



BIOLOGY PRACTICAL NOTEBOOK

STANDARD XI



BIOLOGY

Standard XI

Practical Notebook

Name of the student : _____

Name of the Junior college: _____

Class : _____ Division : _____ Roll No. : _____



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Maharashtra State Bureau of Textbook Production and Curriculum
Research, Pune - 411 004.

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Paper :

70 GSM Creamwove

Print Order :

Printer

Production :

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Publisher :

Shri. Vivek Uttam Gosavi
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Maharashtra State Textbook Bureau
Prabhadevi, Mumbai-400 025.

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FOREWARD

Dear Friends,

The National Curriculum Framework (NCF) 2005 and State Curriculum Frame (SCF) 2010, recommend that children's life at school must be linked to their daily life. That is why a new educational system linking school, society and family is forming instead of bookish education. While the boundaries of different subjects are becoming gray, it has become very much necessary to develop skills of respective subjects, to reach the fundamental concepts, and content and to inreach the test for the concerned subject.

Biology is a subject that must be learnt through practical, activities and observations. Laboratory is a place where students have opportunities for clarification of concepts, they are introduced in the theory course. While performing experiments regarding mountings, slide preparations and specimen identification the students must estimate the errors in their observations and skills, thereby realizing the accuracy and precision of their results. Various parts have been covered in the notebook, thereby facilitating teachers in the proper evaluation of the student in the laboratory. Few projects have been included in the syllabus to make the student familiar with natural resources and their management, similarly this projects will inculcate scientific temper among students. An opportunity to verify the theoretical part in the textbook is obtained through the practical work. All these points are taken into account in this notebook. It will be possible to evaluate the students, with respect to basic of experimental skills, observational methods and skills.

A detailed procedure is given for the practicals included as per the syllabus in the textbook. In addition, thought provoking questions based on the practicals are given. All these should be used not only for the practical examination, but it is expected to be used also for science education through experimental skill. This handbook could be used as a good supplementary material for learning biology. QR code is given on first page; by using QR code you can get additional audio-visual information regarding the practicals and activities.

We are sure, you all will welcome this biology practical notebook prepared with due concern and care. Also taking this note, we wish you all the best for your educational career.



(Dr. Sunil Magar)
Director

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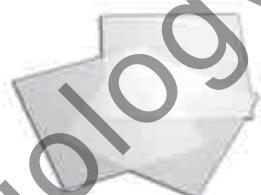
Pune

Date : 20 June 2019

Bharatiya Saur: 30 Jyeshtha 1941

Biology Laboratory Apparatus

1. Collect the information about different instruments, apparatus and other material in your laboratories.
2. Read the books on Scientists and their discoveries.



INDEX

Name of the experiment	Page No.	Date	Signature
A. List of experiments to be performed			
1. Study the part of microscopes.	3 - 8		
2. To observe mitochondria in onion peel cells.	9 - 11		
3. Biochemical tests.	12 - 15		
4. Preparation of stained temporary mount of onion root tip to study mitosis.	16 - 21		
5. To Prepare a Temporary stained slides of Dicot and Monocot specimens.	22 - 28		
6. Study of plant family (Vegetative and Floral characteristics).	29 - 38		
7. To prepare a temporary stained slide of squamous epithelium.	39 - 40		
8. To study the effect of Light on the rate of Photosynthesis.	41 - 45		
9. To study Human dentition.	46 - 47		
10. To study the effect of enzymes on starch, egg albumin and fats.	48 - 50		
11. To test Urine sample for Normal and Abnormal Constituents.	51 - 54		
B. Demonstrative experiments (Spotting) :			
1. Study of specimens and identification with reasons.	55 - 64		
2. Study of specimens and their identification	65 - 80		
3. Study of permanent slide's of T.S. root's of sunflower and maize.	81 - 83		
4. Study of modifications of root, stem and leaf.	84 - 89		
5. Study and identification of Inflorescence	90 - 91		
6. Study of animal tissues like blood smear, cartilage, mammalian bone and muscles (striated, non-striated and cardiac)	92 - 97		
7. Demonstration of Aerobic respiration using Ganong's respirometer.	98 - 100		
8. To Demonstrate Anaerobic respiration.	101 - 102		
9. To study: External morphology, Digestive system of Cockroach with the help of ICT, photographs, models and chart.	103 - 107		
10. To study Mouth part, Gizzard and Trachea of Cockroach with the help of ICT, photographs, models and chart.	108 - 111		
11. Study of histology of digestive organs of mammals viz, T.S. of Pancreas, small intestine and Liver	112 - 114		
12. Study of Human skeleton- (Axial and Appendicular skeleton.)	115 - 122		
C. List of Projects			

BIOLOGY
STANDARD XI
Scheme of practical examination

Biology practical examination

Skeleton question paper

Time 3 Hours

Total marks 30

Q. 1 Make temporary, stained preparation of T.S of sunflower stem.	4
or		
Prepare a temporary stained, squash of onion root tip to show various stages of mitosis. Sketch and label any one stage of mitosis.		
Q. 2 Make a temporary slide of peeling of given onion to show mitochondria.	3
or		
Study the vegetative and floral character of given plant material (family Solanaceae or Fabaceae).		
or		
Perform the biochemical test for Starch (grain mounting)/ Sugar/ Proteins/ Fats .		
Q. 3 Test the given sample of urine for and and make note on its clinical significance.	4
Q. 4 Perform the physiological experiment to demonstrate the effect of salivary amylase on starch/ pepsin on egg albumin/ bile on fats.	3
or		
Make a temporary stained slide of squamous epithelium and draw a labelled diagram.	6
Q. 5 Comment upon the spots as per instruction		
A) Identification of plant specimen / slide.		
B) Root / Stem/ Leaf specimen.		
C) Study of Aerobic and Anaerobic Respiration.		
D) Identification of animal specimen of slide.		
E) Animal tissues / T.S of small intestine or liver or pancreas.		
F) Specimen from 'Human Skeleton'.		
Q. 6 Project report (may be submitted in the form of collection of plants / animals / slides of biological data collection / report on relevant topic)	5
Q. 7 Viva voce based on first four questions.	2
Q. 8 Duly certified practical Record book.	3

A. EXPERIMENTS TO BE PERFORMED

1. Study the parts of microscopes

Date :

Aim : To study the parts of compound microscope and their functions.

Requirements : Compound Microscope, Simple Microscope

Principle : A compound microscope is an indispensable instrument in any biological laboratory. It is used for passive observation of structural details of a cell, tissue or organ in sections. A monocular compound microscope and simple microscope is normally used in biology laboratory. A modern compound microscope has following structural components as non-optical and optical.

Non-Optical Components

1. **Base (Foot)**: It is U or horseshoe-shaped metallic structure that supports the whole microscope.
2. **Arm (Limb)**: It is a curved metallic handle that connects with the base by inclination joint. It supports stage and body tube.
3. **Inclination Joint**: It is used for tilting the microscope if required for observation in sitting position.
4. **Stage**: It is a metallic platform with a central hole fitted to the lower part of the arm. Microscopic slides are held on the stage by either simple side clips or by a mechanical stage clip.
5. **Body tube**: It holds ocular and objective lenses at its two ends. The end holding ocular lens is called head while the end containing 3-4 objective lenses is called nose piece. The body tube has an internal pathway for the passage of light rays which form the enlarged image of microscopic objects.
6. **Draw tube**: It is a small tube that remains fixed at the upper end of the body tube. It holds eyepiece or ocular lens.
7. **Adjustment screws**: There are two pairs of screws for moving the body tube in relation to stage, larger for coarse adjustment and smaller for fine adjustment.
 - a. In coarse adjustment, body tube moves up/down.
 - b. In fine adjustment, body tube moves up/down, but in extremely short distances.

The coarse adjustment is meant for movement of objective lens to a proper distance from the object so as to form image of the same at the ocular end. Fine adjustment is required to obtain sharp image.

Optical Components

1. **Ocular Lens or Eyepiece**: It is lens through which image of the microscopic object is observed. It also takes part in magnification. Depending upon magnification and as per requirements the eye piece can be used normally 5x to 20x.
2. **Objective Lenses**: They are fitted under the nose piece. Objective lenses are of three types –i) low power (commonly 10X or 5X), ii) high power (commonly 45X) iii) oil immersion (commonly 100X, or more). An objective lens is not a single lens but compound lens. It forms real inverted image of the object inside the body tube.
3. **Diaphragm**: It is fitted just below the stage for regulating the amount of light reaches on the object. Diaphragm is of two types, disc and iris.

4. **Condenser:** It is attached below the diaphragm. Condenser can be moved up and down.
5. **Mirror:** It is attached just above the base. Both its surface bear mirrors, plane on one side and concave on other side. Plane mirror is used in strong natural light and concave mirror in weak artificial light. Mirror directs the light on the object through the condenser and diaphragm system.

Extra information :

Assembly

Assembly is made up of lens, diaphragm and filter holder. Lowering of condenser gives diffuse light whereas raising of condenser gives bright light. Iris diaphragm controls the quantity of light. The filter holder can be used to get light of desired colour by using suitable filter. In addition to this, a phase contrast ring also can be used to get a cone of light on the object, phase contrast arrangement is helpful to study living organism and structures like flagella, cilia, etc.

Plane and concave mirrors are used to focus light on the object.

Types of Microscopes : Various types of microscopes are available. The microscopes have varied applications and modifications that contribute to their usefulness.

1. **Simple microscope**
2. **Dissecting microscope**
3. **The fluorescent microscope**
4. **Electron microscope**
5. **Transmission electron microscope (TEM)**
6. **The scanning electron microscope (SEM)**

Microscope, as the name indicates, is an instrument designed to magnify objects which are not visible to human eye. Microscope was invented by Anton von Leeuwenhoek in 1675 A. D.

Dissecting microscope is a simple microscope with single lens. It is used to dissect the small organisms or their parts. Dissection of housefly, Cockroach, Drosophila, parts of flower etc. are generally studied under dissecting microscope. The organism to be studied is kept on the stage and the lens is adjusted with the help of adjustment screw to get a sharp image. In this microscope lenses of 5X, 10X or 45X are used.

Compound microscope has much higher resolving power than a simple microscope. Under this small organisms, tissues and cells can be easily studied.

Generally the microscopes which we use in biology laboratory are dissecting and compound microscopes with monocular setting. Research and pathology laboratories use binocular and electron microscopes.

Magnification through a microscope

To get the total magnification take the power of the objective (5X, 10X, 45x) and multiply by the power of the eyepiece, usually 10X.

Resolution of microscope :- The resolution of an optical microscope is defined as the smallest distance between two points on a specimen that can still be distinguished as two separate entities.

Resolution is the power of an optical instrument to capture and produce more details of an image while magnification is the power of an instrument to create and produce a much larger image of an object. Although both are dependent upon each other, a high magnification does not always guarantee a high resolution.

Directions for use of Microscope

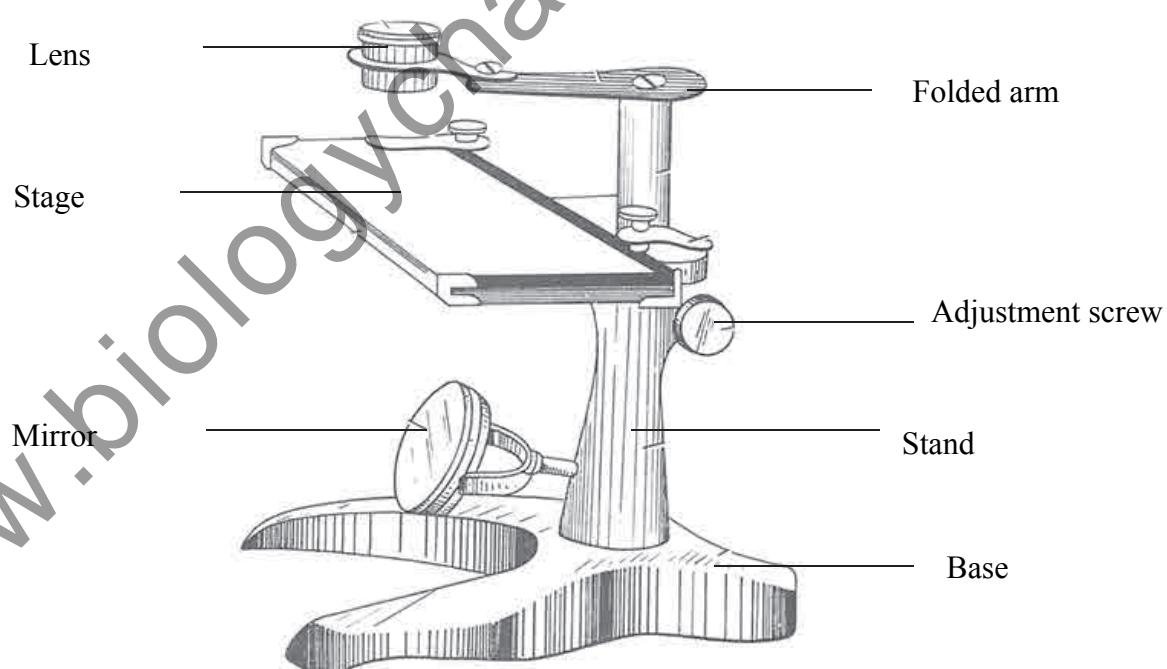
1. Clean the stage and with soft cloth or filter paper.
2. Set low power objective in its correct position first.
3. Keep the condenser up and the diaphragm in open position. Focus light with the help of concave mirror. Avoid direct light from the sun and intense light bulb.
4. Clean the lower surface of the slide before placing it on the stage.
5. View through eyepiece and rotate coarse adjustment knob till you see the image of object .
6. Adjust condenser and diaphragm for better resolution.
7. For the clear image, rotate fine adjustment knob.
8. Adjust slide to view desired portion.
9. Clean the microscope before you leave the place.

