load.***
The effort is the force applied to the lever to lift the load(weight).

The load is weight which is to be lifted.

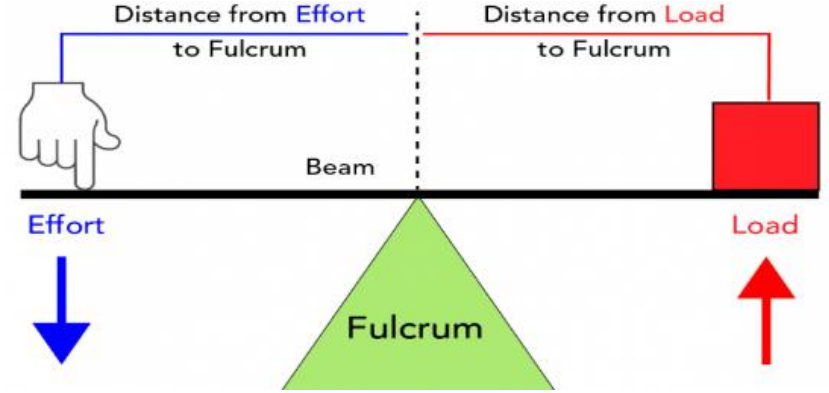
The pivot is the fixed point about which the lever rotates.

NOTE:

The distance from the pivot to the effort is called the **effort distance**

The distance from the pivot to the load is called the **load distance.**

The closer the pivot is to the load; the less force is needed to lift the load and vice versa.



Classes of levers

Levers can be classified into three (3) depending on the positions of ***the load, the pivot and the effort.***

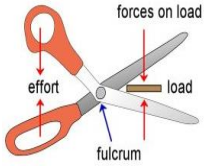
These are

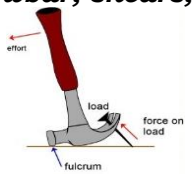
- ☑ First class lever.
- ☑ Second class lever.
- ☑ Third class lever.

First class lever

In the first-class lever, **the pivot (P) is between the effort (E) and the load (L)**

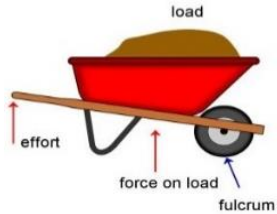
Examples of first class levers are ***a pair of scissors, see-saw, pliers, pick axe, shovel, crowbar, shears, and claw hammer***

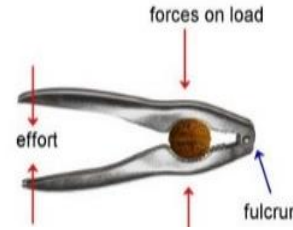




Second class lever

In a second-class lever, **the load(L) is between the pivot(P) and the effort (E)**. Examples of second class levers are ***wheel barrow, nutcracker and bottle opener***

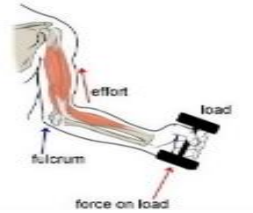




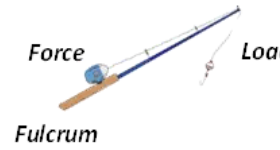
Wheelbarrow ***Nutcracker***

Third class lever

In a third-class lever, **the effort(E) is between the pivot (P) and the load (L)**. Examples of third class levers are ***cutlass, hoe, forceps, fishing rod, sugar tongs, nail clippers, forearm of a human body, etc.***

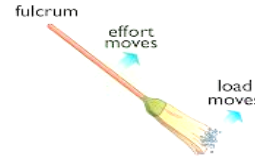


Human arm.



Fishing rod.

Sugar tong.



Broom

Indicators: B7.4.4.2.3 Know Work Input, and Output and Efficiency as they apply to machines.

Work input is the work done by the effort applied on a machine. The work input can be calculated mathematically by multiplying the effort by the distance moved by the effort

Work input = Effort × distance moved by the effort.

Work output is the useful work done by a machine.
Work out put = load × distance moved by the load
NOTE:
The output of a machine is always less than input energy because part of the input energy is used to overcome

1. **Friction between moving parts of the machine.**
2. **Inertia.**
3. **gravitational force**

Efficiency of a machine is defined as the ratio of the work output to the work input expressed as a percentage.
Mathematically;

$$\text{Efficiency} = \frac{\text{work output}}{\text{work input}} \times 100\%$$

$$\text{Efficiency} = \frac{\text{Load} \times \text{distance moved by load}}{\text{Effort} \times \text{distance moved by effort}} \times 100\%$$

NOTE:
The efficiency of a machine is always less than 100% because *some or part of the input energy is used to overcome*

1. *friction between moving parts of the machine.*
2. *gravitational force*
3. *air resistance*

To improve upon the efficiency of a machine you need to

i. *decrease friction by oiling and greasing the metal parts of machines.*
ii. *maintaining the machines from time to time.*

Self-Assessment Task.
Answer the following questions by circling the letter of with correct option

1.What tool would be best to use to lift a heavy load, like a washing machine?

a. Lever b. Screw
c. Wedge d. Wheel and axle

2.Which of the two pulleys changes the direction of an input force?

a. fixed pulley b. movable pulley

3.Which simple machine turns a Ferris wheel?

a. Inclined plane b. Pulley

c. Wedge d. Wheel and axle

4.Which simple machine would stairs be an example?

a. A lever b. A pulley

c. A wedge d. An inclined plane

5.What class of lever does a wheelbarrow operate on?

a. First Class lever b. Second class lever

c. Third Class lever d. wheel and axle.

