



PRACTICAL NOTEBOOK

BIOLOGY

GRADE - X

Web Version of PCTB Textbook



**PUNJAB CURRICULUM AND
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Authors

1. **Rehana Johar (Rtd.)**
Senior Subject Specialist (Biology), Punjab Textbook Board, Lahore
2. **M. Nadeem Asghar**
Deputy Secretary, Higher Education Department
3. **Ghufran Ahmad Asif**
Subject Specialist (Biology), Punjab Textbook Board, Lahore
4. **Robeela Shabbir**
Subject Specialist (Biology), Punjab Textbook Board, Lahore
5. **Attia Razzaq**
Research Scholar, Centre of Excellence in Molecular Biology
6. **Iram Habeeb**
Science Teacher, Beacon House School, Johar Town, Lahore
7. **Dr. Farkhanda Manzoor**
Prof. Department of Zoology, Lahore Collage for Women University, Lahore

Editors

1. **M. Nadeem Asghar**
2. **Dr. Zulfiqar Ali Saqib**
3. **Rehana Johar (Rtd.)**
4. **Ghufran Ahmed Asif**

Supervision

Robeela Shabbir

Layout & Designing

Irhan Ahmed Firdausi
Graphic Designer PTB.

CERTIFICATE

Certified that

Student _____

Roll No. _____ *Class* _____

School _____

has completed Practical Work of
BIOLOGY 10th
for
session _____ *as per syllabus.*

Signature of Science Teacher

Dated: _____

Signature of Head of the Dept.

Dated: _____

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No Practical Activity

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CHAPTER GASEOUS EXCHANGE

10



10.1



Activity to compare the breathing rate at rest and after exercise

Date _____

Background Information

Breathing rate is the number of breaths per minute. A breath is one inhalation (taking in air) and one exhalation (giving out air). Breathing takes place by the movement of lungs, ribs and diaphragm. During inhalation the diaphragm contracts and ribs expand which make chest cavity larger. Lungs expand and the air from the atmosphere rushes into the lungs. During exhalation diaphragm and ribs return to their normal positions decreasing the volumes of chest cavity. Lungs contract and air moves out of the lungs. Breathing rate depends on several factors i.e. altitude, lung capacity, health and level of activity (rest or exercise). Here we will study that how change in the level of activity will bring a change in the breathing rate.

Materials Required

Stopwatch

Procedure

This activity will be performed in groups. In each group, one student will act as an observer who will record the observations of other students of the group.

1. Ask the observer to count and record the breathing rate of other students of the group in resting position.
2. Do some light exercise (e.g. walking) for five minutes.
3. Ask the observer to count the breathing rate and again note the observations.
4. After a 15 minutes rest, do some strenuous exercise (e.g. running) for five minutes.
5. Ask the observer again to record the breathing rate of the group.

CAUTIONS

- Students suffering from asthma and heart problem should not participate in this exercise.



Students Standing while an observer will note the breathing rate



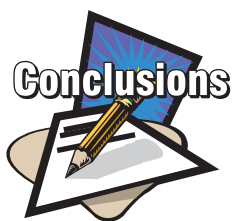
Students run for some time and the observer will note the breathing rate after they stop running.

Fig 10.1 : Breathing rate at rest and after exercise



Table : Breathing Rate

Student No.	At rest	After Light exercise	After Strenuous exercise
1			
2			
3			
4			
5			
Average			



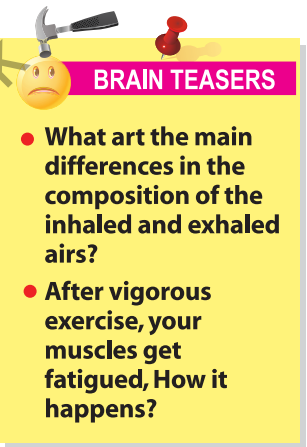
Compare all these observations and interpret the results.



1. What is the stimulus of breathing? (i) carbon dioxide concentration in blood, (ii) carbon dioxide concentration in the alveolar air, (iii) oxygen concentration in blood or (iv) oxygen concentration in the alveolar air!

2. The breathing becomes rapid and deep after exercise. Why?

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BRAIN TEASERS

- What are the main differences in the composition of the inhaled and exhaled air?
- After vigorous exercise, your muscles get fatigued. How does it happen?



10.2 ▶ Experiment to find out how much air a person can take into his/her lungs

Date _____



Respiration allows for the exchange of oxygen and carbon dioxide. Gas exchange between air and blood occurs in lungs which have a network of alveoli (tiny air sacks) and pulmonary capillaries (tiny blood vessels). In these two structures, the two gases are exchanged i.e. oxygen diffuses from the alveoli into the capillaries and carbon dioxide diffuses from the capillaries into the alveoli. As we breathe in, fresh air enters the lungs and passes to each alveoli. After the exchange of gases, the air is breathed out during expirations. The maximum amount of air that the lungs can hold during the deepest possible breath is called total lung capacity. The average total lung capacity of an adult human is about 5 liters. During normal breathing, the volume of air that moves in and out of the lungs in each breath is called tidal volume. This volume varies for different individuals. Average tidal volume of young adult male is 500ml and adult female is 387ml.



Beaker, retort stand, delivery tube / rubber tube, graduated tube



1. Take a beaker and fill it with water
2. Take a 500 ml graduated tube / cylinder and fill it with water.
3. Invert the graduated tube / cylinder into a water-filled beaker or trough, as shown in the figure.
4. Blow air once through a delivery tube / rubber tube into the graduated tube / cylinder. The air displaces the water downward in the graduated tube / cylinder.
5. Record how much water has dropped down in the graduated tube.



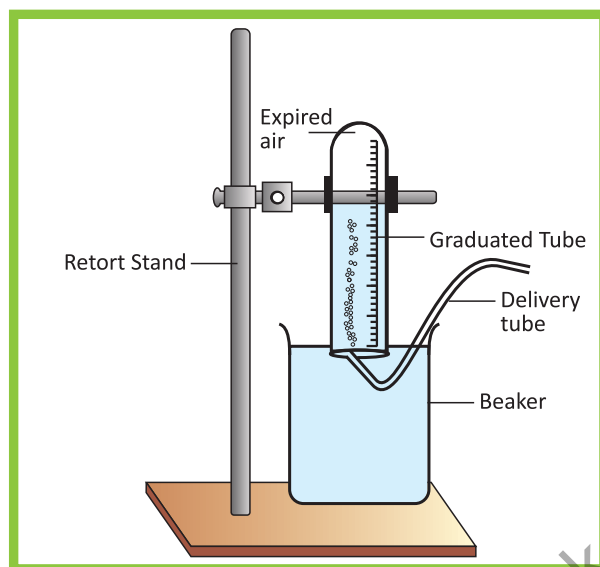
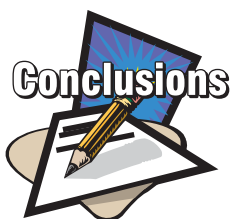


Fig 10.2 : Measuring of the inhaled and the exhaled air

Note the volume of water displaced in the graduated tube / cylinder as it shows the amount of air a person can take into and out of his / her lungs.



Observations



Conclusions

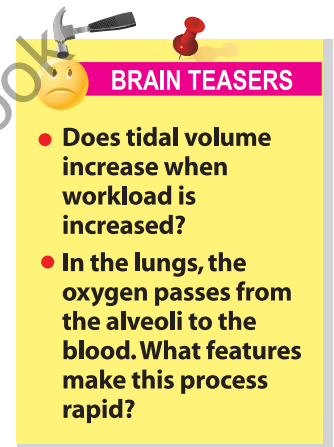
1. How does living in high altitudes influence tidal volume?



**Post Lab.
Activities**

2. What are the factors that can affect the tidal volume and total lung capacity?

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BRAIN TEASERS

- Does tidal volume increase when workload is increased?
- In the lungs, the oxygen passes from the alveoli to the blood. What features make this process rapid?

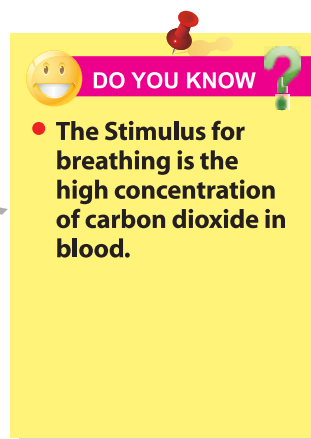


10.3 ► Demonstration of the presence of carbon dioxide in the exhaled air

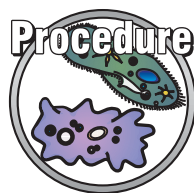
Date _____



During breathing air is drawn into (inhalation) and out (exhalation) of the lungs and gas exchange between the air and blood takes place. In lungs, oxygen is taken from inhaled air into the blood and carbon dioxide is given out of the blood into air. Carbon dioxide turns limewater milky.



Conical flasks, delivery tube, limewater, corks



1. Take two conical flasks and mark them 'A' and 'B'.
2. Fill $\frac{1}{4}$ volume of each flask with limewater.
3. Close flask 'B' with a cork.
4. Pass a glass tube through another cork and fix it on the mouth of flask 'A'.
5. Take a deep breath and blow air in flask 'A' through the glass tube.