Precautions :

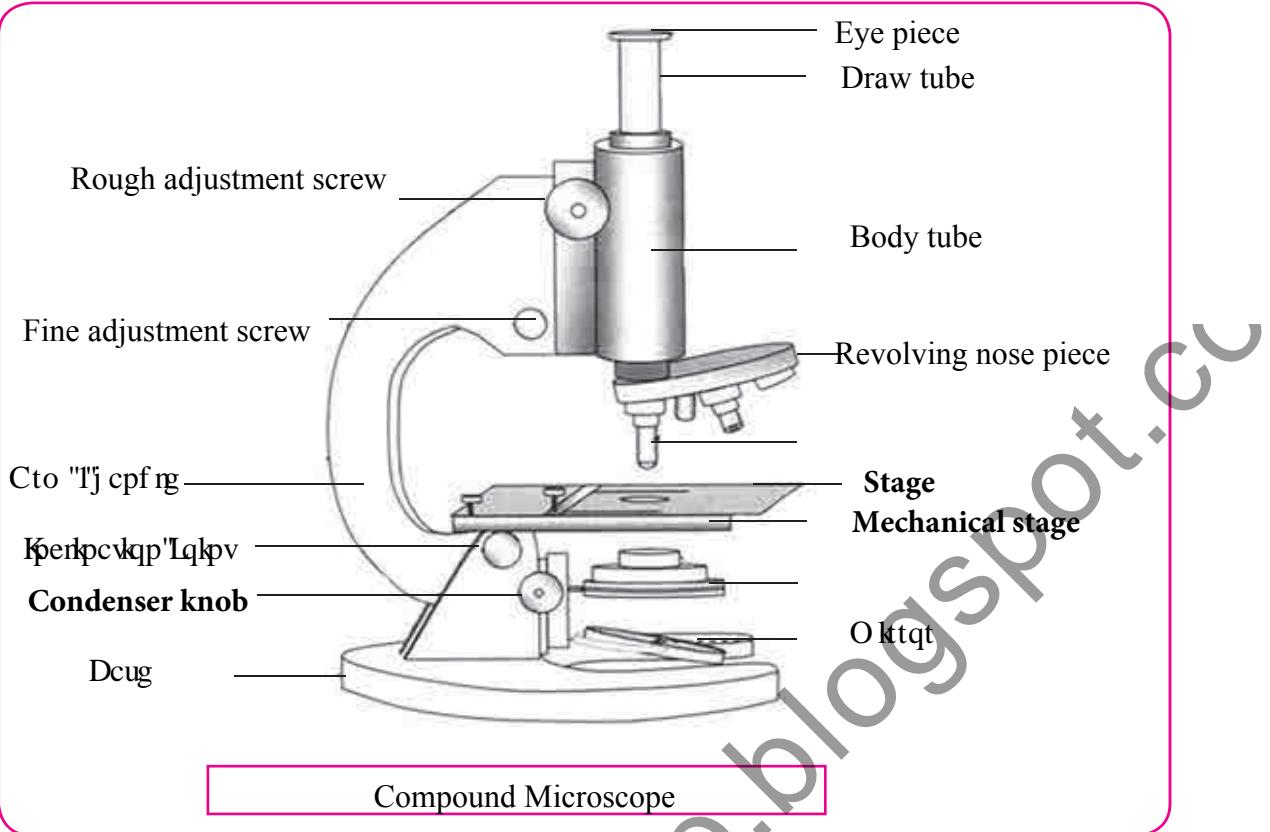
1. Always pick up a microscope using both hands, one hand holding the arm of the microscope and the other supporting its base.
2. Although it may seem tempting, never grab or carry a microscope by its eyepiece.
3. When you put the microscope down again, be sure to do so on a flat surface, such as a tabletop.
4. Mirror of the microscope must be facing light source.
5. Lenses should be clean before and after using microscope.

Activity :

1. Explain the difference between two instruments and give labels to the diagrams.



Simple Microscope



2. Collect the photographs/ Diagrams of the different microscopes from laboratories and make discussions in group.
3. Mount a single Strand of hair on a slide and try to calculate its total magnification under low and high power of compound microscope.
4. Place a drop of water from natural source (pond, well etc.), add a drop of safranin into it and observe different microbes.

Questions

Q. 1 Complete the following table.

Sr. No.	Eypiece Magnification	Objective Magnification	Total Magnification
1.	5X	10X	50 X
2.	10X	45X	450X
3.	15X	100X	1500X
4.	20X	45X	900X

Q. 2 Complete the blank spaces of following paragraph by using information, which you studied regarding the compound microscope.
(low power lens , parfocal, ocular lens, light, greatest ,low power, higher power, closes,)

The eyepiece, also called the **ocular lens**, is a **low power lens**. The objective lenses of compound microscopes are **parfocal**. You do not need to refocus (except for fine adjustment) when switching

to a higher power if the object is in focus on a lower power. The field of view is widest on the lowest power objective. When you switch to a **higher power**, the field of view is **closes** in. You will see more of an object on low power. The depth of focus is greatest on the lowest power objective. Each time you switch to a higher power, the depth of focus is reduced. Therefore a smaller part of the specimen is in focus at higher power. The amount of **light** transmitted to your eye is **greater** at the **low power**. When you switch to a higher power, light (and therefore resolving power, or the ability to distinguish two nearby objects as separate) is reduced. Compensate with the light control (sometimes called the iris diaphragm).

Q. 3 How will the wavelength of light effect the magnification of microscope.

Wavelength of light is defined as the distance between the trough and crests of a wave. Wavelength and frequency are proportional.

The range of visible light in nanometers is that from 380nm to 750nm. The wavelength can be effected in another method is by changing the objective lens and the specimen. The wavelength of light is inversely proportional to the magnification of microscope. If the wavelength increases the magnification of microscope decreases and vice versa.

Q. 4 Which are the part of compound microscope that controls the intensity of light entering the viewing area? How ?

Iris Diaphragm controls the amount of light reaching the specimen. It is located above the condenser and below the stage. Most high quality microscopes include an Abbe condenser with an iris diaphragm.

Q. 5 Which precautions you have taken in porating of microscope?

1. Always grab a microscope with both hands, carrying the microscope's arm on one hand and continuing to support its outpost on the other.
2. Although it may seem tempting, its eyepiece never captures or carries a microscope. Be sure to do this on a flat surface, such as a tabletop, once you keep the microscope away immediately again.
3. Although microscopes may seem durable, they are in fact quite fragile, particularly their glass lenses and delicate mechanisms of focusing.

Multiple Choice Questions

1. Which of the following is not component of compound microscope
 - a. Stage
 - b. Base
 - c. **Electron gun**
 - d. Eyepiece
2. _____ collect the light passing through object.
 - a. Objective lens
 - b. **Condenser lens**
 - c. Eyepiece
 - d. Mirror
3. Which of the following regulates the amount of light passing through the slide specimen on the microscope stage?
 - a. **Diaphragm**
 - b. Eyepiece
 - c. Objective lens
 - d. Body tube
4. A student wants to view cells under the compound microscope at a total magnification of 400X. If the eyepiece is 10X, which of the following objective lenses should be used?
 - a. 10X
 - b. 15 X
 - c. **40X**
 - d. 20 X
5. Movement of slide on stage towards right side, make the image go _____ side.
 - a. Right
 - b. Top
 - c. **Left**
 - d. Bottom
6. Which of the following light is suitable for maximum resolution.
 - a. Red
 - b. **Blue**
 - c. Green
 - d. Orange
7. Match the microscope parts listed with the correct function.

Group A		Group B
a. Turn to change from one power to another	v	i. High power objective
b. Brings objects into rapid but coarse focus	iv	ii. Diaphragm
c. Attached to the revolving nosepiece and contains a lens capable of 45X magnification	i	iii. Mirror/lamp
d. Directs light into the scope adjustment	iii	iv. Coarse adjustment knob
e. Regulates the amount of light entering the scope	ii	v. Revolving nosepiece

Remark and Signature of Teacher

2. To Observe Mitochondria in Onion Peel Cells

Date :

Introduction :

You are aware that Mitochondria provide energy in the packaged form, i e; ATP.

Each cell contains large number mitochondria and they can be observed under a light microscope if stained with Janus green B. This stain is bluish green in colour when oxidized. It appears colourless when reduced. When a dilute solution of the stain is applied to the cells, it enters the cytoplasm as well as mitochondria. Mitochondrial inner membrane contains cytochrome oxidase enzyme. It can keep the stain in oxidized state. Thus mitochondria appear stained while the rest of the cytoplasm appears colourless.

Aim: - To observe mitochondria in onion peel cells.

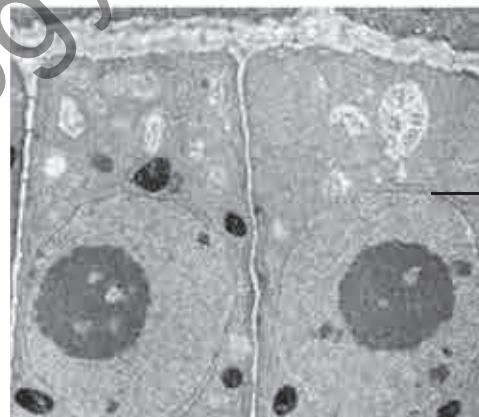
Requirements: - Slide, cover slip, 0.01% Janus green B stain, fresh onion bulbs, etc.

Procedure:-

1. Tear a fleshy leaf of onion and collect a piece of the peel.
2. Spread the peel carefully on a slide.
3. Put a few drops of Janus green B stain on the peel. Allow it to stain for 5-10 min.
4. Wash the extra stain with the help of distilled water. Be careful so that entire stain doesn't get washed off.
5. Mount the cells in a drop of distilled water.
6. Use coverslip to cover the peel. Observe the slide under high power of a compound microscope.

The cells can alternatively be mounted in the stain itself. A few air bubbles remaining inside the cover glass give a background stain that makes the viewing easy.

Activity : Label the diagram.



Mitochondria

Onion peeling showing mitochondria

Observation :-

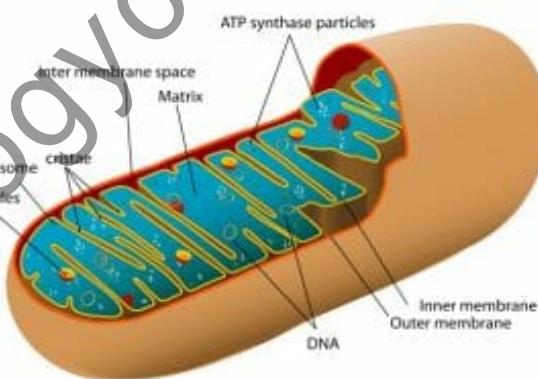
1. Mitochondria appear like bluish coloured spherical or rod shaped structures present in the cytoplasm.

2. Mitochondrion can be easily distinguished from a bacterium as Bacterial cells become more prominently stained and appear sharper than mitochondria.
3. Also as bacteria are on the surface of cells, they will be focused at a slightly different level than mitochondria and can be distinguished.
4. Note your own observation of the slide.
 1. Large, rectangular interlocking cells,
 2. Clearly visible distinct cell walls surrounding the cells,
 3. Dark stained nucleus,
 4. Large vacuoles at the center,
 4. Small granules may be observed inside the cells (within the cytoplasm)
 5. Mitochondria appears like bluish coloured spherical or rod shaped structure present in the cytoplasm.

Questions

Q. 1 Describe the Ultrastructure of Mitochondria.

1. Mitochondria have two membranes, an outer membrane and an inner membrane.
2. These membranes are made of phospholipid layers, just like the cell's outer membrane.
3. The outer membrane covers the surface of the mitochondrion, while the inner membrane is located within and has many folds called cristae.
4. The folds increase surface area of the membrane, which is important because the inner membrane holds the proteins involved in the electron transport chain.
5. It is also where many other chemical reactions take place to carry out the mitochondria's many functions. An increased surface area creates more space for more reactions to occur, and increases the mitochondria's output.
6. The space between the outer and inner membranes is called the intermembrane space, and the space inside the inner membrane is called the matrix.



Mitochondria diagram

Q. 2 Why thin peel of onion is placed in a watch glass containing water?

- 1.The thin peel of onion is placed in a watch glass containing water because: It prevents the peel from folding.
- 2.It prevents the peel from drying.

Q. 3 What is the role of Janus green B stain in this slide preparation.

- 1.The Janus Green B is a mitochondrial stain which acts as a indicator. It changes it's color due to the presence of oxygen. It oxidizes the blue color otherwise in absence the color becomes pink.
- 2.The indicator is used to stain the mitochondria in the living cell. It can also reveal the changes occurring in the electron transfer chain occurring in the cell mitochondria.

Multiple Choice Questions.

1. Which of the following cells will show maximum number of mitochondria?
 - a. Skeletal muscle fibres
 - b. Monocyte
 - c. Hepatocytes
 - d. Adipocytes
2. In order to prevent formation of lactic acid, pyruvic acid should enter in
 - a. Mitochondrial matrix
 - b. Outer chamber of mitochondria
 - c. Crista
 - d. Oxysome
3. To observe cells in an onion peel, we use _____.
 - a. Fruit
 - b. Stem
 - c. Leaf
 - d. Flower
4. The less stained central part of onion peel cell is
 - a. Nucleus
 - b. Cytoplasm
 - c. Vacuole
 - d. Cell wall
5. For observation of an onion pea cells are first seen under _____ magnification.
 - a. 10X × 10X
 - b. 10X × 45X
 - c. 10X × 40X
 - d. 10X × 100X

Remark and Signature of Teacher

3. Biochemical tests

Date :

Aim : To test the presence of Sugar, Starch, Proteins and Fats from suitable plant material.

Requirements:

Slides, cover slips, grains of maize, wheat, jowar, rice soaked in 80% alcohol, potato tuber, sugar cane, ground nut seeds and tur dal powder.

A. Test for starch

Principle : Starch grains react with iodine solution (Tri-iodide ions) due to formation of an inter-molecular charge transfer complex, turning the colour of starch to intense blue-black.

Procedure : The starch grains can be mounted either by taking thin, small section of the given material or squeezing the material and mounting the liquid that oozes out. The section or liquid is to be stained with very dilute solution of iodine.

Activity : Observe the different starch grains under the low power of compound microscope.

Starch grains turn blue after staining in iodine solution. The starch grains appear as follows for Rice, Jowar, Wheat, Maize etc.