6. A screw is a(n).....wrapped around a central cylinder.

a. inclined plane b. lever

c. wedge d. wheel and axle

7. An elevator has a pulley.

a. True b. False

8. Which is an example of a wheel and axle?

a. Flag Pole b. Hammer

c. Ramp d. Wagon

8. Which of the following describes something simple machines **cannot** do?

a. Decrease the force you put in

b. Decrease the work you put in

c. Increase the force you put in

d. Increase the work you put in

ESSAY QUESTIONS

Do the following self-assessment task on paper to know how much you have learnt.

1. Explain how levers function as simple machines.

2. Find out why the efficiency of simple machines is less than 100%.

STRAND 4: FORCES AND ENERGY
Sub-Strand 5: Agricultural Tools

Content Standard: B7.4.5.1:

Demonstrate knowledge and skills in handling and maintenance of basic and simple agricultural tools.

Introduction.

Farmers require certain tools to make their work easier and faster. For example, farmers need tools for clearing the land, cutting down trees, digging the soil, and weeding. These tools are called agricultural tools. They are tools that are used for carrying out our farming activities such as clearing or preparing the land, planting

of crops, weeding, watering of crops, pruning, and harvesting of crops.
Below are some simple agricultural tools and their uses.

1. **Hand trowel**

Uses**:**

a. For transplanting seedlings

b. For earthing up vegetables crops on bed

2. **Measuring tape**

Uses: For taking measurement on the farm

3. **Rake**

Uses:

a. For gathering mulch.

b. For breaking lumps of soil.

c. For levelling the surface of the soil.

4. **Watering can**

Uses**:**

a. For sprinkling water onto seedlings.

b. For watering crops in the field. crops.

5. **Spade:**

Uses:

a. For digging holes to plant crops

b. For turning over the soil.

6. **Hoe**

Uses:

a. For weeding.

b. For planting.

c. For making mounds

7.**Pegs**

Uses:

a. For making straight line

b. For making out planting distance.

8.**Shears**

Uses:

a. For trimming hedges.

b. For pruning crop plants

9. **Wheelbarrow**

Uses: a. For transporting farm produce and tools.

10.**cutlass**

Uses: a. For weeding.

b. For planting crops.

c. For cutting down trees

11. **Secateurs**

Uses: For pruning crop plants and hedges

12. **Hand fork**

Uses: a. For stirring the soil. b. For digging up weeds from beds.

13. **Garden fork**

Uses:

a. For spreading manure on the soil.

b. For stirring compost.

14. **Pick axe**

Uses: For loosening and digging the soil.

15. **Axe**

Uses: a. For digging to prepare beds.

b. For uprooting stumps

16. **Sickle**

Uses: For harvesting cereal crops. E.g. rice

Indicator: B7.4.5.1.1:
Basic rules in handling Agricultural tools

The following are some basic rules or safety precautions to remember when using or operating agricultural tools.

1. Dress appropriately: An untied shoelace and flowing long hair should be tied when using farm tools. Dressing appropriately can reduce the risk of injuries.
2. Maintain awareness: Stay focused. Beware of what you are doing and where you are going.
3. Avoid alcohol: Even one shot of drink can affect your ability to operate machinery. Keep alcohol out of the picture until you are done for the day**.**
5. Have enough rest: Feeling fatigued when using farm tools can be dangerous. Make sure you take break from work when you need rest.

Indicator: B7.4.5.1.2 Maintenance of Agricultural tools.

Agricultural tools need proper care and maintenance so
that they can be used efficiently to perform the various farming operations for a longer period of time.

1. **Sharpen tools before and after use:** The cutting edges of tools such as cutlasses, axes, harvesting knives and shears become blunt after regular use. They should be sharpened by rubbing the blunt cutting edge against specially made stone or with a file. When you sharpen tools, it reduces the amount of force you need to apply to perform the task.

2. **Oil and grease metal parts**: Tools made of iron or metal parts should always be cleaned after use, wash and dry them with rag**.** They should be rubbed with oil or grease before they are stored to prevent them from rusting.

3. **Wooden handles should be strong:** Make sure tools with wooden handles are strong and durable. If there is any defect, replace them.

4. **Hang tools.** They should be Keep your tools hanged. Leaving them on the floor can cause rusts as they come in contact with moisture. Leaving tools on the floor can cause injury to persons or

persons stepping on them may break or deform them. This make them unsuitable for work.
5. Inspect and repair or replace damaged parts of farm tools regularly.
6. Keep records of movements of farm tools so that you do not lose them.
7. Some tools and equipment come in their special cases to keep them protected from damage. Make sure to clean and keep them in their original cases.

Reasons For maintaining farm Tools
Maintenance prolong the life span and efficiency of the tools. A well maintained tool is safe to handle and the risk associated with the handling of these tools are reduced.

