



2023

NEW

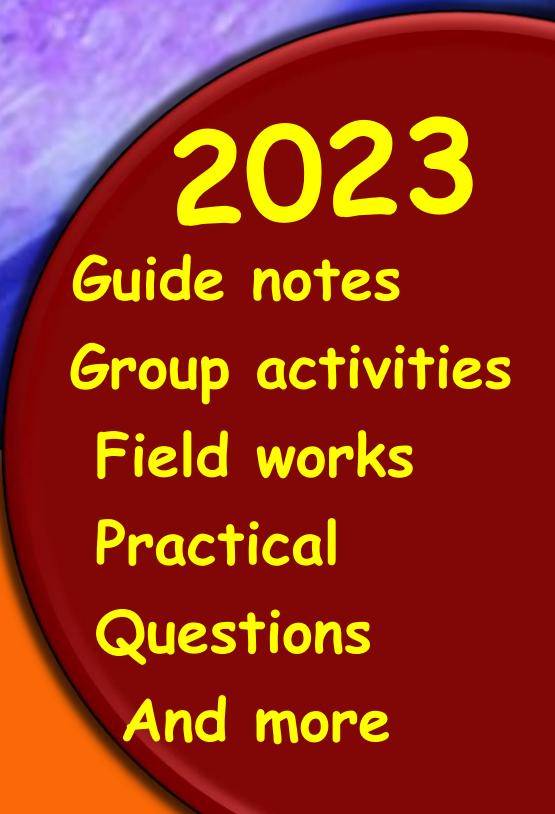
HARROAN

S.3

BIOLOGY

Learner's book

First edition



2023

Guide notes

Group activities

Field works

Practical

Questions

And more

Based on the new curriculum



HARROAN'S

New curriculum learner's book for



s.3

Biology

This book has been made & revised basing on new curriculum for lower secondary education syllabus

Student's information.

This book belongs to:

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1.1 Need for gaseous exchange

Gaseous exchange refers to the diffusion of oxygen and carbon dioxide across a gaseous exchange surface. It takes place between the air and the blood vessels along a gaseous exchange surface.

Gaseous exchange is different from respiration and breathing. **BREATHING/ VENTILATION** refers to the movement of gases in and out of the body of an organism. **Respiration** is the process by which food is broken down to produce energy

Differences between gaseous exchange and ventilation.

Gaseous exchange	Breathing/ventilation
It doesn't involve the use of energy	It involves the use of energy
It occurs along a gas exchange surface	It occurs along the body and a respiratory organ
It doesn't involve action of muscles	It involves action of muscles

Plants and animals interaction in relation to gaseous exchange.



Camel



A plant



A tiger and a plant



A fish and a plant

Plants and animals interact with each other in relation to gaseous exchange to ensure that each of them survives within their habitats.

Animals take in oxygen from the atmosphere which they use to break down food during a process called respiration to release energy and carbon dioxide. The carbon dioxide released by animals is utilized by plants in a process called photosynthesis to produce food and release oxygen. The released oxygen is used for respiration by animals thus plants and animals interdepending on each other.

Some of the released oxygen by plants is used within their cells for respiration which further produces carbon dioxide the plants need for photosynthesis.

Group ACTIVITY

PRESENT TO THE CLASS

1. In groups of two to three students carryout research from textbooks and internet and describe the need and importance of gaseous exchange in organisms.

2. Explain why sleeping under a tree at night is not advisable.

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3. Describe how cows and plants like grass would interdepend on each other in terms of:

 - i) Gaseous exchange.
 - ii) other ways

PRESENT TO THE CLASS

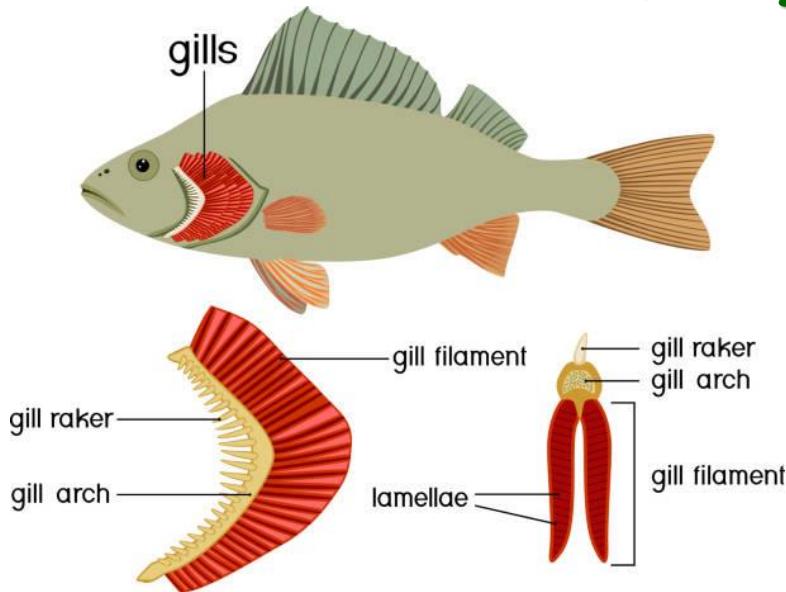
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1.3. Structure of gills and breathing in fish.

Gaseous exchange in a bony fish.

A fish lives in water where it obtains dissolved oxygen. The fish needs oxygen for respiration to sustain its cells. The exchange of gases takes place within the gills in the gaseous exchange surfaces called the **gill filaments**.

Structure of the gills.



Gills are thin filamentous folding of surface cells enriched with blood vessels. Each gill consists of two rows of gill filaments attached to a bony arch. The filaments are very thin and their surface is folded into many gill lamellae (gill plates).

Gill filaments- site for gaseous exchange

Gill arch- for attachment of gill filaments

Gill raker- protects gill filaments by filtering suspended materials in water like sand.

Ventilation mechanism in a bony fish.

Ventilation in a bony fish occurs by two processes i.e. **inspiration** and **expiration**.

During inspiration, the fish opens the mouth (buccal cavity), the floor of the mouth is lowered.

The operculum contracts volume in the buccal cavity increases .Pressure in the buccal cavity decreases below that of the surrounding water.

A higher pressure of the surrounding water forces water to enter the buccal cavity.

The floor of the buccal cavity is raised. The operculum relaxes and bulges outwards (expands). This increases the volume in the operculum and decreases the pressure in it below that of the buccal cavity.

The higher pressure in the buccal cavity forces water to enter into the operculum to the gills where gaseous exchange takes place.

During expiration, the fish closes the mouth as the floor of the mouth is still raised.

This causes an overall decrease in the volume of the buccal cavity and the operculum.

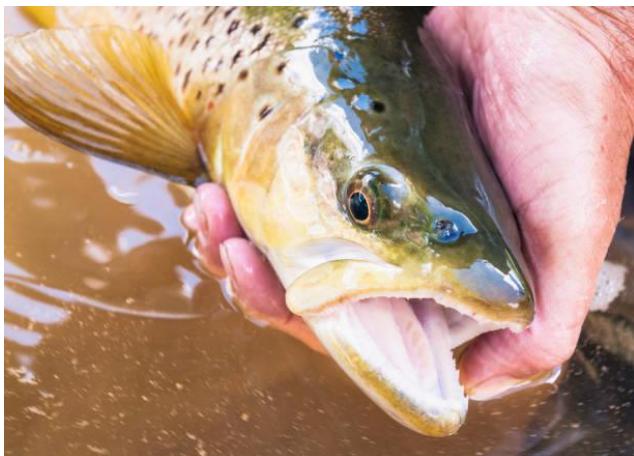
Pressure increases in the buccal cavity and the operculum above that of the surrounding water.

A higher pressure in the operculum makes the operculum valve to open forcing water containing carbon dioxide out the surrounding water.

Group ACTIVITY

PRESENT TO THE CLASS

2. In groups of three to four students, carryout research from the internet and textbooks and answer the questions below. a). Describe the process of gaseous exchange in a bony fish



- b) Describe what happens when the fish is taken out of water **PRESENT TO THE**

PRESENT TO THE CLASS

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- c) Explain why a man dies when he falls in a lake yet water in a lake contains oxygen.

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- d). Why do people carry oxygen in tanks when swimming beneath a water body.

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1.5. Making a lung model.

Demonstrating the mechanism of breathing in man using a model.