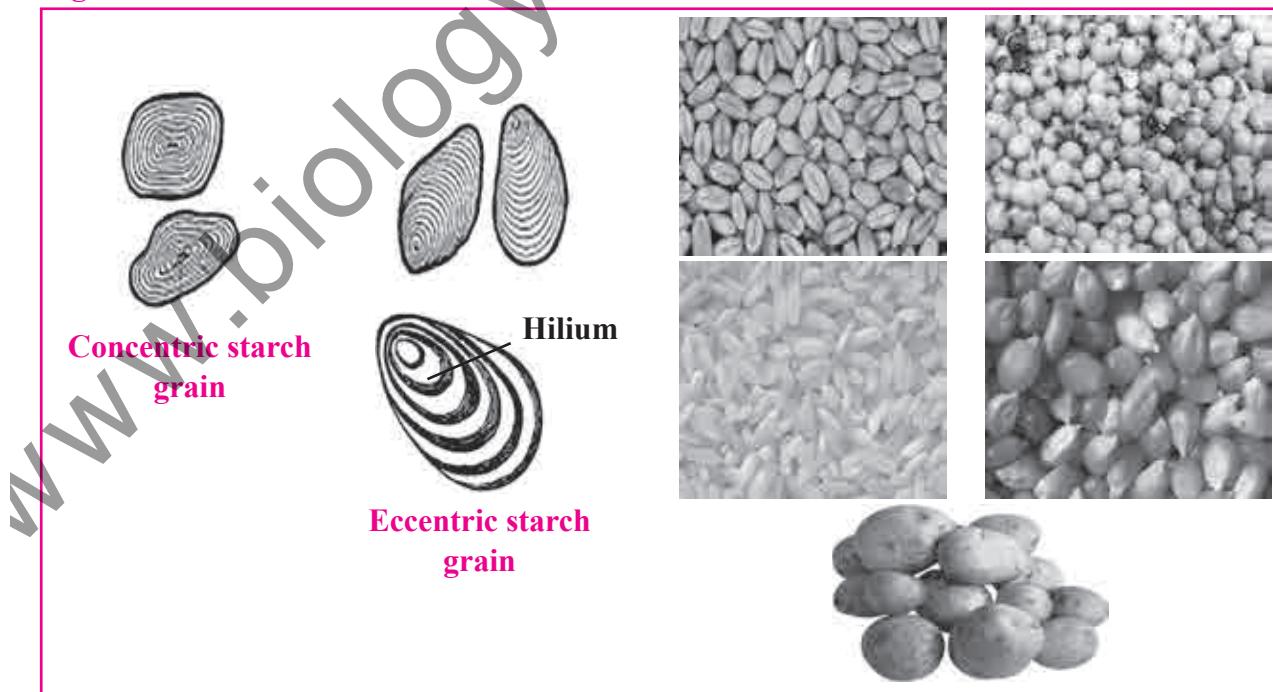
Observation :

The starch granules appear blue on staining with iodine solution. They appear as follows under low power of compound microscope.

- i) **Rice-** starch grains are small, polygonal, simple or compound and concentric i.e. hilum at the centre.
- ii) **Jowar-** starch grains are simple.
- iii) **wheat-** starch grains are simple or compound,
- iv) **Maize-** starch grains are simple or compound, polygonal, concentric with elongated hilum.
- v) **Potato-** starch grains are simple and eccentric i.e. hilum at one side.

Result : Starch is present in the given sample,

Figures :



B. Test of sugar

Principle :

Benedict's reagent contains alkaline CuSO_4 . Sugar when present acts as reducing agent and changes CuSO_4O . Hence the colour change.

Procedure :

Take a drop of sugarcane juice in a test tube, add 1ml of distilled water and a drop of benedict's reagent / solution. Heat the last tube for 2 minutes.

Observation :

solution turns red in colour

Result : sugar is present in sugarcane juice

C. Test for fat:

Procedure :

Cut thin section of the ground nut seed and keep it in Sudan - III for 10 minutes. Now wash the section with 50 % alcohol and then with water. Mount the section in glycerine and observe under microscope.

Observation :

The oil drops takes red colour

Result : Fats are present in ground nut seeds

D. Tests for protein:

Principle :

The test is used to detect peptide bonds of proteins. In presence of peptides copper ions form complexes in alkaline solution. Hence the colour change.

Procedure :

Make a suspension of tur dal powder in water.

i. **Biuret test** – take 2ml of sample solution in test tube, add 1ml of 20% NaOH followed by few drops of 1% CuSO_4 soln.

Observation :

A violet colour appers in the solution.

Result : In the given sample proteins are present

Questions

Q. 1 Match the following pairs.

Group A	Group B
1. Rice	a. The starch grains are simple and eccentric i.e hilum at one side.
2. Jowar	b. The starch grains are small , polygonal , simple or compound and concentric. (hilum at the center)
3. Wheat	c. the starch grains are simple or compound
4. Maize	d. The starch grains are simple. Spherical or slightly angular.
5. Potato	e. The starch grains are simple or compound, polygonal concentric with elongated hila (hilum) and concentric.

Ans- 1- b 2- d 3- c 4- e 5- a

Q. 2 Give reasons

a. Starch grains turn blue after staining in iodine solution.

Iodine dissolved in potassium iodide solution reacts with starch to produce a deep black-blue colour. This reaction is the result of polyiodide chains from reaction between starch and iodine.

b. In sugar test greenish or brownish precipitate appears.

Under alkaline conditions, the reducing sugars reduce cupric ions (Cu^{+2}) to cuprous form (Cu^{+}) which is responsible for the greenish or brownish yellow precipitate (cuprous oxide)

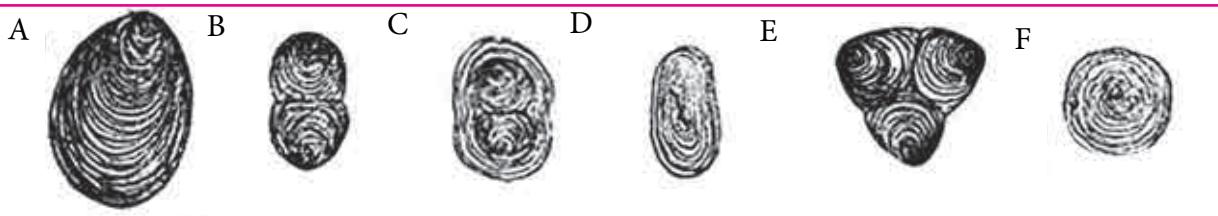
c. In protein test of acetic acid white precipitate appears.

The proteins are denatured and coagulated on heating which gives a white cloudy precipitate in the reaction.

Q. 3 Are different biochemical tests useful in checking of food adulteration? write one example.

Yes, Adulteration of Khava with starch can be checked by using iodine solution.

Q. 4 Observe the following structures and write the details of types of starch grains.



A- Simple eccentric starch grain of potato.

B- compound starch grain of banana

C- half compound starch grain.

D- Simple concentric starch grain of Pea.

E- Compound starch grain of Potato.

F- Semicompound starch grain of Potato

Multiple Choice Questions

1. Which reagent gives blue colour with starch?

- a. Safranin
- b. Iodin
- c. Methylene blue
- d. Eosine

2. _____ reagent is used for testing presence of glucose.

- a. Wrinkler's
- b. Bendict's
- c. Miller's
- d. Iodine

3. Which food sample you will select to test the presence of starch?

- a. Mango
- b. Coconut
- c. Potato
- d. Sugarcane juice

4. Fat storing cells of vertebrates are called _____

- a. Adipose
- b. Melanocyte
- c. WBCs
- d. RBCs

5. Which of the following _____ is rich source of protein in diet.

- a. Leaf
- b. Stem
- c. Germinating seed's
- d. Seed coat

Activity : Collect the information about different biochemical tests for testing of food adulteration and perform any two in laboratory under the guidance of teacher.

Starch in Khava and its products - Boil a small quantity of sample with some water, cool and add a few drops of Iodine solution. Formation of blue colour indicates the presence of starch.

Urea in milk - Take a teaspoon of milk in a test tube. Add $\frac{1}{2}$ teaspoon of soybean or arhar powder. Mix up the contents thoroughly by shaking the test tube. After 5 minutes, dip a red litmus paper in it. Remove the paper after $\frac{1}{2}$ a minute. A change in colour from red to blue indicates the presence of urea in the milk.

Remark and Signature of Teacher

4. Preparation of stained squash of onion root tip for the study of mitosis.

Date :

Aim : To study the different stages of mitosis form the onion root tips

Requirement : Onion bulb, water, beaker, Carnoy's solution, Petridish, 1N HCL, watch glasses, Acetocarmine stain, slides, cover-slips, brush, blade, blotting papers, compound microscope, etc.

Introduction:

The cells division which results in the formation of two daughter cells keeping the chromosome number constant is called mitosis. Mitosis is a somatic cell division required for growth of plants and animals. It is commonly observed in meristematic tissues. This cell division is important for growth and development.

Mitosis observed in animal cell is astral whereas in plants it is anastral. The growing parts of plant show presence of meristematic region where cells in different stages of mitosis can be observed.

Procedure:

A. For growing root tips:

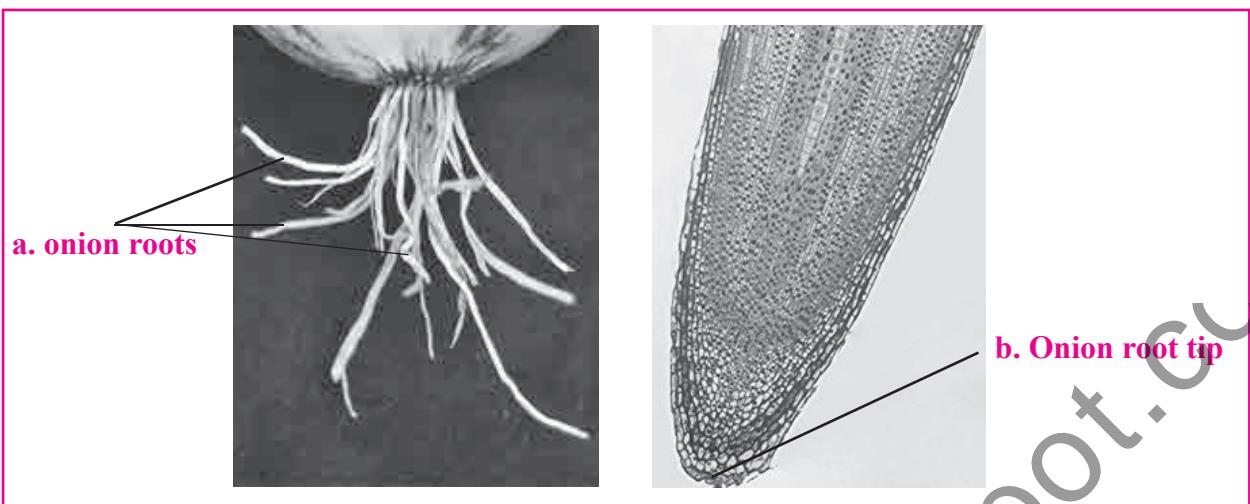
1. Select a medium size good, clean, onion bulb. Give 2-3 superficial cuts on the stem of onion bulb and place it onto the surface of beaker full of water. Always care should be taken that stem portion should remain in touch of water. Within 3-4 days roots will be produced from the bulb.
2. Cut the roots (2-3 cm long) in the morning around 8-10 am. Preserve them in Carnoy's fixative (chloroform + absolute alcohol + acetic acid, 3:2:1).

For squash (Slide) preparation:

Before slide preparation roots tips should be washed and kept in Petridish containing water so as to remove fixative.

1. On a clean glass slide keep the onion root tip and with the help of blade remove the elongation part of root, use only dark whitish root tip portion for the process.
2. Transfer the root tip in a watch glass containing 1N HCL. Warm the watch glass for 3-5 minutes passing it through the flame. Continuous heating should be avoided. (HCL helps in hydrolysis of the root tip cells and heating is required for softening the root tip).
3. From HCL transfer the root tip into another watch glass containing acetocarmine stain. Warm the watch glass passing through the flame. Repeat this until the root tip turns dark purple. (Acetocarmine stains nucleus and chromosomes). Heating helps in fastening the process of staining.
4. Transfer stained root tip onto a slide in a drop of stain. Place the cover slip. For squash wrap the slide in to the 3-4 folds of blotting papers and apply slight pressure with the help of thumb. It spreads the cells.
5. Observe the slide under the low magnification (10 X) of compound microscope and then to under high magnification (45 X) for identification of various stages to mitosis. Mitosis is an equational division occurs in somatic cells results in the formation of two daughter cells receiving the same number of chromosome to that of parent cell.