Self-Assessment Task.
1.Which of the following is used for loosening or cultivating the soil around the growing plants and putting a small amount of compost in the soil?
a. Hand cultivator b. Hand fork
c. Hand spoon d. Hand trowel
2.Hammer is used to draw and remove nails and to drive nails into wood.
a. True b. False

3. A knapsack sprayer is used for
a. applying insecticides, herbicides and foliar fertilizers
b. carrying harvests from the point of production to the market
c. measuring the height of seedlings
d. tightening and loosening knots and bolts
4. Seed trays are containers used for raising and growing
a. flowers b. grass
c. seedlings d. trees

5. Farm implements are accessories pulled by draft animals or mounted to machineries that are usually used in land preparation. They are usually made of iron or other metals.
a. True b. False

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-Strand 1: Waste Management

Content Standard: B7.5.1.1
Exhibit knowledge and skill of scientific basis for management practices of types of waste in the environment.

Indicator: B7. 5.1.1.1:
Apply information from research on good management practices of waste to make the environment clean.

Introduction
Waste can also be described as an unwanted material which is no longer needed. It is usually discarded after its primary use.

Sources Of Waste.
Waste can be generated from various sources. These include wastes from *households, schools, offices, marketplaces, restaurants and other public places.*

B7.5.1.1: Types of Wastes
Wastes come in different forms.
1. **Solid wastes**: These are wastes in solid forms. Solid waste includes sludge from a wastewater treatment plant and water supply treatment plant. Other examples include plastics, Styrofoam containers, bottles, cans, papers, scrap iron, and other trash

2. Liquid Wastes: These are wastes in a form of liquid form. Examples include domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources.

Classification of wastes:
1.**Biodegradable waste:** The waste materials that can be broken down or decomposed into simple forms in nature by the action of microorganisms such as bacteria in due course of time are called ***biodegraded waste materials.*** They are usually wastes generated from green waste, food waste, wood waste paper waste, etc.
2. **Non-biodegradable wastes:** These are the waste materials that cannot be decomposed or broken down by natural organisms or agents. They remain on the earth for thousands of years without degradation. Examples includes plastic water bottles, metals, shoes, etc.

3. **Hazardous wastes:** These are wastes that have the potential of causing harm to the environment and human health. These wastes need special treatments and handling.
They are therefore unsafe to use. They possess any of the following characteristics-flammability, corrosiveness, explosiveness, reactivity and toxicity.

4. **Non-hazardous wastes**: These are wastes that are safe to use commercially, industrially, agriculturally, or economically. They do not have any dangerous characteristics. Examples include ***papers, plastics, glass, metals, beverage cans and organic waste.***

Classification Of Waste According To Their Origin.
1. Municipal Solid wastes: Solid wastes that include household garbage, rubbish, construction and demolition debris, sanitation residues, packaging materials, trade refuges etc. are managed by the district or municipal assemblies.
2. Industrial wastes: These are liquid and solid wastes that are generated by manufacturing and processing units of various industries like chemical, petroleum, coal, metal gas, sanitary and paper etc.
3. Institutional wastes: These are wastes from institutions such as schools, colleges, hospital, university, etc. These wastes include papers, furniture, damaged computers, etc.
4. Agricultural wastes: Wastes generated from farming activities. These wastes or substances are mostly biodegradable.
5. Fishery wastes: Wastes generated due to fishery activities. These wastes are found in coastal and estuarine areas.
6. **Radioactive wastes**: Waste containing radioactive materials. Usually these are by products of nuclear processes. Sometimes industries that are not directly involved in nuclear activities, may also produce some radioactive wastes, e.g. radio-isotopes, chemical sludge etc.
7. E-wastes: waste from electronic equipment such as end of life computers, phones, and home appliances.
8. Medical wastes: Medical waste originates from human and animal healthcare facilities and usually consist of medicines, chemicals, pharmaceuticals, bandages, bodily fluids and body parts. Medical waste can be infectious, toxic or contain bacteria and harmful microorganism.

Impacts Of Waste On Health
1. Chemical poisoning through chemical inhalation.
2. Increase in hospitalization of diabetic residents living near hazardous waste sites.

3. Burning of wastes in the open causes air pollution which has effects on the humans.

Effects Of Waste On Animals And Aquatics Life

1. Increase in mercury level in fish due to disposal of mercury in the rivers.
2. Plastic found in oceans is ingested by birds.
3. Results in high algal population in rivers and sea.
4. Degrades water and soil quality.

Impacts of waste on Environment

1. Waste breaks down in landfills to form methane, a potential greenhouse gas.
2. Change in climate and destruction of ozone layer due to waste biodegradables.
3. Incinerating waste also causes problems, because plastics tend to produce toxic substances, such as dioxins, when they are burnt.
4. Gases from incineration (burning) may cause air pollution and contribute to acid rain, while the ash from incinerators may contain heavy metals and other toxins.

How To Manage Wastes.

Waste disposal is the proper disposition of waste in accordance with local environmental guidelines or laws. The methods waste disposal or waste management practices include the following:

- ☑ Landfill/burying.
- ☑ Incineration (combustion)
- ☑ Resource recovery.
- ☑ Recycling
- ☑ Plasma gasification

1. Landfill: Landfill is a process of waste disposal that focuses attention on burying the waste in the land.

2. Incineration/combustion: This is a type of waste disposal method in which municipal solid wastes are burned at high temperatures so as to convert them into residue and gaseous products.

3. Resource recovery: This is the process of taking useful discarded items for a specific use. These discarded items are then processed to extract or recover materials and resources or convert them to energy in the form of useable heat, electricity or fuel.

4. Recycling: This is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials. OR Recycling is the process of using a used material and manufacture it and sell it as a new product. Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy.

5. Plasma gasification: is another form of waste management. It is the use of electricity and high temperature to turn waste into usable by products without combustion or burning. This process converts organic matter into synthesis gas which is primarily made of carbon monoxide and hydrogen gas.