Materials; plastic (bottle with a cap), 2straws, scissors, 3balloons, push pins, tape.

Procedure:

1. Gather your materials



3. Cut one straw in half



5. Take the other straw and make a 5cm cut on one end so that it is split in half.
Flip the straw around and make two 5cm cuts on the other end so that it is split into four.



2. Cut the necks of two of the balloons



4. Then attach one balloon to each straw half.
Use tape to seal it off. These will be your lungs.



6. Tape one "lung" on the either side
of the two way split straw.



Steps of using hands only CPR for adults and teens.

Step 1. Taking vitals

1. Examine the scene for any danger check whether there is danger nearby preventing you from reaching the patient. E.g. broken electric wires or incoming vehicles in case of car accidents or someone collapses in the road.



3. Call for emergency if you find a person unresponsive and isn't breathing or doesn't have a pulse. Send for a doctor, call an ambulance. In Uganda, 911 or 999 is the emergency number. If you are 2 people, one should call for help as another starts compression. If it is unresponsive because of suffocation, immediately begin compressions for one minute then call for emergency.



2. Check for unresponsiveness. You can shake their shoulders & ask if they are okay. If someone is conscious, Compressions are not needed. If you receive no response, check for signs of breathing like person's chest rising and falling, placing your finger on their neck or wrist to check for the pulse of blood vessels.



4. Check for breathing. Make sure that the airway is not blocked. If the mouth is closed, tilt their head back so it opens up. Remove any visible obstacle in your reach but never push your fingers too far inside. Put your ear close to the victim's nose and mouth and listen to slight breathing. Watch for rising and falling of the chest. If the victim is breathing or coughing normally, do not perform compressions

Step 2 administering compressions



5. Keep the victim on their back on a firm

Tilt the person's chin up to open the airway. Tilt their head back while pressing their chin up & forward with 2 fingers. This should move their tongue out of the way & make it easier for them to breathe.

6. Rapidly push down on the center of the chest (compress the chest). Place one hand directly over the center of the person's chest (between their nipples). Place the palm of your other hand on top of the hand that's on their chest and interlock your fingers. Press straight down by 5 to 6cm on their chest. Release the compression & allow the chest to return to its original position. Repeat the compressions at a rate of 100 to 120 times a minute until an ambulance arrives or as long as you can until the person responds.



Using CPR with breaths for adults & teens.

Step 1. Taking vitals

1. Follow the same initial procedures as in hand only (1 to 4). These include; examine any danger, assess to see if a person is responsive, if not responsive move them on their back and call emergency services. Check for breathing.

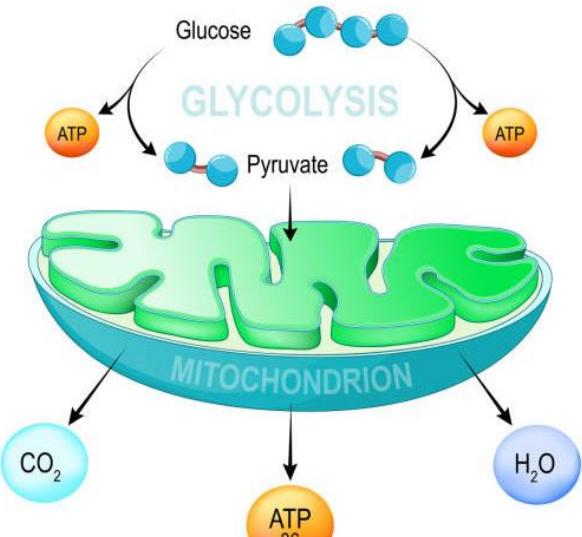


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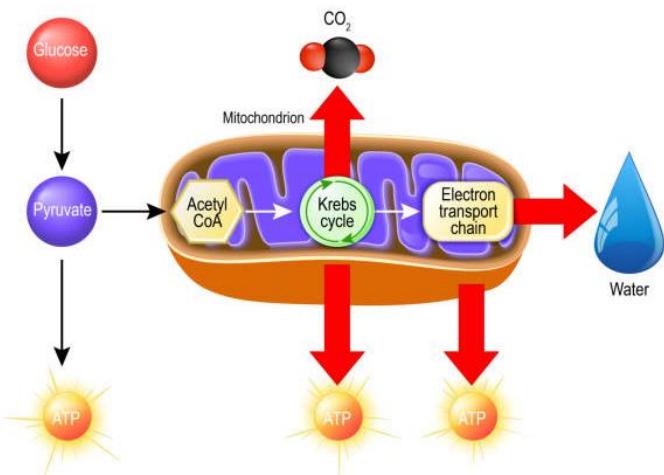
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Chapter two

AEROBIC AND ANAEROBIC RESPIRATION.