Figure :



Explanation of Mitosis Process

Mitosis is completed in two stages

A. Karyokinesis B. Cytokinesis.

A. Karyokinesis takes place in four steps

a. Prophase :

1. Nucleus becomes large.
2. Chromosomes get condensed i.e. shorter and thicker.
3. Nucleolus and nuclear membrane starts disappearing.

a. Metaphase :

1. Imaginary line (equatorial plane) develops at the center of the cell.
2. Spindle fibres are formed between the two poles.
3. Chromosomes arrange themselves onto the equatorial plane in such a way that centromeres line up the plane and arms towards the poles.

a. Anaphase :

1. Centromere divides and actual separation of daughter chromosomes takes place.
2. Chromosomes are pulled toward respective poles due to shortening of the tactic type of spindle fibres.
3. Thus nuclear material is divided into two equal halves.

a. Telophase : This phase is a reverse of prophase

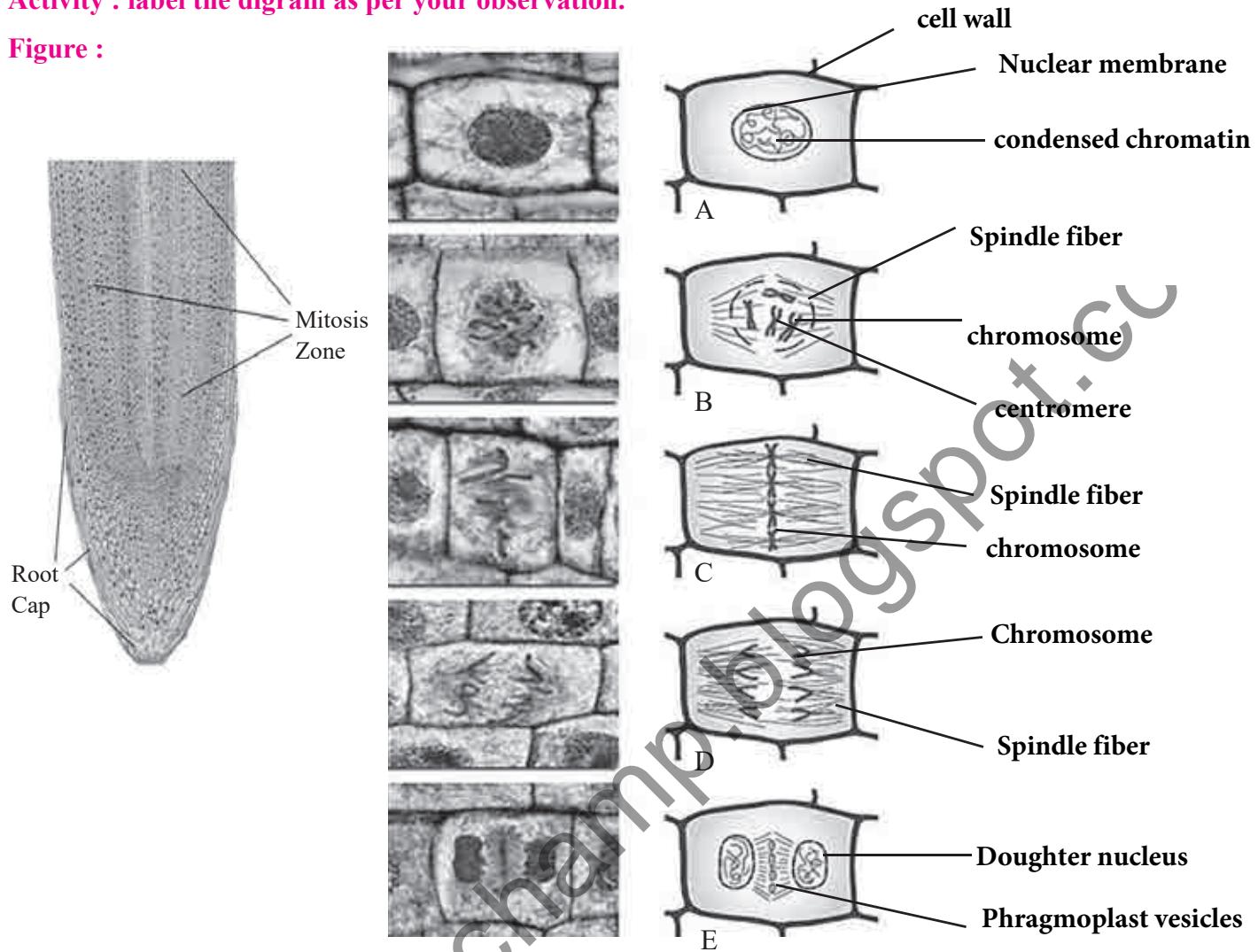
1. Chromosomes aggregate at the opposite poles, become thin, long, dispersed and uncoil.
2. Reappearance of nucleolus and nuclear membrane takes place that results in formation of two nuclei, one at each pole

A. Cytokinesis- Division of cytoplasm is called as cytokinesis

4. In plant cell, cell plate formation takes place at the center of the cell, between two daughter nuclei.
5. It results in the formation of two daughter cells.

Activity : label the diagram as per your observation.

Figure :



Note : The dividing cells undergo cell cycle in which the duration of interphase is longer as compared to M phase i.e mitotic phase (prophase, metaphase, anaphase and telophase). Hence move the slide to focus on the cells showing different stages of mitosis. (Prophase and telophase are more common and you will have to search for metaphase and anaphase)

Observation and Conclusion :

Name the different phases of Mitosis with characteristics given in above Figure as A,B,C,D,E

A Early Prophase:

- (1) Chromatin material condenses into thread like structures called chromosomes.
- Chromosomes appear as thin and long strands, evenly distributed in the nucleoplasm.
- (3) Nucleus is large and in the centre of a cell.

B. Late Prophase:

- (1) Throughout prophase, gradually chromosomes undergo condensation and coiling, hence in late prophase they are thick and short.
- (2) Nucleolus and nuclear membrane disappear at the end of prophase.

C.Metaphase :

1. Chromosomes becomes thick and the two chromatids become prominent.
2. A distinct bipolar spindle body is formed.
3. Chromosomes get arranged along the equator of the spindle.
4. Each chromosome is attached to the spindle fibre by its centromere.
5. The centromeres of the chromosomes line up at the equator while the arms (chromatids) are towards the poles.

D.Anaphase:

- (1) The centromere breaks due to the contraction of spindle fibres.
- (2) The two sister chromatids (now called daughter chromosomes) of each chromosome separate and move to opposite poles due to contraction of spindle fibres,

E. Telophase :

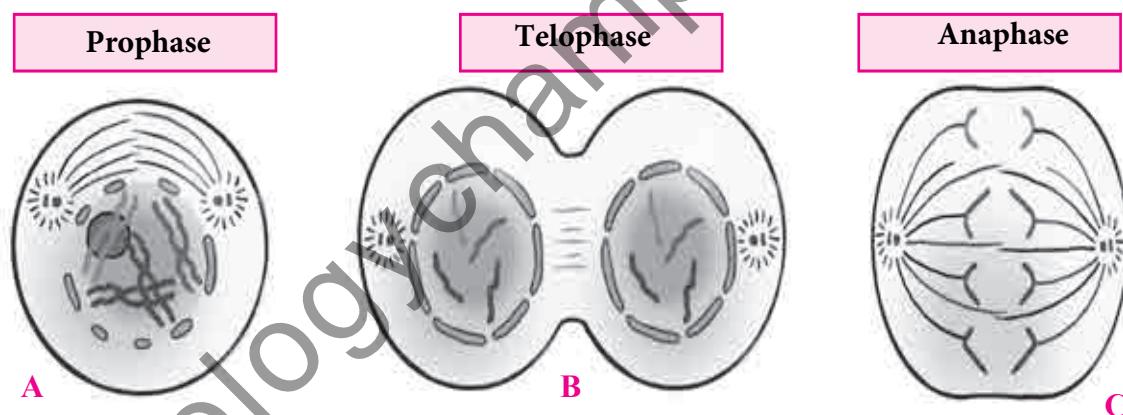
- (1) The spindle fibres disappears and the daughter chromosomes reach the respective poles and two groups get formed.
- (2) They become thin and long.
- (3) Nuclear membrane and nucleolus reappear and two daughter nuclei are formed, one at each pole.

Q. 1 Explain the term mitosis and meiosis.

MITOSIS is equational type of cell division in which the chromosome number of the daughter cells is same as that of the parental cell. It occurs in somatic cells.

Meiosis is reductional type of cell division in which the chromosome number of the daughter cells is half to the chromosome number in the parent cell. It occurs in germ cells.

Q. 2 Observe the diagrams, identify and write the details



A. Prophase.

During prophase, the chromosomes supercoil and the fibers of the spindle apparatus begin to form between centrosomes located at the pole of the cells. The nuclear membrane also disintegrates at this time, freeing the chromosomes into the surrounding cytoplasm.

B. Telophase :

The spindle fibres disappears and the daughter chromosomes reach the respective poles and two groups get formed.

They become thin and long.

Nuclear membrane and nucleolus reappear and two daughter nuclei are formed, one at each pole.

C.Anaphase.

During anaphase, the centromeres split and the sister chromatids begin to migrate toward the opposite poles of the cell.

Q. 3 Is there any difference between mitosis between plant and animal cell? what is that ?

Difference between Mitosis and Meiosis		
Types	Mitosis	Meiosis
Interphase	Each chromosome replicates. The result is two genetically identical sister chromatids.	Interphase – Chromosomes not yet visible but DNA has been duplicated or replicated.
Prophase	Prophase I – crossing-over recombination – Homologous chromosomes (each consists of two sister chromatids) appear together as pairs. Tetrad is the structure that is formed. Segments of chromosomes are exchanged between non-sister chromatids at crossover points known as chiasmata = crossing-over).	Prophase – Each of the duplicated chromosomes appears as two identical or equal sister chromatids. The mitotic spindle begins to form. Chromosomes condense and thicken.
Metaphase	Metaphase I Chromosomes adjust on the metaphase plate. Chromosomes are still intact and arranged as pairs of homologues.	Metaphase – The chromosomes assemble at the equator at the metaphase plate.
Anaphase	Anaphase I Sister chromatids stay intact. But homologous chromosomes drift to the opposite or reverse poles.	Anaphase – The spindle fibres begin to contract. This starts to pull the sister chromatids apart. At the end of anaphase, a complete set of daughter chromosomes is found each pole.
Mode of Reproduction	Asexual Reproduction.	Sexual Reproduction.
Occurs in	Eukaryotic cells.	Diploid cells.
Function	General growth and repair, Cell reproduction	Genetic diversity through sexual reproduction.
Cytokinesis	Occurs in Telophase.	Occurs in Telophase I and in Telophase II.
Karyokinesis	Occurs in Interphase.	Occurs in Interphase I.
Discovered by	Walther Flemming.	Oscar Hertwig.

Q. 4 Explain the characteristics of Cytokinesis.

The characteristics of cytokinesis:

Cytokinesis is the end method in eukaryotic cell division, which separated the cytoplasm, organelles, and cellular membrane.

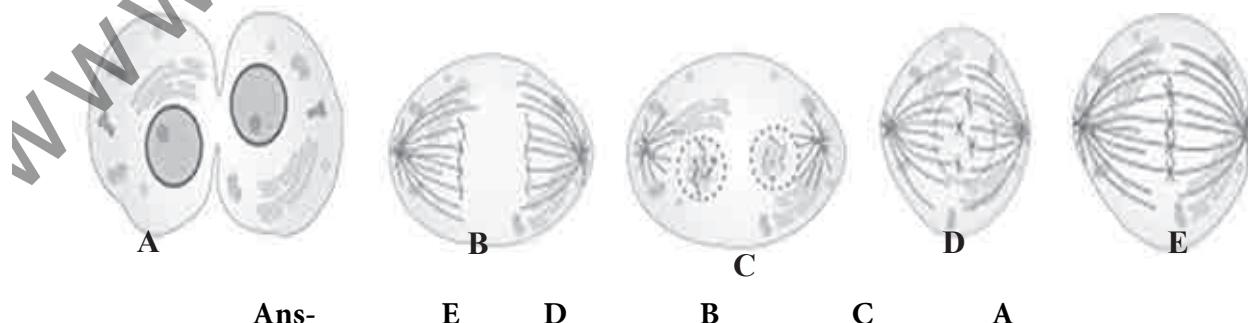
Cytokinesis typically taken place at the end of mitosis, after telophase, but the two are independent procedures.

Cytokinesis is a physical method in which the constriction and division of cytoplasm into two free cells after the division of genetic materials.

During the cytokinesis, the "cytoplasm" has divided by a process, called CLEAVAGE.

The mitosis supports the cell in maintaining proper size.

Q. 5 Observe the following diagram sequence carefully. is it correct? If not arrange it in sequential form with labels.



Ans-

E D

C

A

Multiple Choice Questions .

1. To keep chromosome number constant in each generation produced by sexual reproduction _____ type of cell division is required.
a. Meiosis b. Mitosis
c. Amitosis d. Equational
2. _____ is a chromosomal stain.
a. Janus Green B b. Acetocarmine
c. Methylene blue d. Cotton blue
3. Chromosomes arranged at equitorial plane indicate _____.
a. Anaphase b. Metaphase
c. Telophase d. Interphase
4. _____ cells are formed as a result of Mitosis.
a. 1 b. 2 c. 3 d. 4
5. In somatic cells _____ type of cell division takes place.
a. Mitosis b. Meiosis
c. Amitosis d. Polyploidy
6. Karyokinesis is a division of _____.
a. Nucleus b. Cytoplasm
c. Nucleolous d. Chromosomes

Activity : Draw the diagrams of Mitosis process.



Remark and Signature of Teacher

5. To prepare temporary stained slides.

Date :

5A : To prepare temporary stained slide of T.S. of Sunflower and maize stem.

Aim: To prepare temporary stained slide of T.S. of Dicot and monocot stem to compare their anatomy.

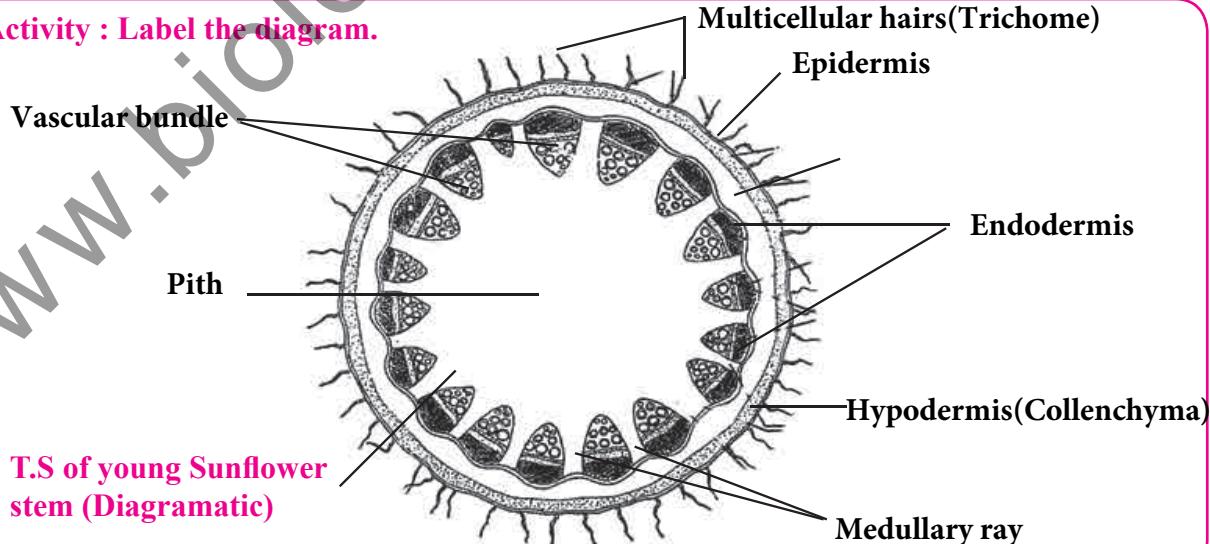
Principle : Understanding the anatomical structure of living matter helps in correlating the structure and function of the tissue/organ. Anatomy can be studied by taking transverse section or vertical section of an organ. A thin and planar section is essential for study of anatomical structure. To distinguish different regions of the section, a colouring solution called stain is used. Specific stains are used for staining specific cells/tissues. Over and understained slides fail to differentiate various regions. Eg; Safranin helps in staining dead tissue and acetocarmine is used to stain nuclear material.