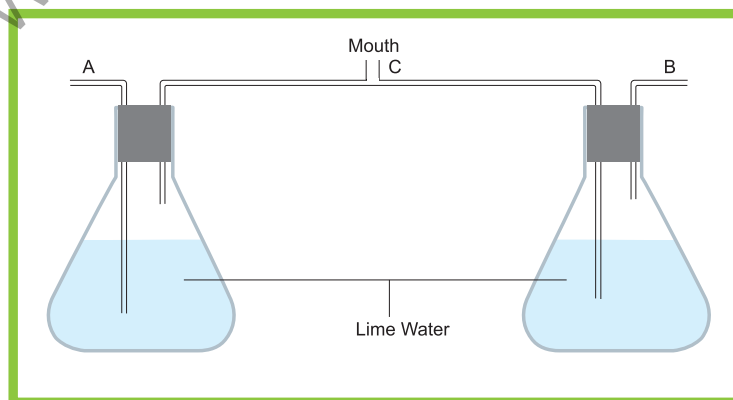


Fig 10.3 : Experimental Setup



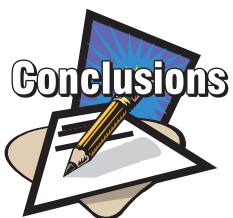
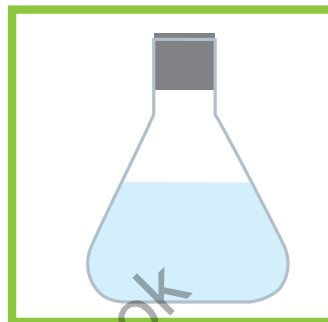


Observe the color changes in both flasks of lime water.

Flask A :



Flask B :



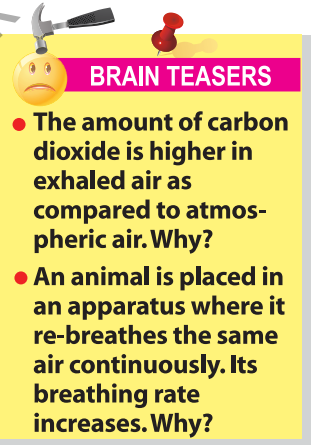
1. The result you have noted is only because of the carbon dioxide which is exhaled by your mouth and not from the surrounding air. Justify.



2. Which compound is formed when limewater combines with carbon dioxide?

3. Which of the flask is acting as a control? Justify.

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BRAIN TEASERS

- The amount of carbon dioxide is higher in exhaled air as compared to atmospheric air. Why?
- An animal is placed in an apparatus where it re-breathes the same air continuously. Its breathing rate increases. Why?



10.4

Demonstration of the presence of tar in cigarette smoke and also showing by charts and pictures the difference of lungs of smokers and non smokers

Date _____



Cigarette smoke contains numerous carcinogens (substances that may cause cancer), poisonous gases (carbon monoxide and hydrogen cyanide) and other chemicals. One of these chemicals is called tar (brown sticky substance) that collects in smoker's lungs from where it passes into blood. It also kills the cells of wind pipe and lungs. Cigarette smoke also contains a strongly addictive drug called nicotine. Even 0.07 gram of nicotine in blood can be poisonous.



Cigarette without filter, stand, matchbox, funnel, white tissue paper, cotton, pictures of lungs of smoker and a non smoker



Part 1:

1. Fix a lighted cigarette in a stand as shown in the figure.
2. Fix a funnel in stand over the cigarette.
3. Close the upper end of the stem of funnel with cotton.

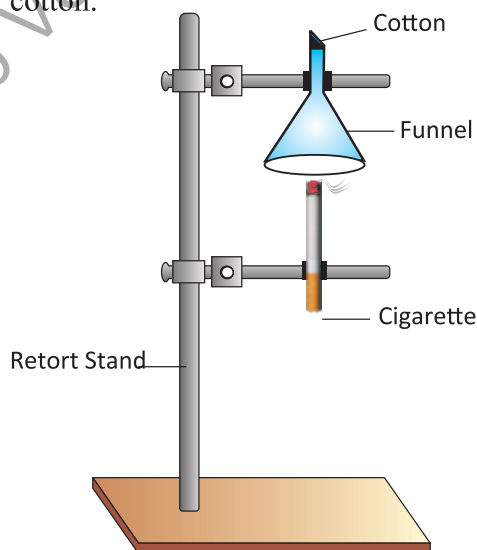


Figure 10.4: Experimental set up to detect tar in cigarette smoke



- Observe the presence of tar by rubbing white tissue paper on the inner surface of funnel.

Part 2:

- Examine the pictures of lungs of a smoker and a non-smoker and observe that tar in the smoke settles on the lining of bronchial tubes of a smoker.



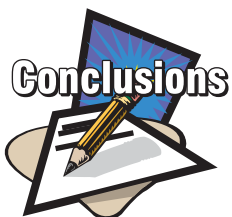
- Compare non-smokers' lungs with those of smokers and note your observations.

- Observe the following photographs. What do you observe about the position of the heart in normal and smoker's chest cavity?



Smoker's lungs and heart

Non-smoker's lungs and heart



Conclusions



Post Lab Activities

1- What are the main effects of smoking?

2- What are the effects of tar on lungs?

3- Write three measures taken by the government to discourage people from smoking and to reduce harmful effects of passive smoking?



BRAIN TEASERS

- Is small quantity of nicotine beneficial?
- Why there is more risk of heart attack among smokers?



11.1

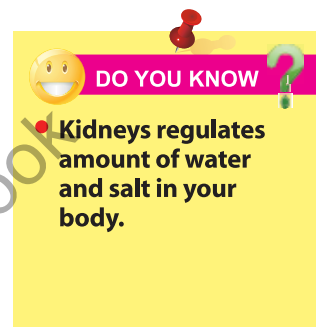
Examination of the structure of the kidney (Sheep kidney/ model)

Date _____

Experiment

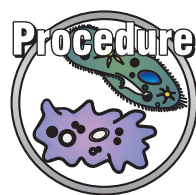


The kidneys are the main organs of urinary system. They are bean-shaped structures lying in abdominal cavity attached to the dorsal body wall. Inside mammalian body, there are two kidneys. The left kidney is slightly higher than the right one. A depression on the concave side of the kidney is called hilus.



A smooth semitransparent membrane that adheres tightly to the outer surface of the kidney is called renal capsule. Renal cortex is the outer region of the kidney. It is dark red in color and lies just below the capsule. Renal medulla is light in colour. It is the inner region of kidney and lies just deep to the cortex. It is segregated into triangular regions. The triangular regions are the renal pyramids, which converge in an empty space called renal pelvis.

Models / charts of sheep kidney, preserved sheep kidney, dissection box, 1% solution of sodium chloride, hand lens, board



1. Observe the different parts of the sheep kidney from the chart / model provided to you.
2. Obtain a fresh kidney of sheep.
3. Remove the fats to observe its external structure and expose the ureter, renal artery and renal vein.
4. Massage the kidney gently in warm saline water (1% solution of sodium chloride), so as to empty its vessels.
5. Cut the kidney longitudinally through the center, with the help of a sharp razor.

6. Observe the internal structure of the kidney, with the help of hand lens.

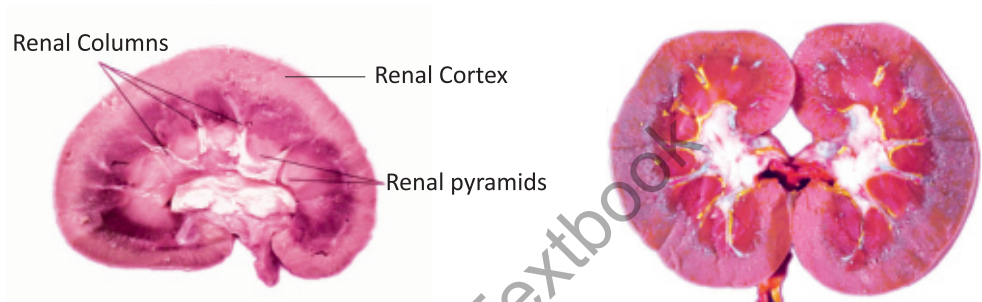
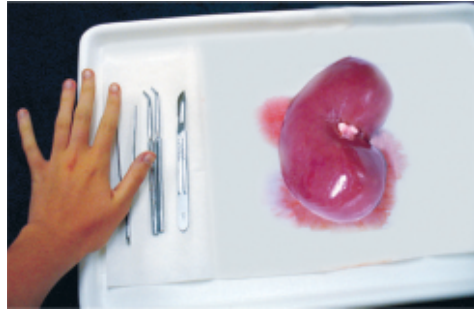
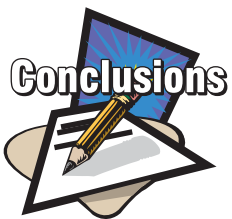


Figure 11.1: Dissection of sheep's kidney

Draw your observations, regarding the external and internal structure of the sheep kidney.





1. What is structural and functional unit of kidneys?

2. Which side of kidney faces vertebral column?
Convex or concave!



BRAIN TEASERS

- In the longitudinal section of kidney, why is the outer region darker than the inner region?
- What is the role of kidneys in the regulation of blood pressure?