By the end of this chapter you should be able to

- Appreciate the importance of respiration
- State the sites of aerobic and anaerobic respiration
- Describe the relationship between aerobic respiration and photosynthesis.
- Carry out experiments in relation to aerobic and anaerobic respiration
- Describe applications of anaerobic respiration
- Compare aerobic and anaerobic respiration

2.1. The process of respiration.

Respiration is the process by which food particles are broken down to produce energy. Respiration is a life process common to all living organisms. Respiration is different from breathing and gaseous exchange.

Importance of energy produced during respiration in the body.

- ❖ Energy is required for the contraction of muscle cells to create movement.
 - ❖ Movement of food along the alimentary canal by peristalsis.
 - ❖ Building up of amino acids and proteins.
 - ❖ Growth of an organism through formation of new cells.
 - ❖ Conduction of electrical impulses by nerve cells.
 - ❖ Active transport of molecules along the cell membrane.
 - ❖ Digestion of food.
 - ❖ The process of cell division to create nerve cells.

The energy got from respiration is also used for other body activities such as;



Reading and studying.



Playing football



Running

Group ACTIVITY

PRESENT TO THE CLASS

- a) Identify other activities in daily life involving the use of energy.

- b)** Give the differences between
Respiration and breathing

<i>Respiration</i>	<i>Breathing</i>

ii. Respiration and gaseous exchange

<i>Respiration</i>	<i>Gaseous exchange</i>

- b)** Explain what happens in the body when someone takes a poison which inhibits respiration.

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- c)** Describe what would happen in case one eats less energy food than the required body demand.

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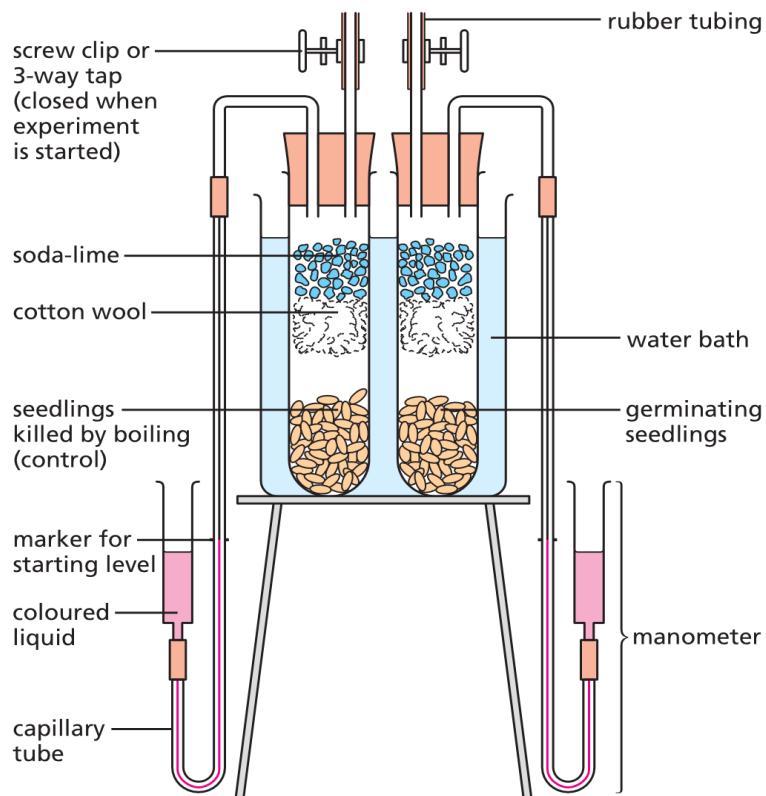
2.3. Experiments in aerobic respiration.

An experiment to show that germinating seeds take in oxygen for respiration.