Requirements: Young sunflower (dicot) and maize (monocot) stem, watch glasses, cover slips, brush, sharp new blade, safranin stain, glycerine and compound microscope,etc.

Procedure:

- Taking a Section :** Take transverse section of sunflower (dicot) and maize (monocot) stem. For this, first hold the stem horizontally and cut off the slanting edge. Hold the stem vertically between thumb and index finger. Keep the edge of razor or blade at right angles to the longitudinal axis of the plant material and cut 7 to 8 thin sections. Place the sections in a watchglass containing water. Make sure that the section is not oblique and as thin as possible. (Appears transparent)
- Staining:** Select 2 or 3 thinnest and complete sections and now transfer the sections into the watch glass containing dilute safranin. Allow the sections to remain in the stain for 2 to 3 minutes. Wash the section with water for removing extra stain.
- Mounting:** Take a clean slide and place a drop of glycerine or water in the centre of the slide. With the help of brush, transfer well stained section on the slide. Place a cover slip. Avoid air bubbles while placing the coverslip. After mounting the section, blot the excess of glycerine or water from the sides of the cover slip. Observe the section under low power objective of a compound microscope.

Activity : Label the diagram.

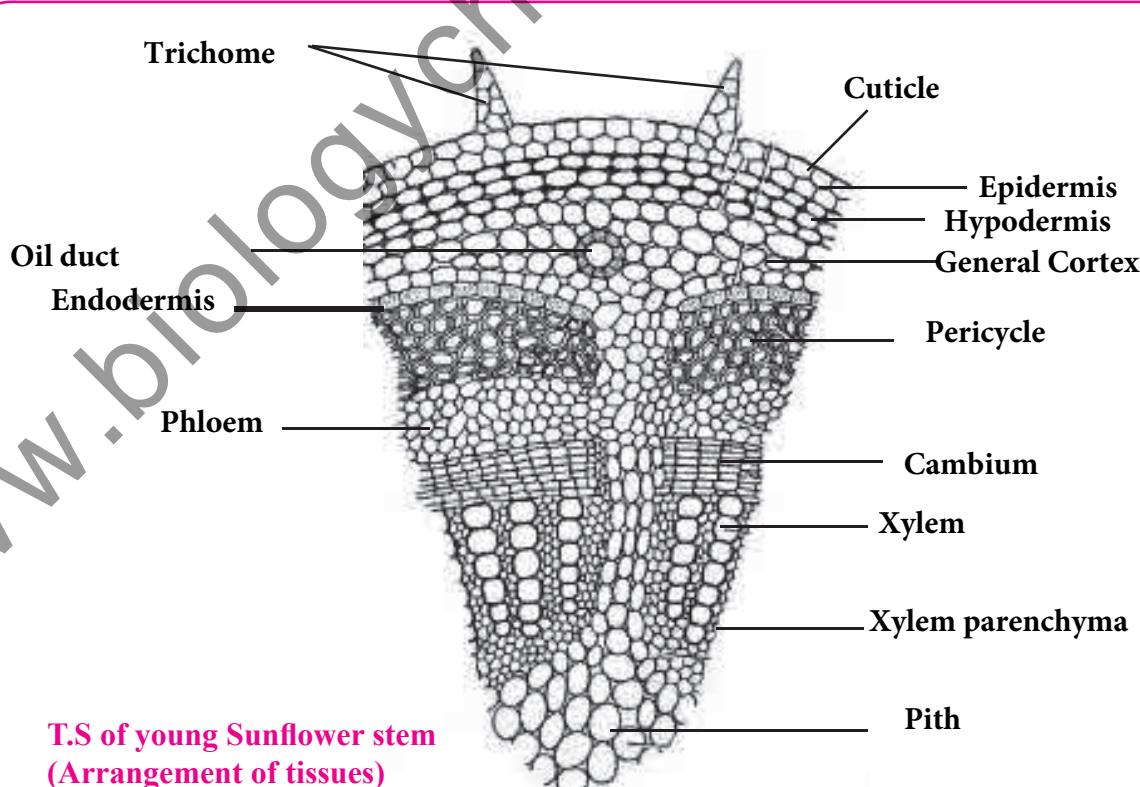


Observations:

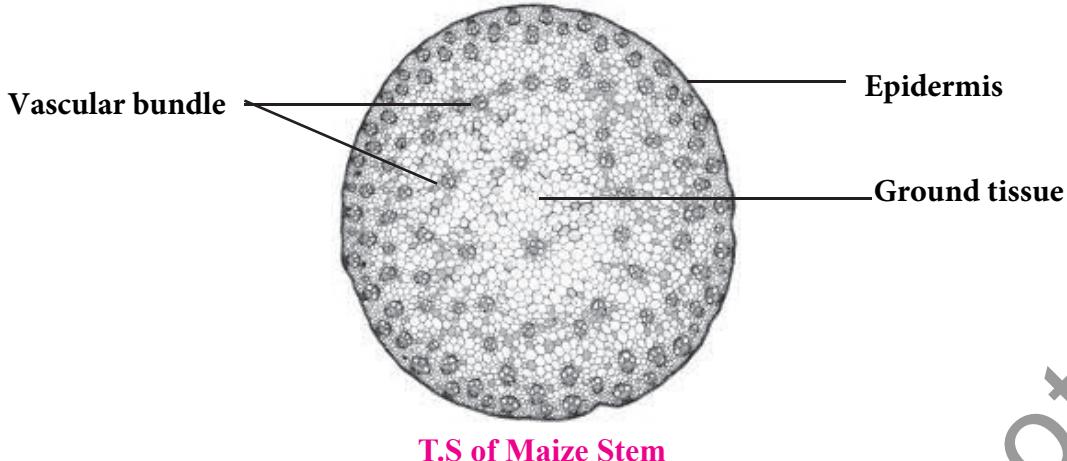
T.S. of Sunflower stem shows the following regions from periphery to the centre.

1. **Epidermis:** It is a single, outermost, protective layer and lined by thin walled parenchyma cells. It shows presence of multicellular outgrowths called trichomes.
2. **Cortex:** It is present just below the epidermis. It consists of three regions viz, outer hypodermis, middle general cortex and inner endodermis.
3. **Hypodermis:** It is present just below the epidermis. made by many layers of collenchymatous cells.
4. **General cortex:** It is made of few layers of thin walled large, rounded parenchmatous cells with intercellular spaces.
5. **Endodermis:** It is the innermost layer of cortex. Cells of this layer are barrel shaped, thin walled and parenchymatous.
6. **Stele:** The stele consists of pericycle, vascular bundles, pith and medullary rays.
 - **Pericycle:** It is the outermost layer of stele. It is present between endodermis and vascular bundles. It is a multilayered structure having sclerenchymatous cells above the vascular bundles (also called hard bast).
 - **Vascular bundles:** Approximately 6-12 vascular bundles are present in a ring. Each vascular bundles is conjoint, collateral and open type. Xylem is endarch and composed of vessels, xylem-parenchyma and xylem sclerenchyma. Phloem is present towards the outer side. It has sieve tubes, companion cells, phloem parenchyma and phloem sclerenchyma.
 - **Medullary rays:** The parenchyma cells present between vascular bundles form medullary rays. These are useful for lateral conduction.
 - **Pith:** it is the central part of the stem. It is composed of parenchyma cells. As stem grows older, these cells die and a cavity is formed.

Activity : Give the suitable label to given diagram.



Activity : Label the diagram given below .



T.S. of Maize stem shows following tissues from outer edge to the centre of the section.

1. Epidermis: It is a single outermost layer with a thick cuticle on the outer surface. It is made up of living parenchymatous cells. In monocots, the epidermis is devoid of trichomes.
2. Hypodermis: it is present just below the epidermis. It is 2-3 layer thick and made up of sclerenchymatous cells having lignified cell walls. It provides mechanical strength to the stem.
3. Ground tissue: In case of monocot stem, the cortex, endodermis, pericycle and pith are absent. It is made up of parenchymatous cells.
4. Vascular bundles: These are numerous and scattered in ground tissue. Each vascular bundle is conjoint, collateral and closed i.e. without cambium. Hence, secondary growth is absent. Xylem is endarch (meaning Protoxylem is towards innerside and Metaxylem is towards the periphery). The Phloem lies towards outerside. It consists of only sieve tubes and companion cell.

Activity : Label the diagram given below.

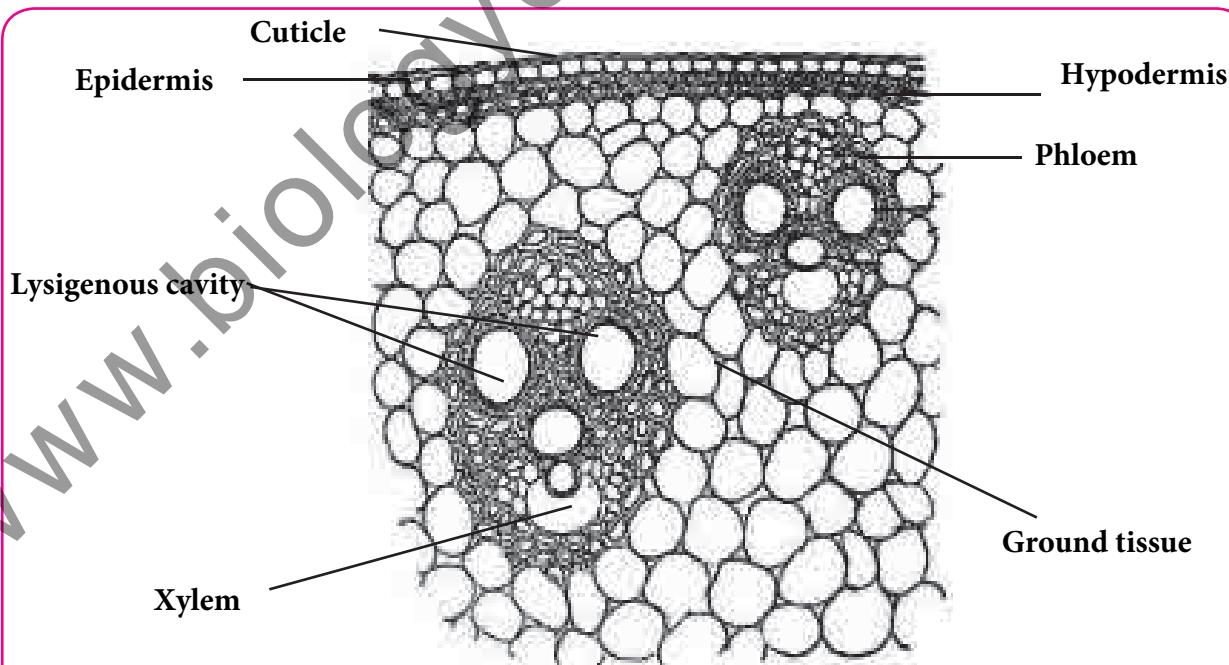


Fig. T.S. of Maize stem

Questions

Q. 1 What is stele?

In vascular plants the stele is the central part of the root or stem containing vascular tissue.

Q. 2 What are the kinds of vascular bundles found in dicot stem?

In dicot stem two types of vascular bundles are present. They are
1. collateral
2. bicollateral.

Q. 3 Differentiate between the open and close type of vascular bundle.

i. Open vascular bundle contains cambium, which is present in dicot plants
ii. Closed vascular bundle does not contain cambium, which is present in monocot plants

Q. 4 Mention any two examples of monocot plants.

Maize and jowar

Multiple choice questions

1. We use Safranin for staining
 - a. Cuticle of leaf
 - b. Hypodermis of dicot stem
 - c. Cortex of dicot root
 - d. Mesophyll of dicot leaf.