CHAPTER COORDINATION

12



Experiment

12.1 ▶

Observation and recording of the difference in quickness of response of the two types of co-ordination (by asking a student to say few words in front of class and observe the changes in heart beat)

Date _____



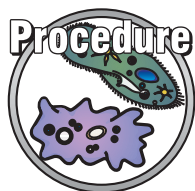
Background Information

Living organisms have the ability to respond or react to a stimulus. A stimulus is detected by receptors or sense organs. A response is brought about by an effector (muscle or gland). Co-ordination in human body is brought about by nervous and hormonal control. Nervous system coordinates the body activities enabling us to respond in an appropriate way to a given stimulus. Hormones are produced by endocrine glands and secreted directly into the blood. The adrenal glands produce adrenaline at the time of excitement, anger, fight or stress and prepare the body for flight or fight. The adrenaline increases the heart and breathing rates. The responses brought about by hormones are usually slower than the responses brought about by the nervous system.



Materials Required

Stopwatch, meter rod, stethoscope



Procedure

a- Response in Nervous Coordination

1. Student A: Stand up and hold the meter rod's upper end.
2. Student B: Sit in chair and keep your thumb and first finger near the zero reading of meter rod.
3. Student A: Leave the meter rod; Student B: Try to catch the meter rod, as soon as it starts falling.
4. Note the position along the ruler at which the Student B has caught the rod.
5. Repeat this test five times and record the distance.
6. Note down the shortest distance achieved.



	Distance at which the meter rod was caught (in cm)
First time	
Second time	
Third time	
Fourth time	
Fifth time	

Shortest distance achieved:

b- Response in Chemical (Hormonal) Coordination

1. Ask your partner to sit quietly and count his / her heart rate / pulse rate by counting the number of pulses per minute.
2. Repeat it several times and obtain the average pulse rate.
3. Now ask the partner to come to stage and speak for 4-5 minutes.
4. Record his / her heart rate and pulse rate immediately after the speech.
5. Note the change in heart rate.



CAUTIONS

- Students suffering from fever or asthma should not participate in this activity.

Record your observations in the table given below



Heart Rate

At Rest	After Speech

Conclusions

- The image shows a blank page from a textbook with horizontal ruling lines. A large diagonal watermark across the page reads "Web Version of PCTB Textbook". In the bottom right corner, there is a yellow box containing the title "BRAIN TEASERS" and two questions.

BRAIN TEASERS

 - Give an example of stimulus response in plants.
 - What are the effectors in nervous coordination?



- Give an example of stimulus response in plants.
- What are the effectors in nervous coordination?

Post Lab Activities

-



Experiment

12.2

► 12V. DC current

Date _____



Background Information

In vertebrates, skeletal muscles are voluntary and are used for movement. A large number of muscle fibers are grouped together to form a large muscle e.g., Gastrocnemius muscle in lower leg of the frog and human. In living organisms, muscle contracts by the action of a nerve impulse. Experimentally, a muscle can be stimulated to contract by applying an electrical stimulus directly to the muscle or to the attached nerve, which then sends an impulse to the muscle. If the nerve attached to a muscle is given a single electrical stimulus sufficient to produce an impulse, it will produce a single contraction of the muscle called a muscle twitch.

When a muscle contracts, oxidation-reduction reactions occur in it and some chemicals are released from contracting muscles. These chemicals reduce methylene blue solution and decolorize it.

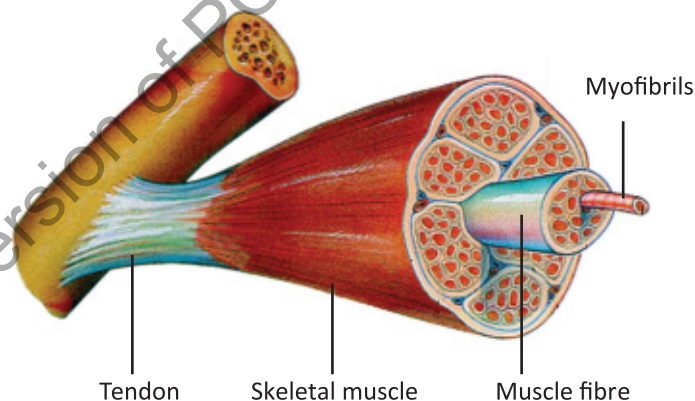


Fig 12.1 : Structure of Skeletal Muscle



Materials Required

Pithed frog, dissection box, methylene blue solution, Ringer's solution, petri dish, 12V. DC battery, two copper wires, dropper, vaseline



Procedure

1. Fill a petri dish with Ringer's solution and add a few drops of methylene blue solution in it.
2. Put the shin muscle of frog (provided by the teacher) in the petri dish.

3. Connect the wire of negative terminal of battery to one end of shin muscle. On the other end of muscle connect another wire.



Fig 12.2 : After skinning frog leg, Gastrocnemius muscle and underlying nerve is exposed

4. Cover the petri dish and seal it by using Vaseline (to avoid entry of air).
5. Connect the free end of wire with the positive terminal of battery.
6. Repeat it for a few minutes.

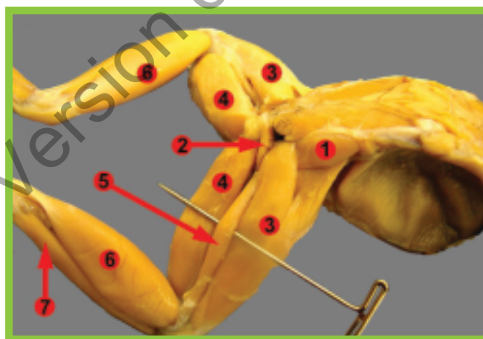


Fig 12.3 : The contraction in Frog's shin muscle using 12V.DC current

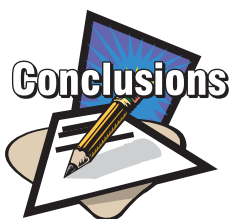


▲ CAUTIONS

- Good contacts of electric current are essential.
- Before covering the petri dish keep the nerve and muscle moist by frequently applying Ringer's solution.

- Observe changes regarding the contraction of Shin muscle.





Conclusions



Post Lab Activities

1. Note down changes in color of methylene blue. Also write down reason for color change.



BRAIN TEASERS

- What is the source of energy for muscle contraction and why do muscles contain many mitochondria?
- Which kind of muscle contracts without any conscious message from the brain?

2. What is meant by antagonistic muscles? Give an example.



12.3 ► Identify the different parts and draw a labeled diagram of longitudinal section of eye of a sheep or a bull

Date _____

Experiment



Eye is located in a bony socket or orbit, in the skull. The eyeball is a spherical fluid-filled structure which contains three tissue layers. The outermost layer is tough, white sclera, the middle layer is choroid and the inner layer is called retina.

When light strikes the eye, it passes through the cornea, a transparent portion of the sclera. It then passes through aqueous humor. Next, there is iris that is the colored part of the eye and is visible through the cornea. It has a hole in the centre, called the pupil. From aqueous humor, the light passes through pupil to the lens, which focuses it on the retina. Before reaching retina, light passes through vitreous humor. The part of retina where the receptor cells (cones) are packed tightly is called fovea. Here, light is focused when you look straight at an object.

DO YOU KNOW ?

- As the lens ages it becomes less flexible. Its ability to accommodate reduces, which weakens the sight. That is why older people wear eye glasses.

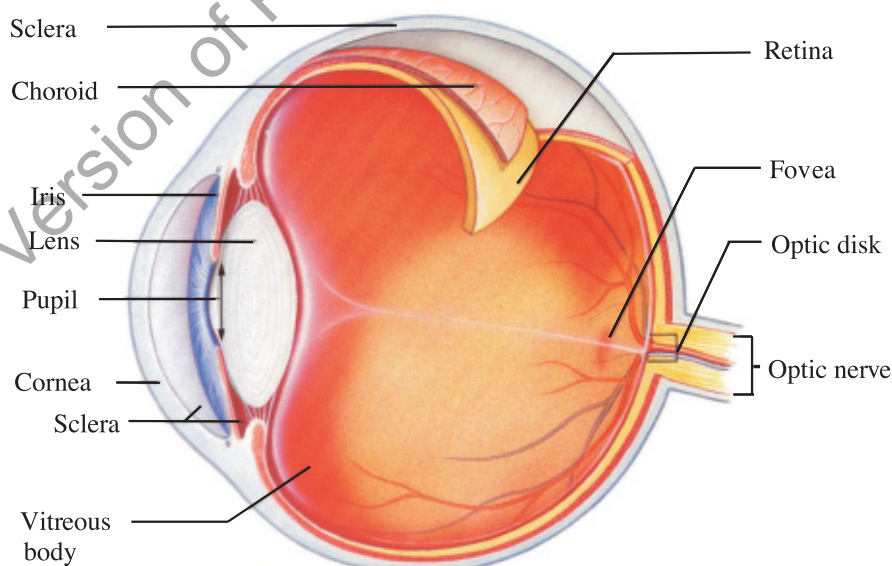


Fig 12.4 : The Structure of a typical mammalian eye

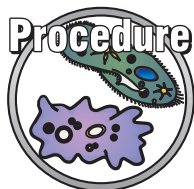


Sheep or bull eye, dissection box, water, gloves, paper towel, dissecting board, sheet of newspaper



CAUTIONS

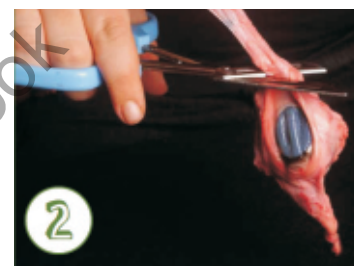
Use Gloves to avoid any cut on your hands.