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-Strand 2: Human Health

Content Standard: B7.5.2.1:
Demonstrate knowledge of common deficiency diseases of humans, their causes, symptoms, effects and prevention.

Indicator: B7.5.2.1.1:
Explain the relationship between food nutrients and common deficiency diseases and how they affect humans.

Food nutrients are chemical compounds in food that are used by the body to function properly and maintain good health. The food nutrients are

Carbohydrates: This is the nutrient that gives us high amounts of energy. Food that contains carbohydrate include: Cassava, plantain, yam, rice, gari, wheat, millet, sugarcane, etc.

Proteins: This is the nutrient that builds muscles and bones. It is needed by the body for growth and repair of body tissue. Foods that contain proteins are beans, milk, meat, snail, fish, egg, etc.

Lipids (commonly called fats): Nutrient that gives us stored energy. Sources include egg yolk, pork, margarine, salmon, sheabutter, groundnut, and mackerel

Vitamins:(Nutrient that helps regulate body processes). They are organic substances needed in small quantities for the

maintenance of normal health. They enable the body to carry out its normal life activities and stay healthy by preventing vitamin deficiency diseases. Sources of vitamins include fruits and vegetables.

Minerals salts: (Nutrient essential to growth and metabolism). They are needed for healthy development of the body. Sources of minerals include sea fish and iodated salts.

Water: (It is essential for digestion, respiration and also carries energy). Water is considered a food nutrient because it is vital to life. That is man can live without food for longer periods than without water. It forms about 70% of the human body. Water performs the following functions in our body:

i. It keeps the body at a steady temperature
ii. It helps to get rid of waste and poisonous substances out of the body.
iii. It helps in digestion thereby preventing constipation
iv. It carries blood cells, nutrients and other important substances around the body.
v. It helps in the healthy development of the body.

Importance of food nutrients

1. Food nutrients help the body to acquire energy. This energy is used by the body the organism to carry out its life processes such growth, movement, reproduction, excretion, etc.
2. Food nutrients protect the body against diseases.
3. It helps the body to maintain and repair worn out tissues.

Deficiency Diseases

A person may get enough food to eat, but sometimes the food may not contain a particular nutrient. If this continues for a longer period of time, the person may suffer from its deficiency. Deficiency of one or more nutrients can cause disease or disorder in our body. **Deficiency disease** *is the absence or lack of a particular nutrient in the diet of humans*.

The following are some common deficiency diseases and their causes.

Disease	Cause
kwashiorkor	Lack of protein
Rickets	Lack of vitamin D
scurvy	Lack of vitamin C

Goitre	Lack of iodine
Beriberi	Lack of vitamin B1
Anaemia/Dermatitis	Lack of Vitamin B2
Night blindness	Lack of vitamin A
Marasmus	Lack of carbohydrates
Pellagra	Lack of vitamin B3
Prolong bleeding	Lac of vitamin K

Carbohydrate: Carbohydrates are the main source of the energy. Lack of carbohydrates in the body leads to a deficiency called **Marasmus**. The deficiency of marasmus makes the skin dry and wrinkle. It usually affects children below the age of one year.

Protein: Proteins are called body building food. It is needed for repair of worn out tissues and also protect the body against diseases. Lack of protein in the body is causes a disease called **kwashiorkor**.

Vitamins: Vitamins help in protecting our body against diseases. They also keep ***our eyes, bones teeth and gums healthy.*** Lack of vitamin A in food causes **night blindness**. A person who is suffering from night blindness cannot see properly in dim light. It may lead to complete blindness.

Vitamins	Deficiency Diseases	Symptoms
Vitamin A	Night blindness	Poor vision, loss of vision at night
Vitamin B_1	Beriberi	Weak muscles, nervousness, paralysis
Vitamin B_3	Pellagra	Dermatitis, diarrhea,
Vitamin B_5	Skin disorder	Crack around the mouth, nervous break down
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal.

Vitamin D	Rickets	Weak bones and tooth decay.
Vitamin E	Hemorrhage	Clotting of blood affected.
Vitamins	Deficiency Diseases	Symptoms
Vitamin A	Night blindness	Poor vision, loss of vision at night
Vitamin B_1	Beriberi	Weak muscles, nervousness, paralysis
Vitamin B_3	Pellagra	Dermatitis, diarrhea,
Vitamin B_5	Skin disorder	Crack around the mouth, nervous break down
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal.
Vitamin D	Rickets	Weak bones and tooth decay.
Vitamin E	Hemorrhage	Clotting of blood affected.

Minerals: Minerals are required in small amounts in our body. They are essential for proper growth of body and for maintaining good health.

Minerals	Symptoms
Calcium	Brittle bones, Excessive bleeding, Stunned growth.
Sodium	Dehydration, Extreme body weakness.
Phosphorus	Bad Bones and teeth, Body weakness.

Iron	**Anaemia:** It decreases the level of haemoglobin in the blood. An anaemic person gets tired quickly, loses appetite, has dark circles under the eyes.
Iodine	**Goitre**: It affects the thyroid gland in the throat and swells up. It also affects the physical and mental growth in children.
Fluorine	Dental decay
Potassium	Muscle weakness, paralysis

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-strand 2: Human Health

Content Standard: B7.5.2.2
Demonstrate knowledge of the nature of selected viral, diseases of humans, their causes, symptoms, effects and management.