2. Which of the following plants will not show increase in girth of stem over the years?

a. Cucurbita	b. Hibiscus
c. <u>Tube rose</u>	d. Jasmine

Remark and Signature of Teacher

5B : Preparation of T.S. of Dicot and Monocot Leaf to compare their Anatomy

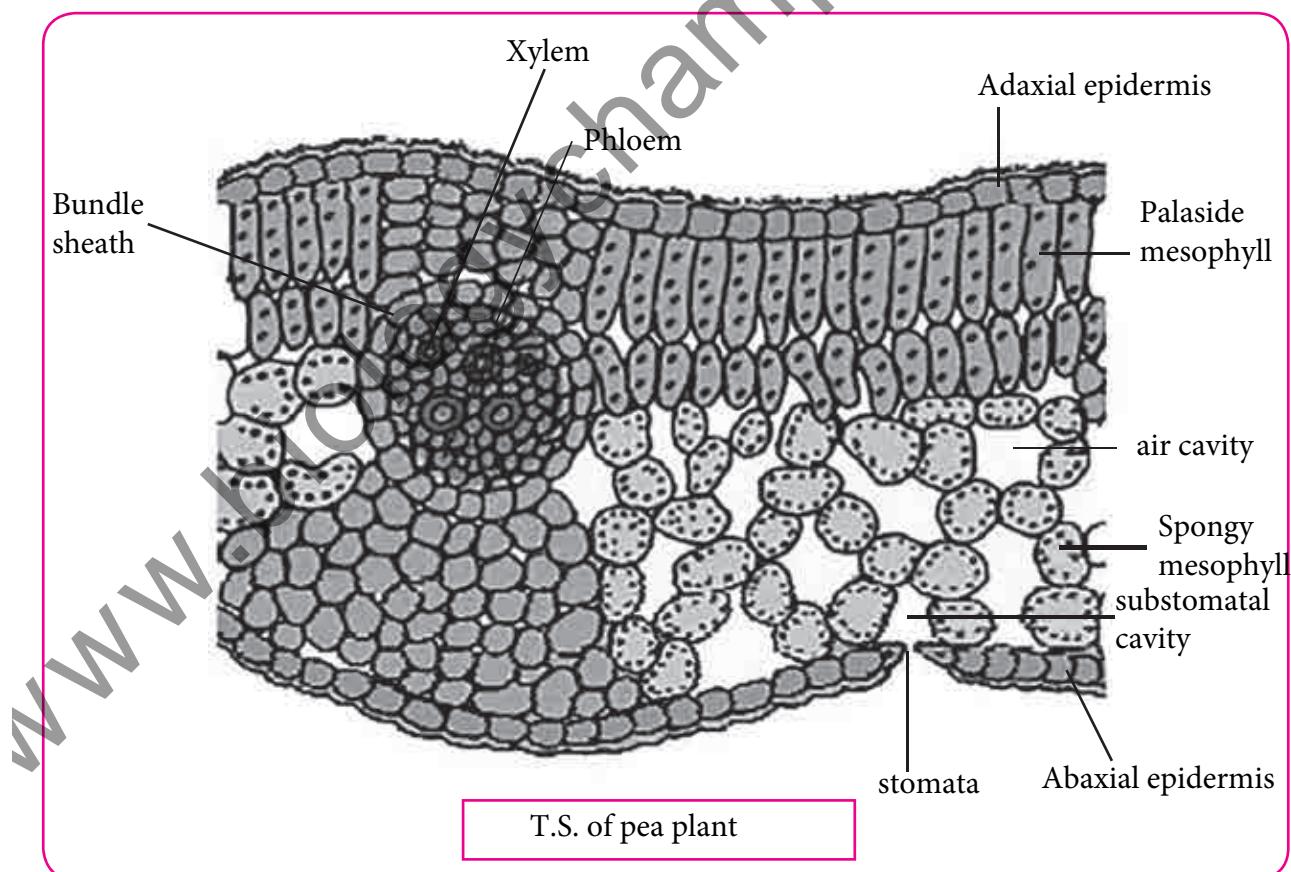
Aim: Preparation of T.S. of Dicot and Monocot Leaf to compare their Anatomy.

Requirements: Young leaf of Monocot (wheat, rice) and Dicot (pea, mint), Watch glasses, Slides, blades, cover slips, brush, section lifter, safranin stain, blotting paper, Compound microscope,etc.

Procedure: The preparation of slide is carried out in following three main steps

- Section taking :** Take transvers section of the plant material. Hold the plant material vertically between thumb and index finger of your left hand. Keep the edge of razor or blade at right angle to the longitudinal axis of plant material and cut thin sections.
- Staining:** Transfer the all section into the watch glass containing water and then only thin section to the watch glass containing stain (safranin). Allow the section to remain in the stain for 2 to 3 minutes and then wash the section with water for removing extra stain.
- Mounting:** Take a clean slide and place drop of glycerin or water in the center of slide. With the help of brush transfer well stained section to this drop and placed cover slip in such a way that it would touch the mounting medium on the slide. After mounting the section, blot the excess of glycerin or water from the sides of the cover slip. Care should be taken not to allow air bubbles to enter the mounting medium.

Activity : Give the suitable title and label the diagram given below.

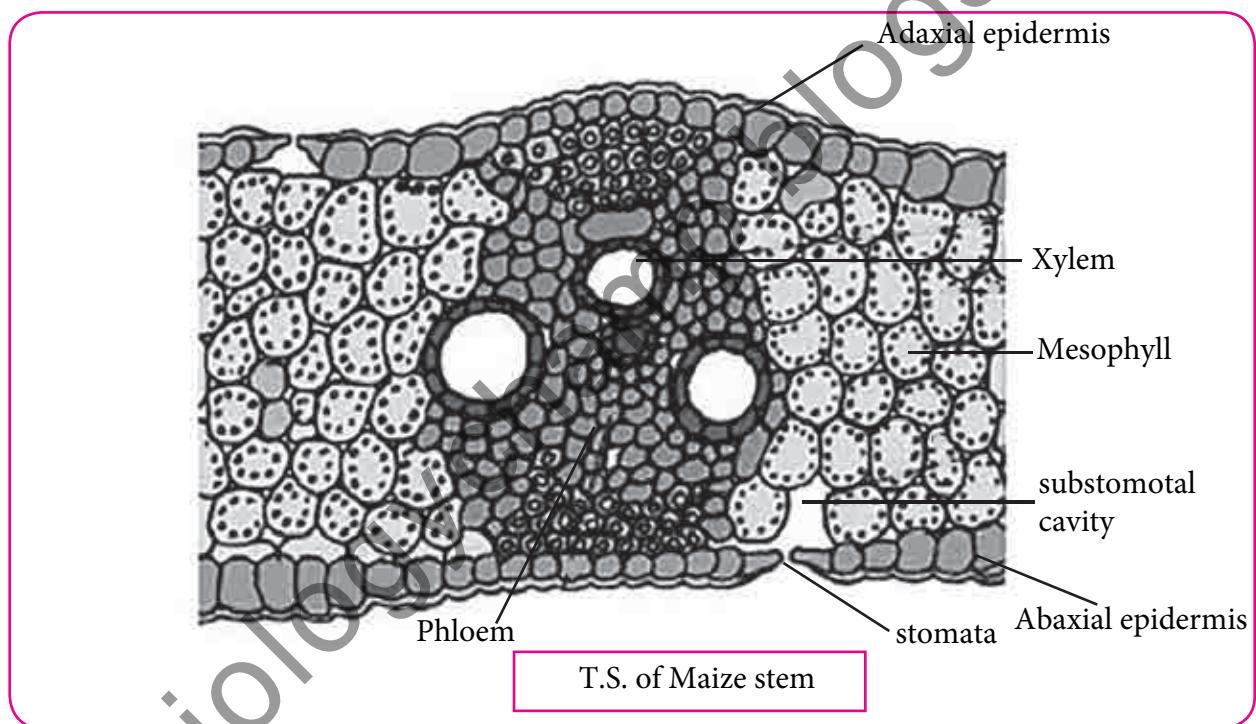


Observation

T.S. Dicot leaf

1. The epidermis which covers both the upper surface (adaxial) and the lower surface (abaxial) of the leaf has a conspicuous cuticle.
2. The abaxial epidermis generally bears more stomata than the adaxial epidermis.
3. The tissue between the upper and the lower epidermis is called mesophyll which contains chloroplast and helps in photosynthesis.
4. The adaxially placed palisade parenchyma which are arranged vertically and parallel to each other.
5. The oval or round and loosely arranged spongy parenchyma is situated below the palisade cells and extend to the lower epidermis.
6. Vascular system includes vascular bundles which found in the veins and the midrib.
7. The size of the vascular bundles are dependent on the size of the veins.
8. The vascular bundles are surrounded by a layer of thick walled bundle sheath cells.

Activity : Give the suitable title and label the diagram given below.



T.S. Monocot leaf

Epidermis

1. A single layer is present on the upper as well as lower surfaces of the leaf which shows presence of stomata.
2. Some cells of upper epidermis are larger in size. These are called bulliform cells or motor cells.

Mesophyll

In between the epidermal layers is present the region of chlorophyll containing cells called mesophyll which is not differentiated into palisade and spongy parenchyma. The cells are spherical or angular with only a few or no intercellular spaces.

Vascular bundles

Many small and large vascular bundles are present which are collateral and closed. Each vascular bundle is surrounded by a layer of thin walled, parenchymatous cells called bundle sheath.

Questions

Q. 1 How can you distinguish between a dicot and a monocot leaf?

- i. A dicot leaf is dorsiventral , while a monocot leaf is isobilateral
- ii. mesophyll of dicot leaf is differentiated into upper palaisade and lower spongy tissue while the monocot leaf shows uniform, undifferentiated mesophyll
- iii. vascular bundle of dict leaf does not possess any bundle sheath while that of monocot has a distinct vascular bundle

Q. 2 What is a monocot and dicot leaf?

Monocot leaves are leaves which appear on plants produced from seeds with single cotyledon like maize, rice, grass, wheat etc. The monocot leaves are usually described as isobilateral leaves because the both the upper and lower surfaces have the same color.

Dicot leaves are leaves which appear on plants produced from seeds with two cotyledon like groundnut, mango etc. The dicot leaves are usually described as dorsilateral leaves because the both the upper and lower surfaces are not same in colour

Multiple choice questions

1. The following is an example of Dicot Plant
 - a. Wheat
 - b. Pea
 - c. Rice
 - d. Sugercane
2. Parallel venation is the feature of
 - a. Leaf of monocot
 - b. Leaf of dicot
 - c. Leaf of Pteridophyte
 - d. Leaf of Higher Bryophyte
3. Stomata are distributed more on abaxial surface than on the adaxial surface in
 - a. Dorsiventral leaf
 - b. Isobilateral leaf
 - c. Monocot leaf
 - d. Jowar leaf
4. Which of the following statement regarding monocot leaf is not true
 - a. Shows parallel venation
 - b. Mesophyll is differentiated in to spongy and pallisade
 - c. Show stomata on both surfaces
 - d. Show presence bulliform cells
5. Pallisade parenchyma is absent in leaves of
 - a. Mustard
 - b. Soybean
 - c. Gram
 - d. Sorghum

Remark and Signature of Teacher

6. Study of plant family (Vegetative and floral characteristics)

Date :

Aim : Identify the family of the given plant material with its distinguishing characters and floral formula.

Procedure :

Take a plant material. Observe vegetative and reproductive characters .

The symbols used for writing floral formulae.

Symmetry of flower	
Actinomorphic	⊕
Zygomorphic	%
Sex of the flower	
Unisexual Male	♂
Unisexual Female	♀
Bisexual	⚥
Bracteate flower	
Calyx	K
Corolla	C
Perianth	P
Androecium	A
Gynoecium	G
Superior Ovary	G
Inferior Ovary	<u>G</u>
Half Superior Ovary	G -

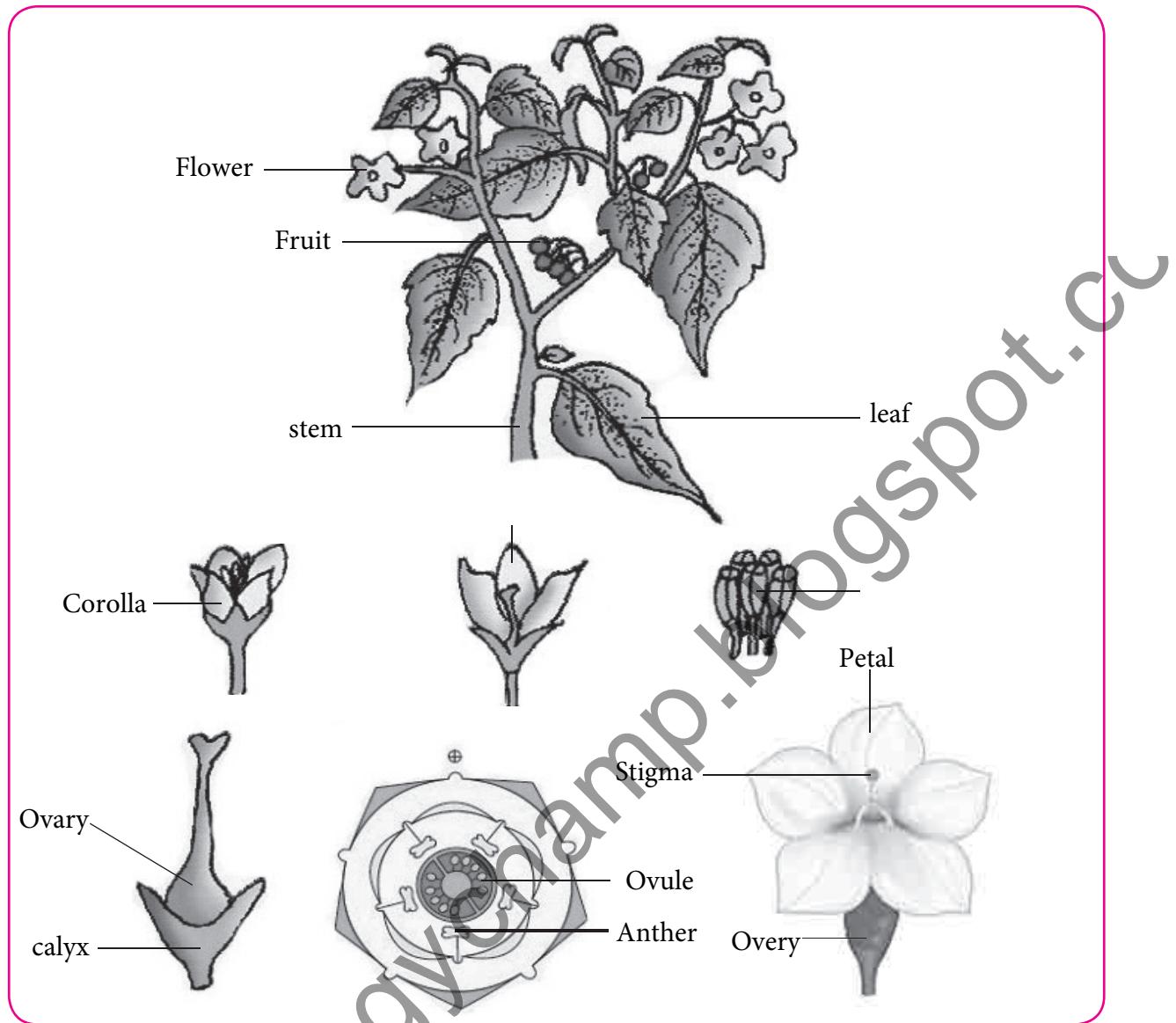
The floral diagram showing the relative position of different floral members is known as floral diagram.

A. Family . Solanaceae (Potato family)

Systematic position

Division	-	Spermatophyta
Sub-division	-	Angiospermae
Class	-	Dicotyledonae
Sub-Class	-	Gamopetalae
Series	-	Bicarpellatae
Order	-	Polemoniales/Solanales
Family	-	Solanaceae

Activity : Labels the figures given below.