Materials: germinating seedlings, manometer colored liquid, capillary tube, soda lime, cotton wool and water bath.

Procedure

- Place germinating bean seeds in one test tube and cover them with cotton wool while boiled seeds in another test tube and also covered with cotton wool.
- Place soda lime at the top of cotton wool in each test tube to absorb carbon dioxide gas from each test tube.
- A capillary tube is used to connect each test tube to the container containing a colored liquid.
- Place the setup in a water bath to maintain favorable temperature for metabolism. Leave the apparatus to stand for 30 minutes.



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Chapter three

EXCRETION IN PLANTS AND ANIMALS



By the end of this chapter you should be able to

- Explain the need to remove unwanted substances from the body
- Understand the process of excretion in humans
- Explain the effects of raised carbon dioxide levels to the body
- Identify the causes, symptoms and treatment of kidney failure
- Describe the tests that we can carry out in the laboratory to determine the presence of glucose and proteins in urine.
- Describe the causes and effects of diabetes mellitus
- Recognize the need for proper disposal of human wastes e.g urine

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3.1. The need for excretion.

Excretion

It refers to the process by which unwanted substances produced from metabolic reactions are removed from the body. During life activities such as cellular respiration, several chemical reactions take place in the body. These are known as **metabolism**. These chemical reactions produce waste products such as carbon dioxide, water, salts, urea, and uric acid. Accumulation of these wastes beyond a level inside the body is harmful to the body. The excretory organs remove these wastes by a process called **excretion**.

Excretion differs secretion and egestion.

Egestion is the removal of undigested food substances from the body.

Secretion is the release of useful substance from a cell or a gland.

Examples of secretion include: Hormones, enzymes, sebum and mucus.

Group activity;

In groups of 3 to 5 students, carryout research from internet and text books and answer the questions below. Present to the rest of the class.

- a) Why is it necessary to remove waste products from the body?

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- b) Study the pictures below.



A



B

- c) Why do you think it's important for a car to exhaust fumes?

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- d) Describe what would happen in case a car fails to exhaust fumes.

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Group activity;

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g) Why is it necessary to remove waste products from the body?

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h) Study the pictures below.



A



B

i) Why do you think it's important for a car to exhaust fumes?

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e) Describe what would happen in case a car fails to exhaust fumes.

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Chapter four

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RECEPTION AND RESPONSE IN PLANTS AND ANIMALS.



By the end of this chapter you should be able to



- Differentiate between irritability stimulus and response
- Conduct experiments on phototropism
- Understand the role of hormones in phototropism
- Conduct experiments on geotropism
- Understand the importance of hormones in geotropism
- Conduct an experiment on tactic response

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4.1. Necessity of coordination and response.

Terms in coordination and response.

Coordination; It refers to the mechanisms in an organism that cause an appropriate response to a stimulus.

Irritability; Is the ability of an organism to respond to a stimulus in the environment

Stimulus; It refers to a change in internal or external environment to which an organism responds.

Stimulus can be categorized as;

- Chemical stimulus e.g. smell and taste
- Physical stimulus e.g. light, gravity, pressure, touch, and heat.
- Internal stimulus e.g. changes in internal body temperature, salt concentration, carbon dioxide concentration and blood sugar.
- Receptors; are cells or organs that receive the stimulus from internal and external environments and convert it into impulses e.g. ears, nose skin, tongue.
- Effectors; are cells or organs or body structures that produce a physiological response when stimulated e.g. muscles and glands.
- Response; it refers to change in activity of part or whole of an organism's body as a result of the presence of a stimulus. It can either be towards the direction of stimulus (positive response) or away from the direction of the stimulus (negative response).

Group activity;

a)). Carryout research from the internet and textbooks and describe the;

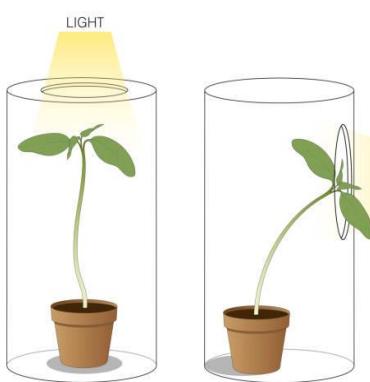
i) Importance of reception and response in plants.