Indicator: B7.5.2.2.1
Explain the nature of viral diseases with special emphasis on corona virus (COVID-19) /Ebola/H1N1 disease its causes, symptoms, effects on humans and its prevention.

Introduction.
A disease is any disorder or deviation that interferes with the normal appearance, structure or function of the body or any of its parts. Diseases are usually caused by microscopic organisms (bacteria, fungi, virus, protozoa, etc.) that invade the body. Diseases are often associated with specific signs and symptoms upon which the kind of disease can be detected.

Viral Diseases.
Viral diseases are extremely widespread infections caused by viruses, a type of microorganism. There are many types of viruses that cause a wide variety of viral diseases. The most common type of viral disease is the common cold, which is caused by a viral infection of the upper respiratory tract (nose and throat). Other

common viral diseases include: corona virus, H1N1, Ebola, HIV/AIDs, etc.
Viral diseases are contagious and spread from person to person when a virus enters the body and begins to multiply. Some common ways through which viruses spread from person to person include:

1. Breathing in air-borne droplets contaminated with a virus
2. Eating food or drinking water contaminated with a virus
3. Having sexual contact with a person who is infected with a sexually transmitted virus.
4. Indirect transmission from person to person by a virus host.
5. Touching surfaces or body fluids contaminated with a virus

CORONA VIRUS.
Corona viruses are a large family of viruses known to cause illness ranging from common cold to a more severe disease such as coronavirus disease 2019 (COVID-19), Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS). COVID-19 is a disease caused by a new strain of corona virus known as **SARS-CoV-2.**

Incubation Period of COVID-19
The incubation period is the period between the entering of the corona virus into the human host and the presentation of clinical symptoms or observable signs. The incubation period of corona virus disease is a between 4 to 6 days.

Mode of Transmission of COVID -19

1. The virus is transmitted to people from wild animals and spreads in the human population through human- to-human transmission.
2. Human-to-human transmission of the virus happens when someone comes into contact with the infected person's secretions. Either through a cough, sneeze or a handshake.
3. The virus can also be transmitted by touching something an infected person has touched and then touching your mouth, nose or eyes.

Symptoms of COVID -19
The common signs and symptoms include:

- cough
- fever (high body temperature)
- Sore throat
- Loss of sense of smell (Anosmia)

- ❖ Breathing difficulties.
- ❖ pneumonia, etc.

In a more severe cases infected persons of COVID-19 can have severe acute respiratory syndrome, kidney failure, and may even lead to death.

The following are preventive measures of COVID- 19.

i. Contact tracing of persons who have come into contact with infected persons.
ii. Maintain distance of one metre from friends.
iii. Wash your hands with soap under running water before touching anything including your eyes, nose and mouth.
iv. Clean your hands with 68% and above alcohol-based sanitizer.
v. Cover your mouth and nose when you cough or sneeze with a handkerchief or disposable tissue paper.
vi. Avoid sharing items like cutlery sets, drinking bottles, cups, and bowls.
vii. If symptoms persist and become worse than a standard cold, see your doctor.

EBOLA

Ebola virus disease (EVD), formerly known as ***Ebola haemorrhagic fever*** is a severe illness in humans. Fruit bats are Ebola virus host.

Mode of transmission of Ebola.

i. It is transmitted through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as fruit bats, chimpanzees, gorillas, monkeys, forest antelope or porcupines found ill or dead or in the rainforest.
ii. Ebola then spreads through human-to-human transmission via direct contact with:
iii. Blood or body fluids of a person who is sick with or has died from Ebola
iv. Objects that have been contaminated with body fluids (like blood, feces, vomit) from a person sick with Ebola or the body of a person who died from Ebola.

Symptoms of Ebola

- ➢ Fever
- ➢ sore throat
- ➢ vomiting
- ➢ Muscle pain

- Headache
- diarrhoea
- fatigue, etc.

Preventive measures of Ebola include:

- ☑ Reducing the risk of wildlife-to-human transmission.
- ☑ Reducing the risk of human-to-human transmission.
- ☑ Contact tracing of persons who have come into contact with infected persons.

H1N1 VIRAL DISEASE

The H1N1 virus is made of swine, human, and avian genes that metamorphosed or was transformed in pigs.

Mode of transmission of H1N1

H1N1 virus was transmitted from animals to humans. It spreads quickly among humans because they had no immunity to it.

Symptoms of H1N1

- Fever
- cough
- sore throat
- runny nose
- diarrhoea etc.

Preventive measures of H1N1include:

- ☑ Reducing the risk of wildlife-to-human transmission.
- ☑ Reducing the risk of human-to-human transmission.
- ☑ Contact tracing of persons who have come into contact with infected persons.

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-Strand 3: Science and Industry

Content Standard: B7.5.3.1:

Realise how careers in science can improve life of humans and research about Ghanaian and internationally recognised scientists and science educators and model after them.

Indicator: B.7. 5.3.1.1

Discover and explain how careers in science can improve human conditions and relate these careers to the work of great national and international scientists and science educators.

Careers in Science field

A career is an occupation which people engage in or undertake on regular basis in order to earn a living. The study of science present to us many careers from which students can choose from in the course of studying science. Below are some attractive careers available within the field of science:

1. Pharmacist
2. Pilot
3. Electrical engineer
4. Research scientist
5. Biologist
6. Ecologist
7. Zoologist
8. Botanist
9. Entomologist
10. Ethologist
11. Forensic scientist
12. Geochemist
13. hazardous waste chemist
14. Material scientist
15. Laser engineer
16. Systems analyst
17. Software engineer, etc.