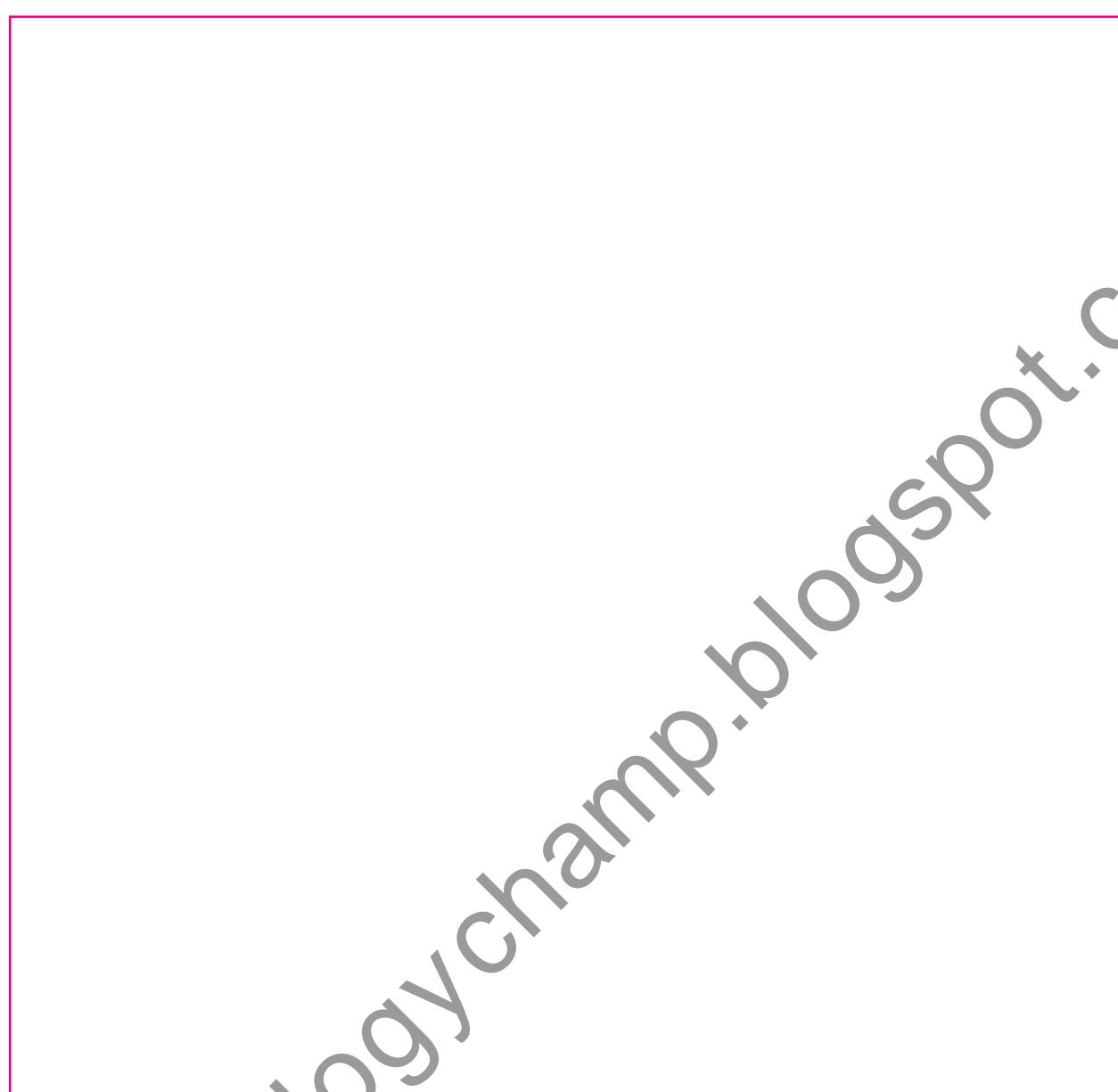


Salient features :

1. Habit Annual Herb
2. Root-Tap root system.
3. Stem . Erect or climber; Solanaceae includes herbs, shrubs, small trees, and climbers
4. Leaves -Alternate, simple or pinnately compound (rarely); exstipulate; reticulate venation.

5. Inflorescence -
Solitary, axillary cymose
 6. Flower-
Complete, actinomorphic, bisexual, shortly pedicellate, hypogynous.
 7. Calyx-
Sepals 5, gamosepalous, persistent (found in fruit condition also), valvate aestivation.
 8. Corolla -
Petals 5, gamopetalous, infundibuliform corolla having sharp pointed teeth, valvate aestivation.
 9. Androecium -
Stamens 5, epipetalous.
 10. Gynoecium -
Carpels 2 (bicarpellary), syncarpous, ovary superior, tetra locular with axile placentation, many ovules in each locule, stigma bilobed.
 11. Fruit
Capsule.
 12. Seed-
Numerous, endospermic, dicotyledonous.
 13. Floral Formula
 $\oplus \ddagger K(5) C(5) A(5) G(2)$
- Diagnostic Features:**
1. Aerial plant parts hairy.
 2. Leaves alternate, becoming opposite in floral region
 3. Calyx 5, gamosepalous, persistent.
 4. Corolla 5, gamopetalous.
 5. Stamens polyandrous and epipetalous.
 6. Gynoecium bicarpellary syncarpous
 7. Ovary superior and placed obliquely.
 8. Placentation axile with swollen placentae.
 9. Fruit berry or capsule.

Activity : Draw floral diagram and floral formula of the given specimen



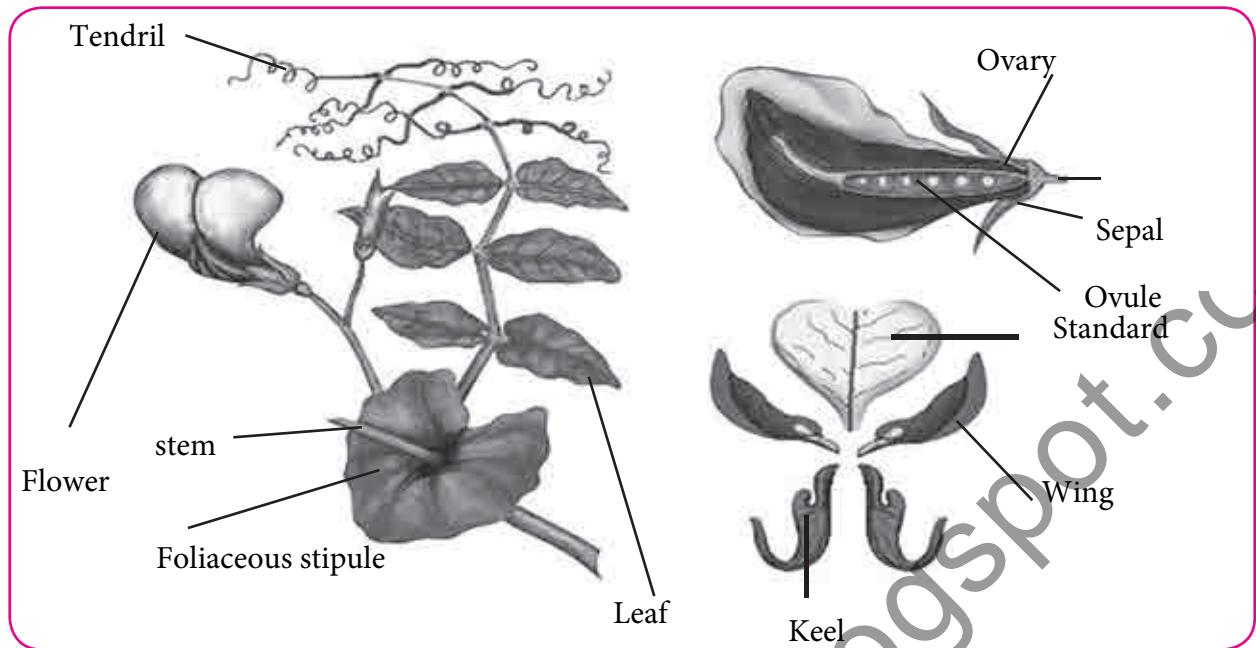
B. Family Fabaceae (Papilionaceae)

This family was earlier called Papilionoideae, a subfamily of family leguminoideae.

Systematic Position

Division	-	Spermatophyta
Sub-division	-	Angiospermae
Class	-	Dicotyledonae
Sub-Class	-	Polyetalae
Series	-	Calyciflorae
Order	-	Rosales
Family	-	Fabaceae (Papilionaceae)

Activity : Labels the figures given below.



Observations :

Activity : Write the Salient features of given plant material.

1. Habit - annual herbs
2. Root - roots with root nodules, Tap root system
3. Stem - Climber, Herbaceous, weak
4. Leaves - Pinnately compound with upper leaflets modified into tendrils, stipulate, reticulate venation
5. Infl orescence - Racemose
6. Flower - Complete, bisexual, bracteate, zygomorphic, pedicellate.
7. Calyx - Sepals 5, gamosepalous, imbricate aestivation.
8. Corolla - Petals 5, polypetalous, papilionaceous corolla, vexillary aestivation

9. Androecium - Stamens 10(9+1), 9 stamens united to form a tube, 10th stamen is free, basifixied inferior, diadelphous, anther dithecus.
10. Gynoecium - monocarpellary, ovary superior, unilocular with many ovules, marginal placentation, style curved and hairy, fattened.
11. Fruit - Legume or pod
12. Seed-Non-endospermic seed.

13. Floral Formula

$\frac{1}{2} \text{♀} \text{K}_{[5]} \text{C}_{1 \cdot 2 \cdot [2]} \text{A}_{[9] \cdot 1} \text{G}_1$

Diagnostic Features:

1. Presence of nodulated roots.
2. Leaves alternate, stipulated, pulvinate, commonly pinnately compound.
3. Flower zygomorphic and papilionaceous.
4. Odd spal anterior.
5. Stamens 10, diadelphous or polyandrous.
6. Gynoecium monocarpellary, ovary unilocular with marginal placentaiton.
7. Fruit a legume.

Activity : Draw floral diagram and floral formula of the given specimen

Questions

Q. 1 Which family is known as protein rich family?

Family -Fabaceae is known as protien family because the members of this family produce protein rich seeds.

Q. 2 Enlist edible fruits in members of Family Solanace

Family solanaceae- *solanum tuberosum* (Potato)
-*solanum lycopersicum* (Tomato)

Q. 3 Why do some plants have tendrils?

A plant's tendrils can form from its branches, shoots, or leaves. This anatomy helps support the plant growth and prevents the drooping of the plant so it avoids breaking its stem. Tendrils grow out of the plant and wrap around fences or any stable structure near the plant.

Q. 4 What is floral diagram?

Floral diagram is the graphic representation of floral structure.

Q. 5 What is diadelphous stamen?

A condition in which stamens are united along their filaments to form two bundles is called as diadelphous stamen.

Q. 6 Differentiate between Zygomorphic and Actinomorphic flower.

Radially symmetrical flowers that can be desected into into identical halves in more than one vertical plane are called atinomorphic e.g. Datura,

Zygomorphic flowers are bilaterally symmerical and can be cut into equal halves in only one vertical plane e.g. Piscum

Q.7 What is placentation?

Arrangement of ovules in the ovary is called as placentation

Multiple choice questions

1. The leguminous plants are important in agriculture because.....
 - a. They are disease resistant
 - b. They require very little irrigation
 - c. They help in Nitrogen Economy of Nature
 - d. Crops of legumes can be produced in a year
2. Androecium of papilionaceae family is
 - a. Monoadelphous
 - b. Diadelphous
 - c. Polyadelphous
 - d. Triadelphous
3. In Family Papilionaceae, 5 Petals form a unique association. in which 3 different element participate these are vexillum, alae & carina, What is the number of these element.
 - a. 1,2,2 respectively
 - b. 2,1,2 respectively
 - c. 1,1,3 respectively
 - d. 2,2,1 respectively
4. Nodulated roots bearing family is
 - a. Mimosoideae
 - b. Fabaceae
 - c. Solanaceae
 - d. Malvaceae
5. Potato tuber is a stem structure because it:
 - a. Lacks roots
 - b. Lacks Chlorophyll
 - c. Contains reserve food
 - d. Possesses axillary buds.
6. Which family members are rich source of proteins:
 - a. Cruciferae
 - b. Fabaceae
 - c. Liliaceae
 - d. Compositae
7. Which type of placentation is found in Fabaceae?
 - a. Axile
 - b. Marginal
 - c. Parietal
 - d. Basal

8. In sweet pea tendrils are modified:
a. Stipule b. Stem c. Leaf d. Leaflet
9. When flower can be cut in two equal portion from any one plane it is called
a. Actinomorphic b. Zygomorphic c. Asymmetrical d. Bilateral
10. In which of the following family, bacteria fix nitrogen by symbiosis
a. Fabaceae b. Solanaceae c. Malvaceae d. Cruciferae
11. What type of placentation is seen in sweet pea?
a. Basal b. Axile c. Free Central d. Marginal

Activity : Draw neat labelled diagrams of specimens with components and L.S of flower with characteristic features which you studied during practical.

Family . Solanaceae (Potato family)

Family Fabaceae (Papilionaceae)

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.....

7. To prepare a temporary stained slide of Squamous epithelium

Date :

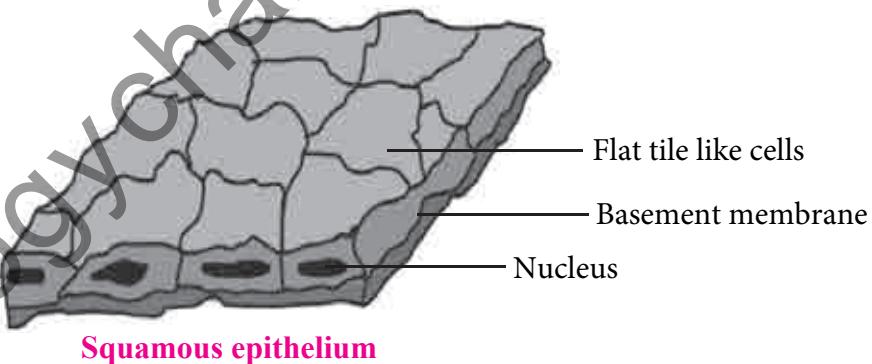
Aim: To prepare a temporary stained slide of Squamous epithelium.