1. Obtain the eye from the laboratory and observe its front view. Identify sclera, fat muscles, cornea, iris and pupil.



2. Cut the fat muscles with scissors.



3. Make an incision in the cornea with the help of scalpel. Cut until aqueous humor under the cornea is released.



4. Make an incision through the sclera in middle of the eye by using scalpel.



5. Put a cut around the middle of the eye in two halves. The front half is cornea. After removing the cornea from the front half, place it on the board and cut it with scalpel or razor through the layer of clear tissue.



6. Pull out the iris which is between cornea and lens. Identify the pupil.



7. Observe the back of the eye and identify vitreous humor.



8. Remove the lens by your hands.
Place this lens on a newspaper and see more magnified words.



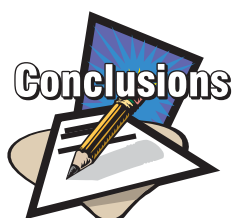
9. Observe the eye and drain all the vitreous humor. Identify retina on the inside of the back half of eyeball.



10. After completing the dissection, wrap all the pieces of eye in plastic bag and throw them in dust bin.



Draw and label the structure of the eye.





1. Which part of the eye contains the sensory cells?

2. List the pathway of light in the human eye.



BRAIN TEASERS

- When the animal is grazing, blades of grass may poke in the eye. Which part of the eye protects the inner eye?
- What type of lens is present in eye? Biconcave or biconvex!

CHAPTER SUPPORT AND MOVEMENT

13



13.1 ► Investigation of the nature of bone (by putting three pieces of the bone of lamb in water, NaOH and dilute HCl)

Date _____



Bone is made up of living cells, which are supplied with food and oxygen by blood vessels. The cells are arranged in rings around the blood vessels. Bone consists of different layers. The hardest layer of the bone, called compact bone, is on the outside. Below is a layer of spongy bone, which has spaces in it. In the center is the bone marrow, which is very soft and has a good supply of blood. Bone marrow is of two types i.e. yellow and red. Yellow marrow consists mainly of fat. Red marrow, which is found in certain bones such as pelvis and ribs, is where red blood cells, white blood cells and platelets are made. The ends of the bone are covered with a layer of cartilage. Bone is a form of connective tissue. Its matrix contains collagen fibers and minerals (calcium and magnesium salts). Minerals of bone e.g. calcium phosphate get dissolve upon the action of HCl, making bone porous. NaOH and water have no visible effect on bone.

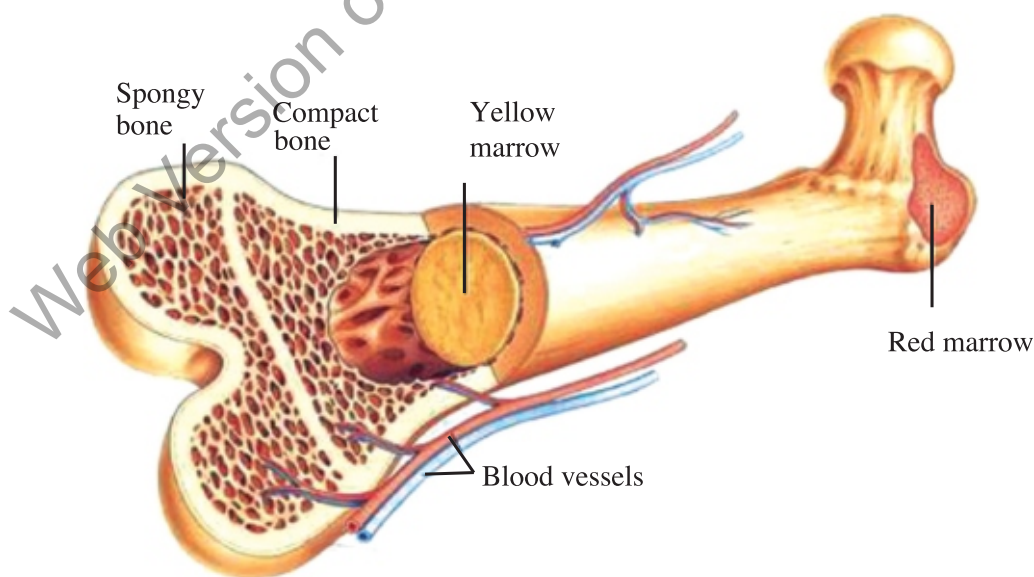
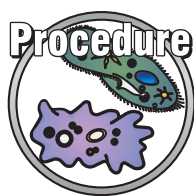


Fig 13.1 : Structure of a bone



Three pieces of rib bone of lamb (each of 2cm in length), NaOH, dilute HCl, water, forceps, beakers



1. Take three beakers of equal size and label them as A, B and C.
2. Put a piece of bone (about 2cm long) in each of them.
3. Fill the beakers with one fifth volumes of (A) NaOH, (B) dilute HCl and (C) water.
4. Observe changes in the bone structure after an hour.
5. Leave the apparatus for several days and observe changes in the bone structure.



Fig 13.2 : Rib bone of mammal



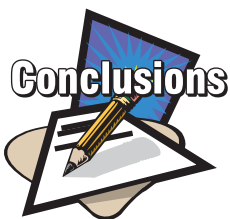
▲ CAUTIONS

- Handle the chemicals carefully
- Avoid splashes of chemicals.
- Leave the beakers away from yourself.



Record the changes in bone structure in the table given below.

In Dilute HCL	In NaOH	In Water





1. What is the type of bone marrow in the ribs?
Yellow or red!

2. What are good food sources of calcium?

A yellow box with a pink header 'BRAIN TEASERS' and a sad face icon. It contains two questions about bone decay and cartilage.

BRAIN TEASERS

- You observed that the bone did not decay in water. What can happen, if the bone is kept in water for months?
- At the joints, there is a soft cartilage between the bones. If there would be no cartilage what would happen to our bones?



14.1

Observation of binary fission in *Amoeba* by using slides, photomicrograph and charts

Date _____



Binary fission is a kind of asexual reproduction in many lower organisms like *Amoeba*, *Paramecium* etc. In binary fission, the parent organism divides into two daughter organisms of equal size, which then grow to a normal size. Binary fission takes place when the conditions are favorable. In *Amoeba*, binary fission takes place within 30 minutes at 20° C.

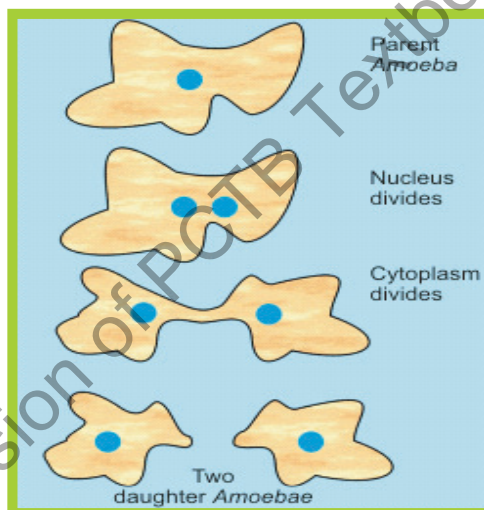
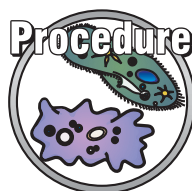


Fig 14.1 : Binary Fission in *Amoeba*

Prepared slides, photomicrographs and charts showing binary fission in *Amoeba*, microscope



1. Study the stages of binary fission in *Amoeba* from photomicrographs or charts.
2. Observe the prepared slide of binary fission in *Amoeba* under the low and high powers of microscope.
3. Locate the different stages of the binary fission.

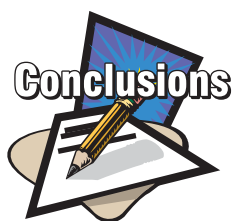


▲ CAUTIONS

- Do not lower the lens of the microscope without looking into the eye piece. Bring it lower very slowly and gradually.
- Handle the prepared slides carefully.



Observe and identify the various stages of binary fission and draw the labeled diagrams.





1. Obtain the permanent slide of binary fission in *Paramecium*. Note down the differences, if any, from the binary fission of *Amoeba*.

2. What type of cell division, binary fission is?
Mitosis or meiosis!



BRAIN TEASERS

- During unfavorable conditions, the parent *Amoeba* produces many cells at the same time. What type of fission is it?



14.2 ▶ Observation of budding in yeast from prepared slides

Date _____



Yeasts are unicellular fungi, found on the surface of fruits, in soil, water and even on dust in the air. Yeasts reproduce asexually by budding in which a bud develops as a small outgrowth on parent's body. The nucleus of the cell divides in two by mitosis. One daughter nucleus passes into bud. The bud grows steadily bigger and bigger until it is about the same size as the “parent” cell. The bud containing the new nucleus and other organelles then pinches off at the base, and breaks away to form a new cell similar to its parent cell. The buds may break off and live independently or it may remain attached forming a colony.

DO YOU KNOW

- Budding occurs at predetermined spots on cell wall.
- Parent cell may form more than one bud at a time.