Pharmacists: A pharmacist is a healthcare professional who specialize in the right way to use, store, preserve and provide medicine.

Pilot: A pilot is a person who is trained to fly an aircraft.

Ecologist: An ecologist is a scientist who studies how animals and plants interact with their environment. To be an ecologist, you must first learn about ecology-the study of organisms and how they relate to their environment.

Zoologist: A zoologist is a scientist who study animals and their interaction with the ecosystem. They study their physical characteristics, diets, behaviours, and the impact humans have on them.

Biologist: A biologist is a scientist who study animals, humans, plants or even micro-organisms to develop knowledge and understanding of living processes.

Botanists: A botanist is a scientist who study plants kingdom.

Entomologist: An entomologist is a scientist who studies insects. Study the life cycle, distribution, physiology, behaviour.

Ethologist: An ethologist is a scientist who studies the behaviour of animals under natural conditions. They study domestic

animals, livestock or wildlife to gain insight about their natural behaviours.

Forensic scientist: Forensic scientist collect and analyse evidence from a crime scene. They collect items like dirt samples, blood samples, fingerprints and more. They are responsible for using their expertise to report on and present their findings in legal cases.

Geochemist: Geochemists study the appearance, movement and effect of chemical compounds of the earth. This involves the movement and distribution of compounds through water systems, the chemical makeup of minerals.

Synthetic chemist: Synthetic chemists test and develop chemical compounds to create new material for a specific purpose. They work in a lab and develop materials for industries including healthcare, manufacturing and food and beverage.

Hazardous waste chemist: Hazardous waste chemists are responsible for monitoring and managing chemical pollutants in the air and water.

Materials scientist: Materials scientists study and analyse both natural and man-made items to learn more. Their findings might be used to develop new materials, alter materials or make decisions about using materials in a different way.

Pharmacologist: Pharmacologists perform studies on new and existing drugs and other pharmaceuticals for their effectiveness on humans and animals. They also study the source and chemical makeup of drugs.

Toxicologist: Toxicologists are responsible for testing various blood and tissue samples to detect the presence of pharmaceuticals, poison, alcohol and other substances in the body.

Laboratory technician: A laboratory technician helps physicians to diagnose and treat diseases. Some of the primary responsibilities of a laboratory technician include performing tests on blood samples, tissue and other body fluids.

Software engineer: A software engineer is a scientist who apply scientific and mathematical principles in order to solve problems. They design and create computer software and applications to solve real time problems. Software engineers are sometimes called ***software developers.***

Some Ghanaian Scientist

1. Prof. Ibok Nsa Oduro
2. Prof. Francis Allotey.
3. Professor Ewurama Addy

4. science educationists:
5. Professor Anamuah-Mensah
6. Professor Theophilus Ossei-Anto
7. Professor Christian Anthony-Krueger

Some International Scientists:

i. Albert Einstein
ii. Alexander Fleming
iii. Charles Darwin
iv. Paul Ratnei
v. Stephen Hawkins

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-Strand 4: Climate Change and Green Economy.

Content Standard: B7.5.4.1

Demonstrate understanding of sustainable energy choices and their impact on the environment.

Indicator: B7.5.4.1.1
Search for information on ways sustainable energy choices and scientific ideas are used to protect the environment.

Introduction
For better understanding of sustainable energy choices there are certain vocabularies that you need to know in order to consolidate your understanding on climate and green economy.
Weather: Weather describes the condition of the atmosphere over a short period of time. It describes the state of the atmosphere for example the degree to which it is hot or cold, wet or dry, calm or stormy, clear or cloudy.
Climate: Climate is the condition of the atmosphere at a particular location over a long period of time. It is the long-term summation of the atmospheric elements and their variations.
Climate change: The term climate change refers to significant changes in average weather patterns (i.e. precipitation, temperature, wind and other indicators) that persist within a climate system, caused directly or indirectly by human activities.

Effects of climate change on the Environment:

1. Direct physical harm on humans
2. Crop failure and farmland loss
3. Sea level rises and coastal submersion
4. Freshwater loss and desertification

Greenhouse effect: The greenhouse effect is a natural process that warms the Earth's surface. OR It is the trapping of heat near the earth's surface by gases (greenhouse gases, especially carbon dioxide) in the atmosphere. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. The major greenhouse gases are

i. water vapour (H_2O)

ii. carbon dioxide (CO_2)

iii. methane (CH_4)

iv. chlorofluorocarbons(CFCs)

v. Hydrogenated chlorofluorocarbons (HCFCs)

vi. Tropospheric ozone (O3)

vii. Dinitrogen oxide (N2O).

The warming of the atmosphere by greenhouse gases is known as ***greenhouse effect.*** Without greenhouse effects the world would have been too cold to live in. The concentration of the greenhouse in the atmosphere has been rising due to human activities such as burning of fossil fuels and other agricultural activities. The warming of the earth as a result of greenhouse gases produced from human activities is called ***global warming.*** The main human activities that cause build-up of greenhouse gases are burning of coal and fuel by power stations and the burning of forest. Carbon dioxide is the main source of concern because of the massive quantities emitted. Methane (CH_4) is not produced in large quantities as carbon dioxide but it has much greater warming effect. The main source of methane is agriculture. Decaying organic matter and the digestive system of farm animals particularly cattle. It is also generated from landfills.