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ii) Importance of reception and response in animals.

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b) The pictures below show responses in plants and animals; for each, identify the response and its importance to the organism.



A



B



C



D

For each, identify the response and its importance to the organism.

A

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3.2. Reception and response in plants

Plant responses include;

- Nastic/Nasty response
- Tropic/Tropism response

Nastic response. Is a non-directional movement of part of a plant in response to a non-directional stimulus

Examples of nastic response.

- Folding and drooping of leaves of mimosa pudica when lightly touched.
- Closing up of the lid of a pitcher plant on entry of an insect (heptonasty)
- Opening of crocus and tulip flowers in response to a rise in temperature(thermometry)
- Opening of evening primrose flowers at night (photo nasty)
- Some plants fold their leaves when light intensity decreases and are spread with increase in light intensity (photo nasty)

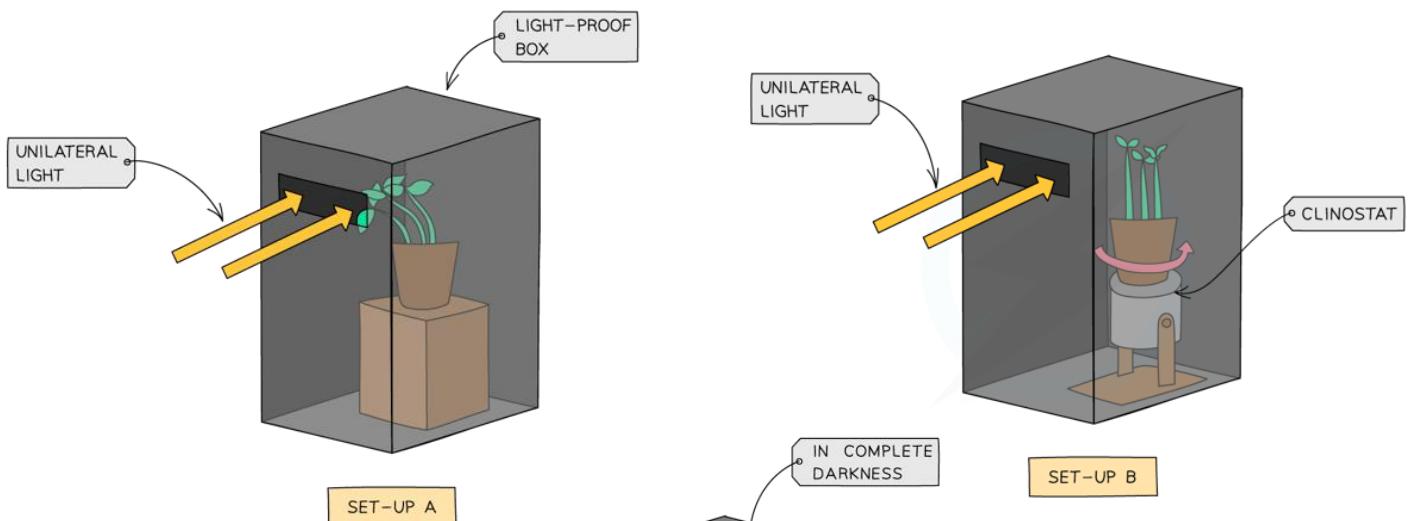
Group activity;

Investigating phototropism in a plant shoot.

Materials; Water, clinostat, 2 boxes with a window, 3 potted seedlings with straight shoots.

Procedure:

- Get two potted bean seedlings and water them.
- Place one in a box with a window to allow illumination of the shoot from one direction only label it box A.
- Place the other in an identical situation but on a slowly rotating clinostat so that all sides of a shoot are exposed to light label it box B.
- Place a third seedling in a covered box without a window label it box C. leave the experiment to sand for a few days.

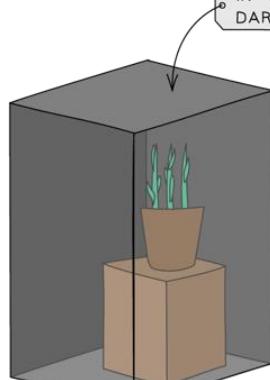


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a) State the observations for the plant in each box;

A

B

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