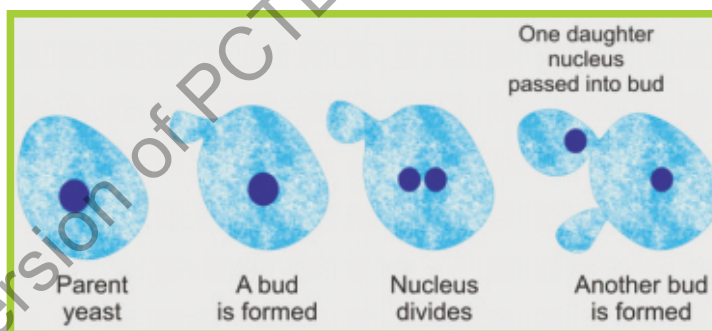


Fig 14.2 : Budding in Yeast

Prepared slides showing budding in yeast, microscope



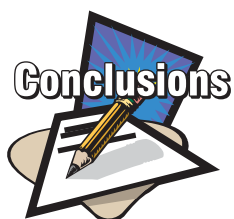
1. Observe the prepared slide of budding in yeast under low and high powers of microscope.
2. Locate the different stages of budding in yeast.

CAUTIONS

- Handle the microscope carefully.
- Clean the lens before use.



Observe and identify different stages of budding in yeast and draw the labeled diagrams.





1. What is the role of yeast in your daily life.?

2. Differentiate between budding and binary fission.

**BRAIN TEASERS**

- Suggest the name of any multicellular organism in which budding occurs.
- Compare budding in unicellular and multicellular organisms.



14.3

Examination of a bulb (onion), corm (colocasia), rhizome (ginger) and stem tuber (potato) and their cultivation to get new plants

Date _____

There are several types of underground storage organs formed from modified stem or root. These organs conserve food for the new growth and are also responsible for the vegetative reproduction in plants. Such energy reservoirs are all relatively large and fleshy. The main types of underground storage organs are bulbs, tubers, corms and rhizomes.



A-Bulb of Onion

A bulb is an underground shoot. It consists of a short vertical stem having adventitious roots with overlapping thick fleshy leaves. A tuft of adventitious roots arises from the base of the stem. Axillary buds are situated between the fleshy leaves bases and a terminal (apical) bud lies at the tip of the stem. Axillary buds develop into new bulbs while the terminal bud develops into new plant.

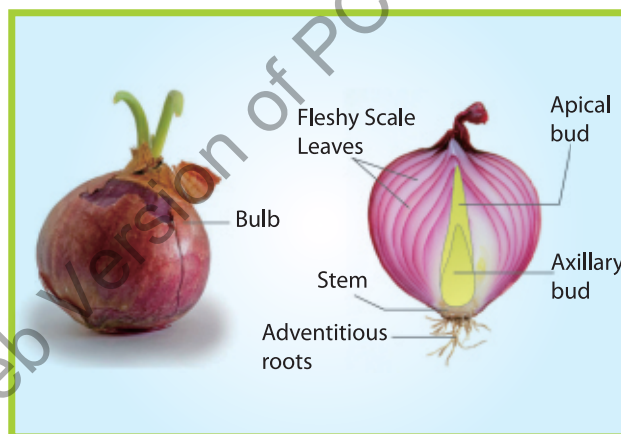
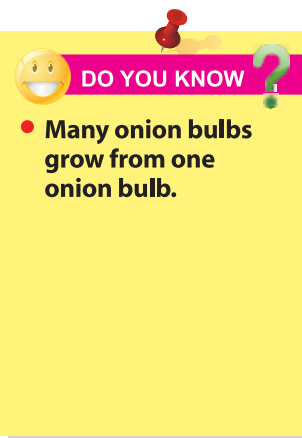
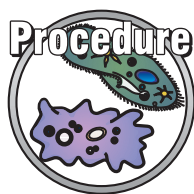


Fig 14.3 : Bulb of onion



Materials Required

Razor, hand lens, pots filled with soil, blade, needle, bulb (onion), corm (colocasia), rhizome (ginger) stem tuber (potato)



Procedure

1. Take a bulb of onion and examine its external parts.
2. Cut the bulb in half vertically and examine its internal parts by using hand lens.
3. Record your observations.

Cultivation of onion bulb

1. Sow one bulb in the soil and water it daily. Buds present in the scale leaves form stem through which branches emerge out.
2. Record your observations.

B - Corm of *Colocasia*

A corm is a short swollen vertically growing underground stem. It stores food and survives the winter, giving rise to a new plant from the terminal bud. On the surface of the stem there are a number of loose sheeting scale leaves which arise from the nodes. Adventitious roots keep the corm adhered to the soil. One or more buds lie at the axil of each leaf. Some of these buds grow into daughter corms while the terminal bud gives rise to aerial shoot.

 **DO YOU KNOW ?**

- During the growing season, the plant uses the food stored in the fleshy stem, and at the end of the season, the leaves provide food for producing a new corm on top of the old one.

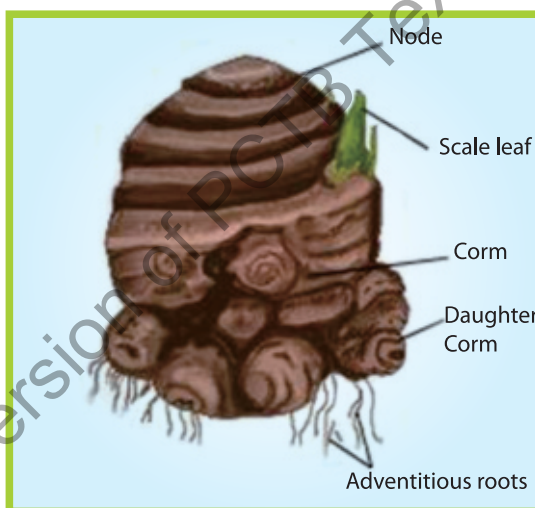


Fig 14.4 : Corm of *Colocasia*



1. Take a corm of *Colocasia* and examine its external parts.
2. Cut the corm in half vertically and examine its internal parts by using a hand lens.
3. Record your observations.

Cultivation of Corm of *Colocasia*

1. Sow a corm having at least one bud in the soil and water it daily. After a few days it will produce many corms.
2. Record your observations.



C- Rhizome of Ginger

A rhizome is a swollen stem bearing leaves and roots. It grows horizontally on or just below the soil surface and continues to live for many years. There are enlarged portions called nodes on rhizome. A small thin and dry brownish scale leaf is present at each node. Axillary buds are found in the axils of scale leaves while a terminal bud lies at the tip of rhizome. The terminal bud produces leaves and flowers above the ground. The lower surface of rhizome has adventitious roots.

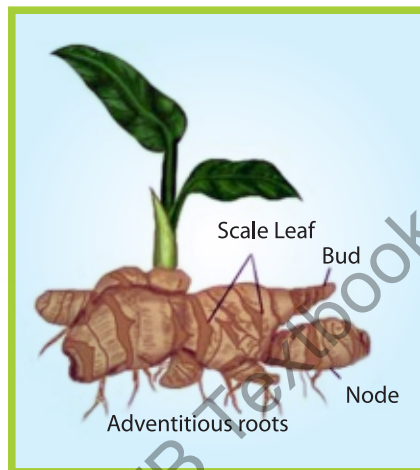


Fig 14.5 : Rhizome of Ginger



1. Take a rhizome of ginger and examine its parts.
2. Record your observations.

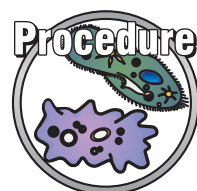
Cultivation of Ginger Rhizome

1. Sow ginger rhizome having nodes / buds and water it daily. After some days, new branches emerge and develop into new ginger.
2. Record your observations.



D-Stem Tuber of Potato

A stem tuber is a swollen underground stem which stores food, survives the winter, and gives rise to new plants the following year. There are aggregations of tiny buds in the form of “eyes” along the surface of tuber. Scale leaves lie close to the eyes. Each bud develops into a shoot that grows upward and also produces roots.



1. Take a stem tuber of potato and examine its parts.
2. Record your observations.

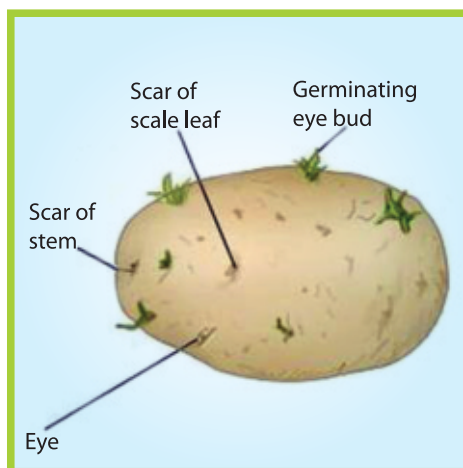


Fig 14.6 : A Stem tuber

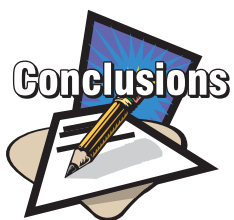
Cultivation of stem Tuber of Potato

1. Sow stem tuber of potato having at least one or a few eyes and water it daily. After some days, eye will grow into new shoot which will produce new stem tuber.
2. Record your observations.