Green economy is one whose growth of income and jobs is driven by investments that reduce carbon emissions and pollution, enhance efficiency and sustain biodiversity and ecosystem service. It is an economy paradigm that can drive growth of income and jobs without creating environmental risk.

Advantages of Green Economy

1. Green economy potentially works towards decreasing environmental pollution, and thus improves the quality of soil, water and air and also protects environmental well-being.
2. Global warming, loss of biodiversity, deforestation, desertification, resource depletion can gradually be obstructed by implementing green economy which will automatically save the earth and its animals from destruction as far as possible.
3. Economic growth is also enhanced due to the establishment of new markets for biofuels and renewable energy resources.
4. Establishment of new markets have potential to support international advantages when these new markets will invite funds through exports and also increase domestic sales.
5. Agricultural industries will be able to achieve a dignified place due to the emphasis on green technologies.

Sustainable Energy Choices and Scientific Ideas That Can Be Used to Protect the Environment.

Sustainable Energy: Energy is sustainable if it meets the need of the present without compromising the ability of the future generation to meet their own needs.
Sustainable energy is widely encouraged as it does not cause any harm to the environment and is always available. Fossil fuels are not considered as sustainable energy sources because they are limited, cause immense pollution by releasing harmful gases and are not available everywhere on earth. These short coming about fossil fuels compelled scientists to look out for sustainable source of energy. Among the discovered sustainable energy choices are; ***solar energy, wind energy, hydropower, geothermal energy and ocean energy.***

1. **Solar Energy**: Solar energy is derived by capturing radiant energy from the sun and convert it into electricity. Photovoltaic (PV) systems can convert direct sunlight into electricity through the use of solar cells.
Benefits: One of the benefits of solar energy is that sunlight is always available. It improves public health and environmental conditions because there no release of greenhouse gases in the environment.

2. **Wind Energy**: Wind farms capture the energy of the wind by using turbines and converting it into electricity.

Benefits: Wind energy is clean energy source which means that it does not pollute the air like other forms of energy. Wind energy does not produce carbon dioxide or release any harmful products that can cause environmental degradation.

3. **Geothermal Energy:** Geothermal energy allows us to fetch energy from beneath the earth. This occurs by installing geothermal power stations that can use the heat coming out from inside the earth to generate electricity. Geothermal energy cannot be harnessed everywhere as high temperature is needed to produce steam that could move turbines. It can be harnessed in areas that have high seismic activity and are prone to volcanoes. They are environment friendly and can produce energy throughout the day but their ability to produce energy at suitable regions restricts us from using it on a much wider scale.

4. **Ocean Energy:** The waves or tides of the ocean have great power which can tapped can generate a lot of energy to power millions of homes. Waves produced at the oceans can be used by ocean thermal plants to convert the kinetic energy in waves to mechanical energy of turbines which can be converted to electrical energy through generators.

5. **Biomass Energy:** Bioenergy is a renewable energy derived from biomass. Biomass is organic matter that comes from living plants and organisms. Using wood in your fireplace is an example of biomass that most people are familiar with. There are various methods used to generate energy through the use of biomass.

6. **Hydroelectric Power**: There are the rivers or waterfalls whose energy of the moving water when captured that can turn turbines to generate power. This is commonly known as hydroelectric power. It is very common nowadays and it is powering most parts of the world especially Ghana, the Akosombo Dam.

Need for Sustainable Energy

The following are some of the reasons why sustainable energy is important to us today

1.Sustainable energy fights against climate change. Sustainable energy emits little or no greenhouse gases in their generation. This make them the cleanest and the safest way to prevent environmental degradation or pollution.

2. Renewable energy will never deplete or run out. Wind energy, solar power, geothermal energy, and hydropower will continue to

provide us with energy as long as the wind blows, the sun shines, and the tides roll in.
3. Sustainable energy does not harm the environment and can help improve public health.
4. Renewable energy resources emit little or no greenhouse gases, which is better for the environment and our health. The smog produced by fossil fuels irritates our lungs and can lead to lung and respiratory diseases.
5. Sustainable energy can reduce or eliminate our reliance on fossil fuels. Fossil fuels may be reliable and easy to access today, but it won't always be the case.

Impact of sustainable energy choices on the environment:
The following are some of the positive impact of sustainable energy choices on the environment:
Generating energy that produces no greenhouse gas emissions from fossil fuels and reduces some type of air pollution.
Diversifying energy supply and reducing the dependence on imported fuels.
Creating economic development and jobs the manufacturing, installation and more.

Self-Assessment Task

Explain the following terms:
Sustainable energy choice
Greenhouse effects
Climate change

STRAND 5: HUMAN AND THE ENVIRONMENT
Sub-Strand 5: Understanding the Environment

Content Standard: B7.5.5.1

Demonstrate understanding of different plants and animals found in different land forms and how they survive.

Indicator: B7.5.5.1.1

List and describe the different types of plants and animals that live in different land forms such as plateau, plain, mountain valley and others.

Introduction.

Environment can be defined as a sum total of all the living and non-living elements and their effects that influence human life. The living or biotic elements are animals, plants, forests, fisheries,

and birds. The non-living or abiotic elements include water, land, sunlight, rocks, and air.

Landforms are defined as the natural physical features found on the surface of the earth created as a result of various forces of nature such as wind, water, ice, and movement of tectonic plates. Some landforms are created in a matter of few hours, while others take millions of years to appear. There are many types of landforms on the earth's surface. The following are some of the common types of landforms:

i. Mountains
ii. Hills
iii. Plateaus
iv. Valleys
v. Plains
vi. Deserts
vii. Islands
viii. Rivers
ix. oceans, etc.

Mountains: Mountains are landforms higher than the surrounding areas. They are formed due to the tectonic movements, earthquakes, volcanic eruptions and erosion of the surrounding areas caused due to wind, water and ice. Mountains are found in the oceans and on land. Examples of plants found here are lichen, shrubs, Mosses, alpine flowers, etc.

Hills: A hill is a landform that extends above the surrounding terrain. It often has a distinct summit. A summit is a point on a surface that is higher in elevation than all points immediately adjacent to it.

Plains: Plains are flat or the low relief areas on the surface of the earth. It might be formed as a result of the sedimentation of eroded soil from the top of the hills and mountains or might be due to flowing lava deposited by the agents of wind, water, and ice.

Plateaus: Plateaus are flat highlands that are separated from the surroundings due to steep slopes. They are formed by collisions of tectonic plates, magma action that causes the elevation in earth's crust.

Valleys: Valleys are low-lying areas of land between hills or mountains that are formed due to the actions of glaciers and rivers over millions of years. Depending on the shape they are classified as V-shaped valleys and U-shaped valleys. V-shaped valleys are

formed by the flowing rivers and U-shaped valleys are formed due to glaciers.

Deserts: Due to lack of adequate rainfall, desert is a dry piece of land with little or no vegetation. They are mostly found mainly in rain shadow areas which are leeward of a mountain range with respect to the wind direction. In deserts, the atmospheric air is very dry, and daytime temperature is high.

Islands: An island is a piece of land which is surrounded by water from all sides and formed either due to volcanic eruptions or due to hot spots in the lithosphere.

Rivers: Rivers are natural flowing streams of fresh water descending from mountains. They mostly flow toward a lake, sea, ocean or another river.

Oceans: Oceans are the biggest water bodies found on earth and are saline in nature. Oceans cover over 71% of the earth's surface and are responsible in controlling the weather and climate of the earth. Oceans originated due to continental drifts. That is, the movement of the earth's tectonic plates.

Deltas: Deltas are low-lying, triangle-shaped areas, located at the mouth of rivers. In the course of creating a delta, the sand, silt, and rock particles are accumulated in a nearly triangular shape.

Mechanisms for Survival of Plants and Animals in Different Landforms

Plants and Animals in Mountains

Plants:

i. Mountain plants grow close to the ground to avoid being uprooted by strong winds.
ii. These plants also produce smaller leaves to prevent water loss.
iii. Some plants are also able to grow under a layer of snow.

Animals:

i. Some mountain animals hibernate or migrate to warmer areas during colder months.
ii. Small ears and tail minimize heat loss from the body.
iii. Padded feet help the polar bear to walk on the snow.
iv. Thick fur and a layer of fat under the skin protect the polar bear from cold.

Plants and Animals in Deserts

Plants:

i. The leaves are modified as spines to minimize water loss.
ii. The stem is green, to make food for the plant.
iii. The stem is swollen and fleshy to store water.
iv. Cactus plant has a thick, waxy coating that prevents water loss and helps it to retain water.

Animals:

i. Desert animals have thick skin to prevent the loss of water from the body.
ii. Most of the desert animals have the capacity to store water and food. For example, a camel can tolerate extremely hot temperature due to the stored water in its body, which helps in cooling.
iii. Most of the small desert animals live in burrows to save themselves from fluctuation in temperature.
iv. Reptiles are well-suited to the desert climates. They get most of the water through their food and lose hardly any moisture from their skin.

IndicatorB7.5.5.1.2: Nature of associations that exist among plants and animals in different landforms and their mechanisms for survival.

The type of interactions that exist among organisms (plants and animals) in different landforms:

i. mutualism
ii. parasitism
iii. commensalism
iv. predation.

Mutualism: Both organisms benefit from their interactions. An example of mutualism is between herbivores and the bacteria that live in their intestines. The bacteria get a place to live. The bacteria also help the herbivore to digest its food. Both species benefit, so this is a mutualistic relationship. Another example is the ants and the acacia tree which form a symbiotic relationship of mutualism. The ants benefit by living in the acacia tree, and the tree benefits when the ants consume the insects that eat the leaves of the trees.

Parasitism: Parasitism is a relationship in which one organism is helped while the other is harmed. An example is the tape worm. The tapeworm obtains its nutrients while residing within the

host, while the host is harmed because the tapeworm absorbs all of the nutrients.

Commensalism: In this interaction one organism benefits while the other is neither harmed nor gains. Commensalisms may involve an organism using another for transportation or housing. For example, spiders build their webs on trees. The spider gets a place to live on the tree, but the tree is unaffected.

Predation: In these interactions, one organism benefits while the other is negatively affected. Red fox and hare interactions is an excellent example of predator-prey dynamics. The hares consume grasses, then the red foxes predate the hares. The grasses are negatively impacted by the hares while the hares benefit by getting a meal. Foxes then benefit by eating the hares.

Symbiosis: This is interaction between two different organisms living in close physical association, typically to the advantage of both.

Self-Assessment Task

1.Name three animals and plants that are found in forest landforms.

2.Describe any three characteristics of animals found in forest land forms.