- ☐ Draw your observations regarding the structure of a bulb, a corm, a rhizome and a stem tuber.

- ☐ Draw your observations regarding the growth in the cultivated bulb, corm, rhizome and stem tuber.



Conclusions



Post Lab Activities

1. What is meant by the “eye” present on a potato?

2. Define a bulb, a rhizome, a corm and a tuber.

3. Give the advantages of vegetative reproduction in the plants.



BRAIN TEASERS

- Why potato is called under-ground stem instead of root?



14.4 ► Propagation by stem cuttings (rose or any locally available plant) and *Bryophyllum* leaf

Date _____



Cutting is an artificial method of vegetative propagation in many plants e.g. rose, *Hibiscus*, leechi etc. Gardeners use it widely. In this method, cutting is taken mainly from the stem and roots of the parent plant. These cuttings must have meristematic region from where growth can occur. When cuttings are placed in a suitable soil and under favorable conditions (sufficient nutrients, water and sunlight), their roots and shoots grow and develop into the plants identical to the parent plant. This process is used to produce many plants from a single plant.



Fig 14.7 : Stem Cutting in Rose

Vegetative propagation can also occur by leaves cutting. It is not common and is seen in few plants e.g. *Bryophyllum*. It has fleshy leaves and adventitious buds are present at the margins of its leaves. When a leaf falls on the ground, the buds grow into new plants.



Fig 14.8 : Bryophyllum Leaf



Materials Required

Rose plant or any locally available plant, *Bryophyllum* leaves, sharp razor blade, pots filled with soil.



Procedure

a. Propagation by stem cutting (rose)

1. Take a sharp razor blade and cut 8-10 inches long piece of healthy shoot of rose plant just below a node. The stem should be cut obliquely and the cutting should have 2-3 nodes.
2. Clean off the majority of the leaves from the cutting to prevent massive water loss due to transpiration.
3. Now insert the 2/3 part of the cutting (having at least one node) into a fertile soil and place the pot under favorable conditions.
4. Water the cuttings regularly and wait for few weeks.



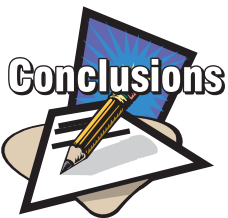
CAUTIONS

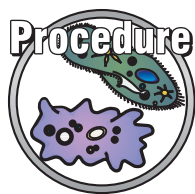
- Use the razor blade carefully.
- Water the cuttings regularly.



Observations

Observe the cuttings and note the growth of root and shoot. Draw what you have observed



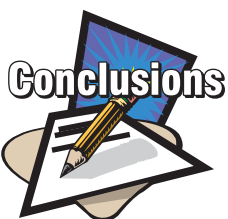


b. Propagation by leaf cutting

1. Take some *Bryophyllum* leaves and cut them into small pieces. Each piece must have one adventitious bud.
2. Place them on the surface of damp fertile soil.
3. Cover them partially with soil and sprinkle the water regularly.
4. After some weeks observe the parent *Bryophyllum* leaf pieces and record your observations.



Observe the cuttings and note the growth of root and shoot. Draw your observations.





1. What are the disadvantages of artificial propagation?

2. Give some other examples where you use this process (stem cutting or leaf cutting).

3. In which months of the year you can get best results from rose cuttings?

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A yellow rectangular box with a pink header containing a sad face icon and the text 'BRAIN TEASERS'. Below the header, there are three red bullet points with text. The box is decorated with a hammer and a red pushpin at the top.

BRAIN TEASERS

- Why did we cut the stem below the node?
- Why did we use thick stems for stem cutting?
- What part of *Bryophyllum* leaf gives rise to a new plant?



14.5

Examination of mustard flower, gram seed and maize grain

Date _____



a: Examination of mustard flower

Flower is the reproductive part of a plant. *Brassica* flower consists of stalk called pedicel. The flattened tip of pedicel is called thalamus or receptacle, on which floral leaves are arranged in whorls. Sepals are four in number and generally greenish in color situated at the base of the flower. The whorl of sepals is known as calyx. Petals are four in number, yellow in colour and lie just inside the sepals. The whorl of petals is called corolla. Stamens are six in number and are male organs of the flower. The whorl of stamen is known as androecium, which lies inside the petals. Each stamen has a single stalk called the filament which bears two small sacks at its tip called anthers. Anthers contain pollen grain. Carpel is a female organ of the flower and the whorl of carpels is called gynoecium. It lies in the centre and consists of two carpels, which are fused together. Each carpel has a swollen lower part called ovary. The ovary extends above into a thin stalk called style and swollen tip of style is called stigma. The ovary contains ovules, which are ripened to form seeds. Ovary is ripened to form fruit.

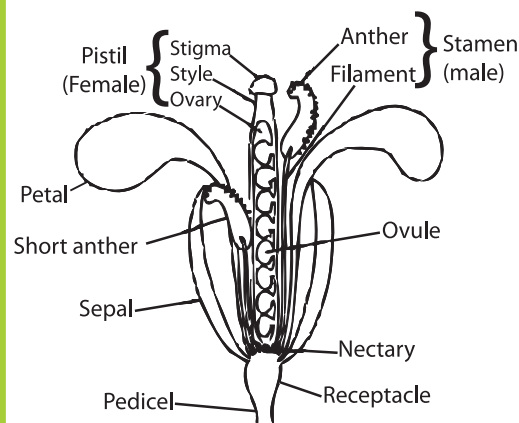
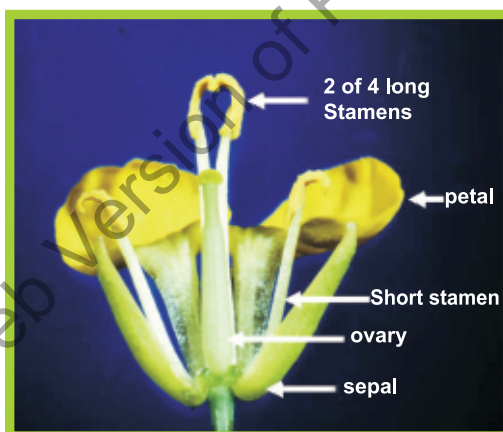
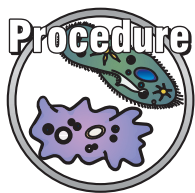


Fig 14.9 : Structure of Brassica Flower

Brassica flower, magnifying glass, glass slide or petri dish, forceps



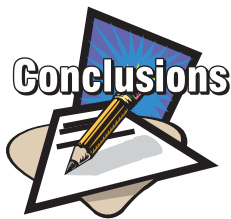
Procedure



1. Take a *Brassica* flower, place it on a glass slide and observe its parts by a magnifying glass.
2. Separate its various parts by using forceps and study them.



Identify the parts of flower and draw labelled diagram.





b: Examination of gram seed and maize grain

A seed develops from an ovule after fertilization. It consists of a protective seed coat called testa, which varies from a thin membrane to tough covering. The testa is enclosing an embryo which consists of a plumule (young shoot), a radicle (young root) and one or two cotyledons (seed leaves). Seed has a tiny hole called micropyle, which is the main site of water entry. The seed coat of gram seed is tough and hard. In maize grain, cotyledon is modified into an organ called scutellum. In some seeds, the cotyledon contains food reserves while in others a separate tissue called endosperm is present for nourishment. Seeds of monocotyledonous plants have one cotyledon while those of the dicotyledonous plants have two cotyledons.

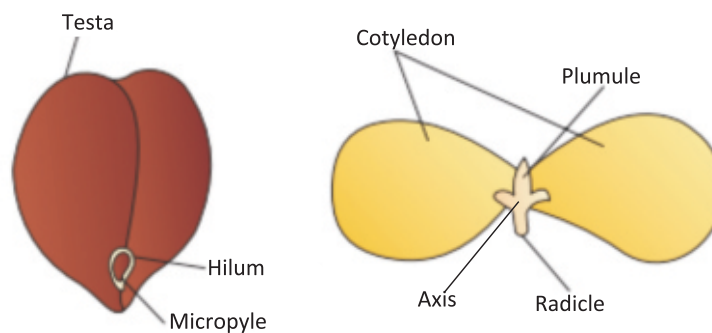


Fig 14.10 : Gram Seed (External and Internal) Structure

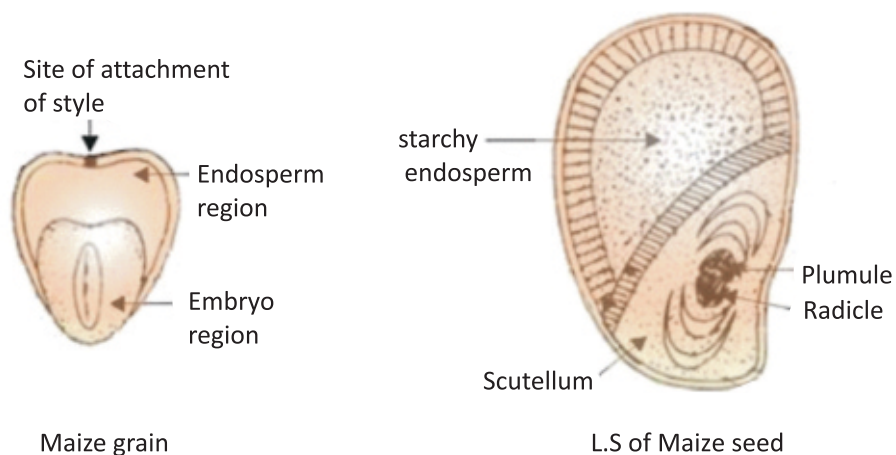


Fig 14.11 : Maize grain (External and Internal) structure



Materials Required

Gram seed, maize grain, watch glass, microscope, dissecting box



CAUTIONS



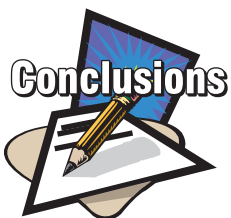
Procedure

1. Examine the external features of dry and soaked gram seeds and maize grains.
2. Cut longitudinally through the soaked seeds and identify the internal structures.

Record your observations in the following table and draw diagrams.

	Characteristics	Gram Seed	Maize grain
External Structure	Shape		
	Colour		
	Hardness / Softness		
Internal Structure	Endospermic or non-endospermic		
	Monocotyledonous or dicotyledonous		
	Location of embryo plumule, radical		





Conclusions



Post Lab Activities

1. Why is it necessary for a seed to absorb water before it can germinate?

2. Seeds develop from ovule while fruits develop from ovary. How do the seedless fruits develop?



BRAIN TEASERS

- What are the advantages of seeds being in a dried out state while they are lying in the soil?
- Name some edible flowers.
- Why a maize grain is known as a fruit?



14.6 Investigation of the conditions for seed germination

Date _____



The process through which a seed becomes active to form a young seedling is called seed germination. Favorable conditions (water, temperature, oxygen etc) are required for seed germination. The embryonic stem below the point of attachment of the cotyledons is the hypocotyl and above the point of attachment is epicotyl. The root is the first structure that emerges from the radicle present in the seeds. Then plumule develops into tiny shoot which elongates and comes out of soil.

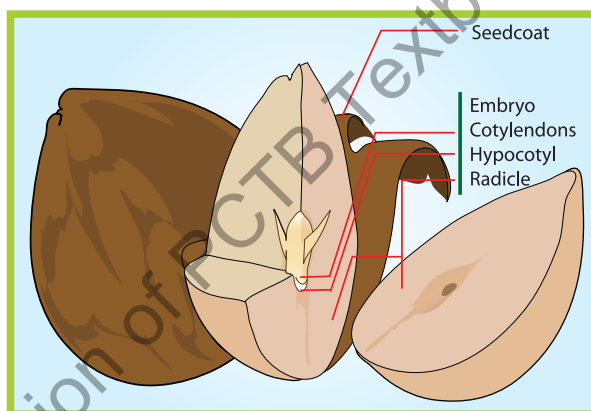
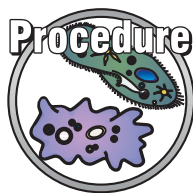


Fig 14.12 : Structure of a typical seed

The seeds of most plants when ripe have low water content and germination can not occur until the seed coat and other tissues have imbibed (taken in) water. Air provides oxygen for the respiration in the cells of embryo. Seeds differ greatly in their temperature requirement for germination. The optimum temperature for the germination of the seeds of most plants ranges from 25-30°C.



Petri dishes, beakers, cotton wool, gram / bean / pea / wheat seeds, refrigerator, incubator

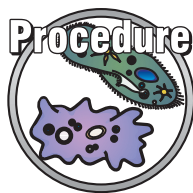
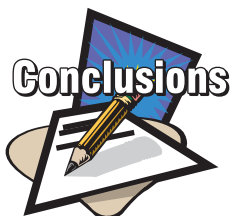


a: To investigate that water is essential for germination

1. Label the three petri dishes as A, B and C.
2. Put a layer of cotton wool at the bottom of each dish.
3. Place 5-6 seeds (soaked for twelve hours) in Petri dish A on moist cotton wool.
4. Place 5-6 soaked seeds in Petri dish B but keep the cotton wool dry.
5. Place 5-6 un-soaked seeds of gram in Petri dish C on dry cotton wool.
6. Leave the three Petri dishes for a few days.



Note down the germination of seeds in each Petri dish and draw your observation.

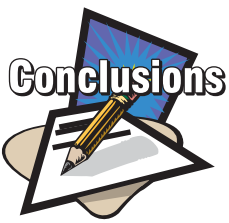


b: To investigate the effect of temperature on germination

1. Label the three Petri dishes as A, B and C and place a layer of moist cotton wool in each of them.
2. Put 5-6 soaked seeds in each Petri dish.
3. Place the Petri dish A at 35 °C (in incubator), petri dish B at 4 °C (in refrigerator) and Petri dish C at room temperature (20 °C).
4. Leave the three Petri dishes for one week.

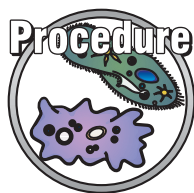


Note down the germination of seeds in each petri dish and draw your observation



Conclusions

c: To investigate the oxygen requirement for germination of seeds



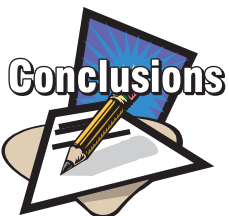
Procedure

1. Take two 500 ml beakers and label them as A and B.
2. Fill half of beaker A with fertile soil and put some soaked seeds not more than 1-2 cm deep.
3. Put some soaked seeds in beaker B and fill this beaker completely with fertile soil.
4. Pack the beaker B in the polythene bag.
5. Keep the beakers for a few days.



Observations

Note down the germination of seeds in each beaker and draw your observation.



Conclusions



Post Lab. Activities

1. If temperature is 50°C but other conditions for germination are suitable, whether the seeds would germinate or not?

2. When does a seed complete its germination?

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15.1 ►

Recording the heights of class fellows to predict which kind of variation is it and presentation of the data of class fellows' heights in graphical form (either histogram or bar chart)

Date _____



All of us belong to the same species i.e. *Homo sapiens*, yet each one of us looks different. These differences that are observed among individuals within a species are called variations. Variations are of two kinds (i) Continuous variations (ii) Discontinuous variations. In continuous variations there is a complete range of measurements from one extreme to the other. Continuous variations are the combined effects of many genes and are often affected by environmental influences. Human height, skin colour, intelligence and kernel colour in sweet corn etc. are examples of continuous variations.

Discontinuous variations show distinct phenotypes, and are based on features that cannot be measured. The individuals of a population either have the characteristic or they do not have it. Discontinuous variations are controlled by a single gene pair. The environment has little effect on this type of variation. Height in pea plants, tongue rolling and blood groups in humans are examples of discontinuous variations.

The graphical representation of the data of a hereditary trait is called histogram. In a histogram of hereditary data, the horizontal axis shows the range of different phenotypes of a trait and the vertical axis indicates the number of individuals in the population.

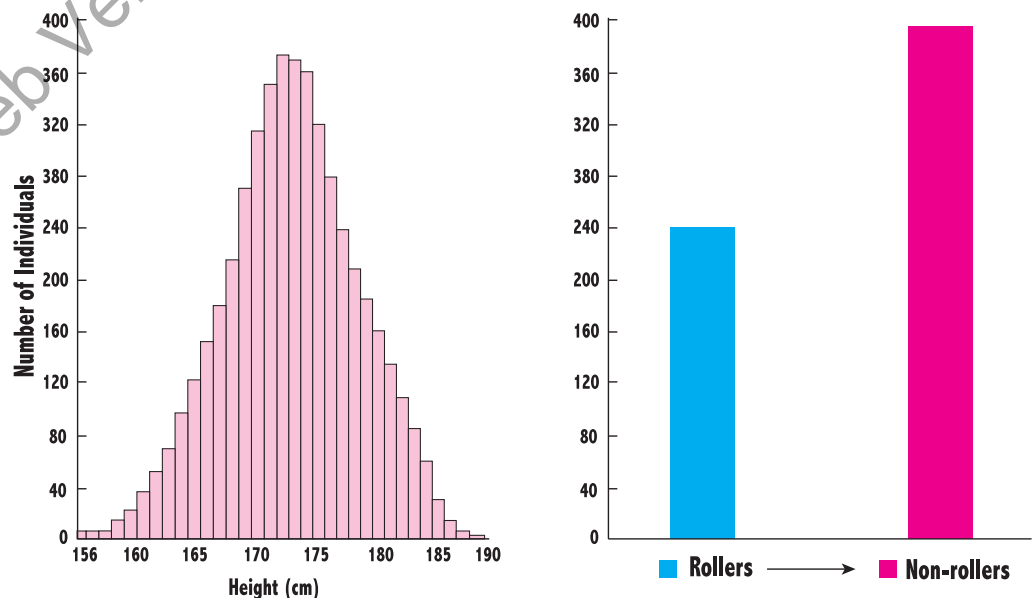
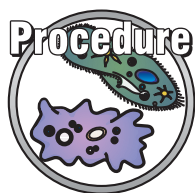


Figure 15.1: (a) Histogram of continuous variation (b) and discontinuous variations



Measuring tape, Graph paper

Procedure



1. Measure and record the heights of all the students of your class in inches.
2. Now arrange the heights in order of magnitude and make a frequency table. The table should show the height ranges as follows.

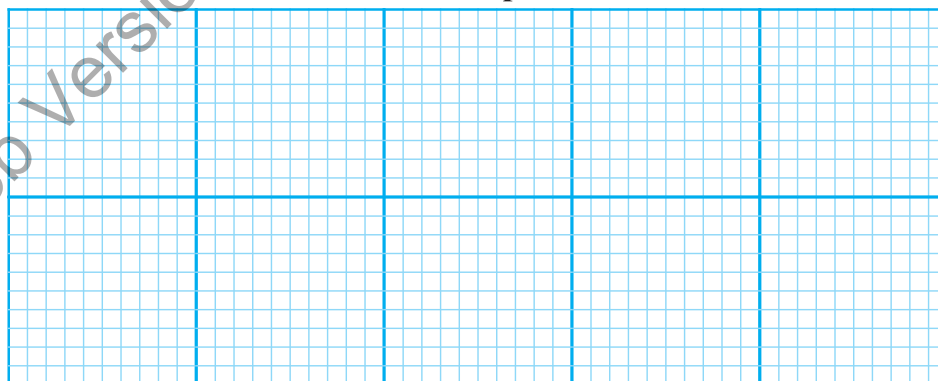
FREQUENCY TABLE

Groups	Height (Range in inches)	Frequency (No. of Students)
1	Less than 55 inches	
2	56-58 inches	
3	59-61 inches	
4	62-64 inches	
5	65-67 inches	
6	68-70 inches	
7	71-73 inches	

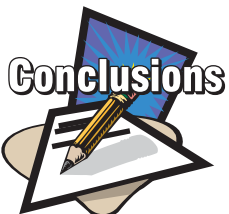


Construct a histogram from the above data.

Graph

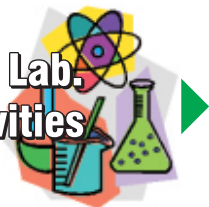


By visualizing your histogram, explain what type of trait is human height.



Conclusions

Post Lab. Activities



1. List the different continuous variations in plants.

2. Count the number of “tongue-rollers” and “non-tongue-rollers” in your class and tabulate the data.

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BRAIN TEASERS

- Who are tongue rollers?
- Give examples of common discontinuous variations in humans.

MAN AND HIS ENVIRONMENT



Experiment

16.1

Investigation of an ecosystem e.g. an aquarium or a pond

Date _____



A natural self-sufficient unit composed of biotic community and its abiotic environment is known as an ecosystem. Pond is an example of freshwater ecosystem in which, like other ecosystems, there are two types of components; i.e. abiotic components and biotic components. Abiotic components of pond consist of water, solid, temperature, light, air, etc. Solar radiations are the main source of energy. The biotic components include producers, consumers and decomposers.

Producers are autotrophs (prepare their food) and include plants, algae and photosynthetic bacteria. Consumers are heterotrophs (depend on the producers for their food) and include the herbivore, carnivore and omnivore animals. Primary consumers (i.e herbivores) eat producers; secondary consumers (i.e. carnivore eat primary consumers, and tertiary consumers (i.e carnivore eat secondary consumers. Decomposers are saprophytic organisms (e.g. many bacteria and fungi) which decompose the wastes and dead bodies of plants and animals into inorganic materials.

DO YOU KNOW

- Aquatic ecosystems are vulnerable to the direct and indirect impacts of environmental pressures around them mainly in terms of getting nutrients.
- Oceans alone cover nearly three-quarters of the Earth's surface. Oceans and other aquatic ecosystems provide food and other resources necessary for all life on the planet.

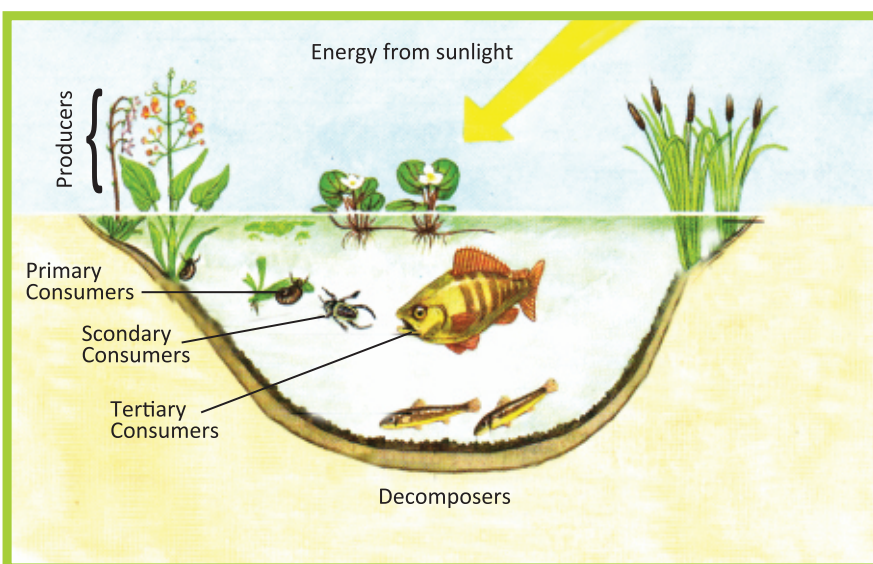
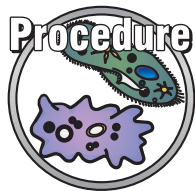


Fig 16.1 : Schematic diagram of a typical pond ecosystem



Materials Required

Insect net, microscope, hand lens, slides, cover slips, jars, rubber bands, tin cans, markers, plastic bags



Procedure

(Your school administration or teacher would manage a visit to a nearby pond ecosystem. A garden or a desert may also be visited, if visit to a pond is not feasible.)

1. Observe the different types of plants growing around and in your selected ecosystem. Under your teacher's supervision, collect some samples of the plants growing there.
2. Note the different types of animals present there and collect samples of these by using insect net.
3. Collect samples of water and soil from the different zones of the ecosystem. Observe the water sample by using hand lens or microscope.



CAUTIONS

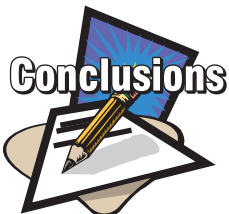
- Be careful during sample collection from the pond



Observations

Fill the following table.

	Name of the Animal or Plant	Description	Any Special characteristics
Producers			
Primary Consumers			
Secondary Consumers			
Tertiary Consumers			
Decomposers			
Soil	-----		
Water	-----		
Temperature	-----		



Conclusions



1. Give an example of terrestrial ecosystem. How is it different from pond ecosystem?

2. You know the different categories of consumers i.e. primary, secondary, tertiary consumers. In which category the omnivores fall?

3. How a pond works as a self-sufficient and self-regulating system?

4. What types of decomposers are usually found in a pond ecosystem?



17.1 ►

Investigation about the role of yeast and bacteria in the fermentation of flour and milk

Date _____

a- Fermentation of Milk

Background Information

Yoghurt is formed by the fermentation of milk at warm temperature by bacterial cultures. Milk contains lactose which can be fermented to lactic acid by the enzymes produced by lactic acid bacteria (e.g. *Lactobacillus*). These bacteria ferment the lactose in the milk and form yoghurt.



DO YOU KNOW ?

- Yoghurt originated in the Balkans and the Middle East; it is now quite popular in Asia, Europe and America, as well.

Materials Required

One cup of milk, paper cups, one tablespoon yoghurt, spoon, stove / Bunsen burner, match stick, beaker.



▲ CAUTIONS

- The temperature of the mixture must not rise above 45°C during the process of fermentation.
- Do not keep the mixture at a cool place as fermentation will not take place at low temperature.

Procedure

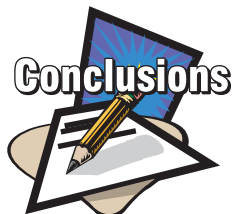
1. Heat the fresh milk slowly to 85°C and keep it at this temperature for 2 minutes (to kill microorganisms).
2. Cool the milk to 40°C slowly.
3. Put a spoon of yoghurt in a cup.
4. Fill the cup with milk and stir.
5. Cover the cup with a cling wrap or any other way and place it in an oven or warm place at 40°C.



Fig 17.1 : Yoghurt formation



Record your observations regarding the physical nature of the mixture.





b- Fermentation of Flour

Flour is fermented by the yeast. Flour contains starch and some of this break down to the sugar maltose when flour is moistened. When yeast is added to the dough, it further breaks down the sugar as it carries out fermentation.



Flour, jar, water, beaker, Baker's yeast



1. Soak one tablespoon of Baker's yeast in a small quantity of water for a few minutes.
2. Take a bowl and put some flour in it.
3. Mix water with flour. Add yeast in it and make dough.
4. Keep this bowl at room temperature for 4-6 hours.

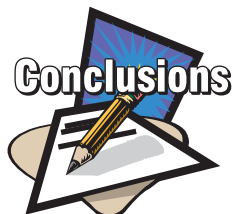


Fig 17.2 : Flour fermentation



Observations

Record your observations regarding the physical nature of the mixture.



Conclusions



Post Lab.
Activities

1. What is pasteurization?

2. During fermentation, why did we maintain the temperature between 40-45°C?

3. What other food products we obtain from the fermentation of milk?

4. What other food products are made by using the fermented flour?



BRAIN TEASERS

- Why fresh milk is pasteurized before the fermentation process?
- Why is it a good idea to keep bread in refrigerator?