Requirements: Live material of concern tissue, methylene blue, beakers, glass slides, coverslips, watch glasses, dropping bottle, dropper, required stain, glycerin, NaCl solution (0.9% w/v), needle, forceps, brush, toothpick, water, wash-bottle, dissecting tray, microscope.

Procedure:

1. Rinse mouth well with water and gently scrap the inside of your cheek with the broad end of a clean toothpick and discard this material.
2. Scrap again, and spread these cells gently on a clean slide.
3. Add a drop of 0.9% NaCl solution and a drop of methylene blue with the help of a dropper.
4. After two minutes, remove the excess stain and saline using the edge of a filter paper.
5. Now, put a drop of glycerin on the cells. Place a coverslip over the tissue and gently press it with the back of a pencil to spread the cells.
6. Examine the slide under the low power of microscope. Draw a labelled diagram of your preparation.

Activity : Observe the diagram given below and label the parts .



Observation : Observe the slide under low power and then under high power. You will notice that the cells are thin, polygonal, nucleated without intercellular spaces, cells are held together by cementing material.

Questions

Q. 1 In which tissue cells are flat and polygonal ?

simple squamous epithelium the cells are flat and polyclonal. The cells look like the tiles present on the road.

Q. 2 What is alternative name for squamous epithelium ?

Squamous epithelium is also known as pavement epithelium

Q. 3 Give the function of squamous epithelium.

- i) squamous epithelium forms the inner lining of lungs, alveoli and blood capillaries and also the wall of Bowman's capsule.
- ii) it plays an important role in diffusion, osmosis and filtration.

Multiple Choice Questions

1. Cells of squamous epithelium are rest on _____.

- a. Basement membrane
- b. Peritoneum
- c. Perichondrium
- d. Perosteum

2. Squamous epithelium performs the function of _____.

- a. Excretion
- b. Protection
- c. Egestion
- d. Circulation

3. Epithelium of bronchi is _____.

- a. Simple cuboidal
- b. Simple squamous
- c. Glandular
- d. Ciliated columnar

4. Intercellular material is negligible in _____ tissue.

- a. Connective
- b. Cardiac
- c. Epithelial
- d. Muscular

5. Ciliated epithelium is found in lining of _____.

- a. Ureters
- b. Stomach
- c. Fallopian tubes
- d. Trachea

Remark and Signature of Teacher

8. Effect of Light on the rate of Photosynthesis.

Date :

8 A : To Study rate of photosynthesis under different Light intensites.

Aim : To Study rate of photosynthesis under different Light intensites.

Principle : The intensity of light is one of the principle limiting factors of photosynthetic process in green plants. A very small fraction of light wavelength can be trapped by the green plants and utilized in photosynthesis. Further, the efficiency of photosynthesis (as measured by O₂ evolution) by light (as a function of the wavelength of light) is termed ‘action spectrum’.

Requirements : Beakers (500 ml capacity), funnel test tubes, glass rods, Hydrilla plants Dist. water stop watch, 25W, 60W, 100W electric bulbs, table lamps (3).

Figure :

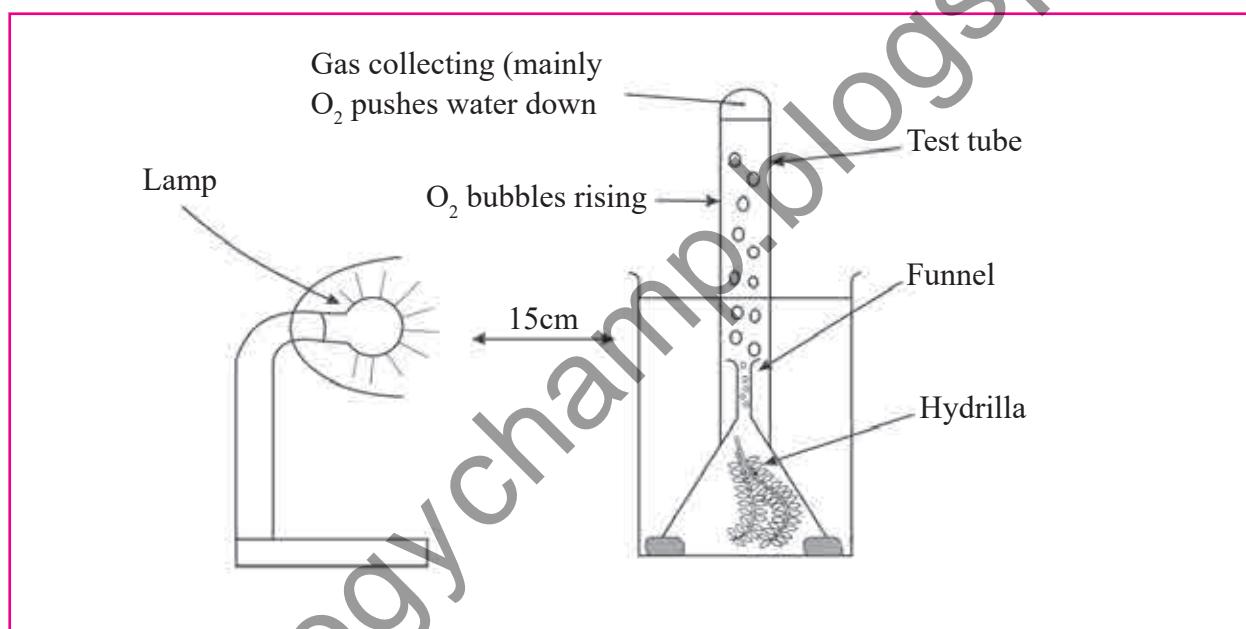


Fig. Experiment Setup

Procedure:

1. Make three set of experiments having beaker, conical flask, Hydrilla plant with different light intensity (25wt, 60wt and 100wt).
2. In each set fill the beaker with distilled water up to 2/3 mark.
3. Take some fresh and healthy Hydrilla plants and cut their ends.
4. Insert the cut ends inside the neck of the funnel.
5. Place the funnel inside the beaker in such a manner that all plants remain inside the funnel.
6. Add a few ml of 0.1% KHCO₃ soln. for dissolved CO₂ source.
7. Invert a graduated test tube filled with water over the neck of the funnel so that the jet of the funnel remains inside the tube in vertical position.
8. Place the whole set-up under variable light intensity 25wt, 60wt and 100wt.

9. Allow the experiment to continue for about 20 minutes. Then record the evolution of air bubble (O_2 gas) inside the tube and count Number of O_2 bubbles evolved per minute.

Observation:

It is observed that evolution of bubbles from the cut ends of the plants takes place in the set-up exposed to light of variable intensity and count Number of O_2 bubbles evolved in each set and record the reading.

Observation table:

Observations	Light intensity	No.of bubbles evolved per min.
1	25 W	08
2	60 W	12
3	100 W	20

Rate of Photosynthesis = No. of bubbles formed per min per fresh plant.

Inferences:

The rate of photosynthesis increases with increasing intensity of light

Remark and Signature of Teacher

8 B : To Study the effect of Light quality on rate of photosynthesis.

Aim : To Study the effect of quality of Light on the rate of Photosynthesis.

Principle : The quality of light interms of variable wavelengths (Red, Blue, Green light) have an impact on rate of photosynthesis. A very small fraction of light wavelength can be trapped by the green plants and utilized in photosynthesis. Further, the efficiency of photosynthesis (as measured by O₂ evolution) by light (as a function of the wavelength of light) is termed ‘absorption spectrum’.

Requirements : Beakers (500ml capacity), funnel, graduated glass tubes, glass rods, Hydrilla plants, Dist. water, stop watch, Red, Blue, Green coloured transparent sheets, 60W bulbs (3), Table lamps (3), etc.

Figure :

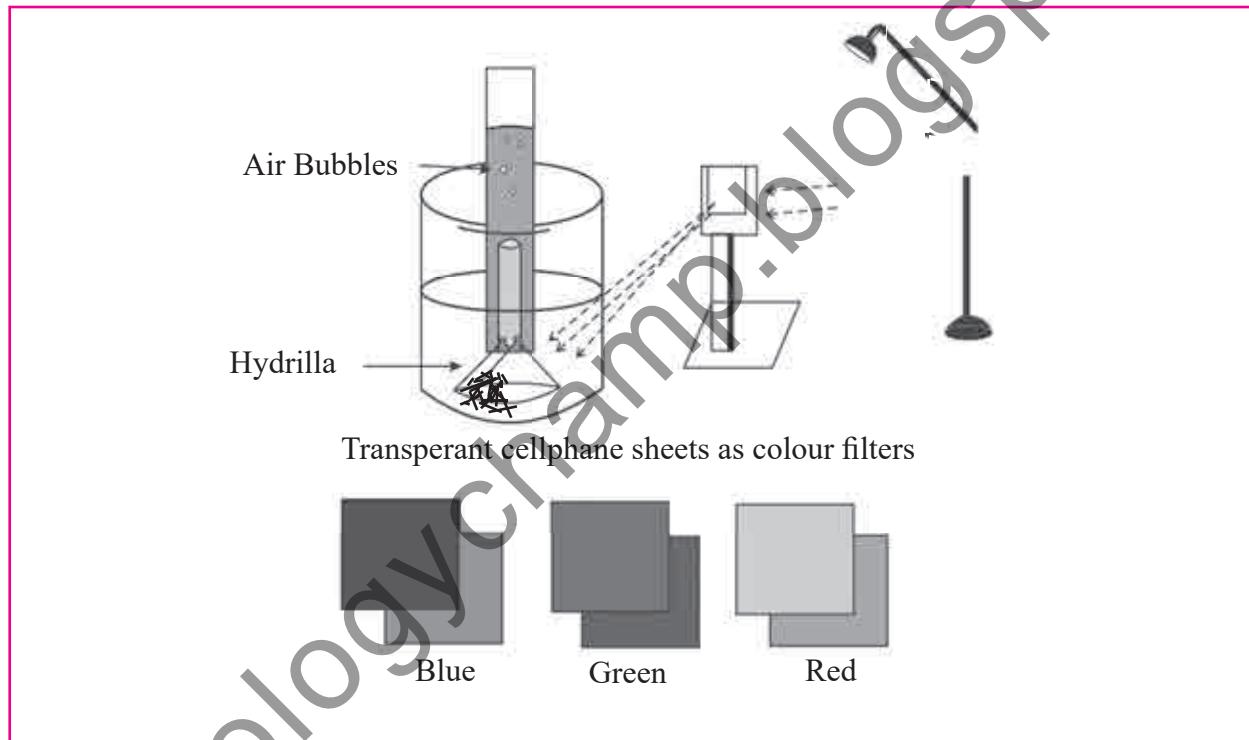


Fig. Experiment Setup

Procedure:

1. Prepare four photosynthetic experimental sets using Hydrilla plants in beakers in the usual manner. Add traces of KHCO₃ salt in each set.
2. Place the experimental sets in separately illuminated for artificial exposure to light for an hour. (Red, Blue, Green)
3. Record the evolution of O₂ as a result of photosynthesis separately in each experimental set for 1 minute (each reading).

Observation:

For individual quality of light, the photosynthesis rate varies. The higher rate is seen in red light region.

Observation table:

Sr. No	Number of oxygen bubbles recorded per minute			
	Sunlight	Red light	Blue light	Green light
1	10	12	12	1

Rate of photosynthesis = No. of bubbles formed per minute by fresh plant

Inferences:

Rate of photosynthesis is maximum in red and blue lights, but minimum in green light

Questions

Q. 1 Why Hydrilla is used in this experiment?

Hydrilla is a submerged aquatic plant and it has not stomata to take carbon dioxide and release oxygen that is why it respires through their whole body surface and release oxygen through whole body surface so we can easily see the oxygen in the form of bubbles while in terrestrial plant we can't see the oxygen in the bubbles form.

Q. 2 Why test tube is kept in inverted manner in this experiment?

Vj g'guv'wdg'hkngf 'y kj 'y cvgt'ku'ngr'vlp xtvgf "qxgt'j g'hwppgn'uqh'j cv'qz { i gp"gxqnxgf "ecp"dg"qdugtxgf "d{ " f qy py ctf "f kur ncego gpv'qh'y cvgt'0Vj g'pwo dgt'qh'dwddigur'tqf wegf "r gt'o kpwg"eqttgur qpf u'q""j g'tcvg"qh' r j qqu{pj guku

Q. 3 Apart from red region which other spectrum shows high absorption?

Apart from red region, blue region of spectrum shows high absorption by photosynthesis

Q. 4 Which region of light shows least absorption?

Green region of light shows least absorption by chlorophylls.

Q. 5 Why KHCO_3 is used in these experiments?

KHCO_3 solution provides a source of dissolved CO_2 as a raw material for photosynthesis which is used by aquatic plants

Multiple Choice Questions

1. Rate of photosynthesis does not depend upon _____

- a. Duration of light
- b. Intensity of light
- c. Quality of light
- d. Temperature

2. In Polyhouse, maximum yield is obtained because of increased _____

- a. % of CO_2
- b. % of O_2
- c. % of Humidity
- d. % of carbon

3. Nurseries use _____ coloured 'Shed Net' for faster seed germination.

- a. Green
- b. Red
- c. Blue
- d. White

4. Maximum absorption of light for photosynthesis occurs in _____

- a. Red light
- b. Yellow light
- c. Green light
- d. Blue light

5. Rate of photosynthesis is measured by _____

- a. Counting O_2 bubbles
- b. Counting CO_2 bubbles
- c. Measuring water level
- d. Counting H_2 bubbles

6. _____ light is not used for photosynthesis by plants.

- a. Green
- b. Blue
- c. Red
- d. Sun

Remark and Signature of Teacher

9. To study Human Dentition

Date :

Introduction : The study of teeth with respect to their number, characteristic arrangement, kind, development is called as Dentition.

Human being has heterodont kind of teeth. There are four kinds of teeth viz *Incisors*, *Canines*, *Premolars* and *Molars*. Human adult has the following dental formula 2·1·2·3

The total number of teeth in an adult human is 32. The teeth helps in mastication of the food into small particles and mixing with saliva.

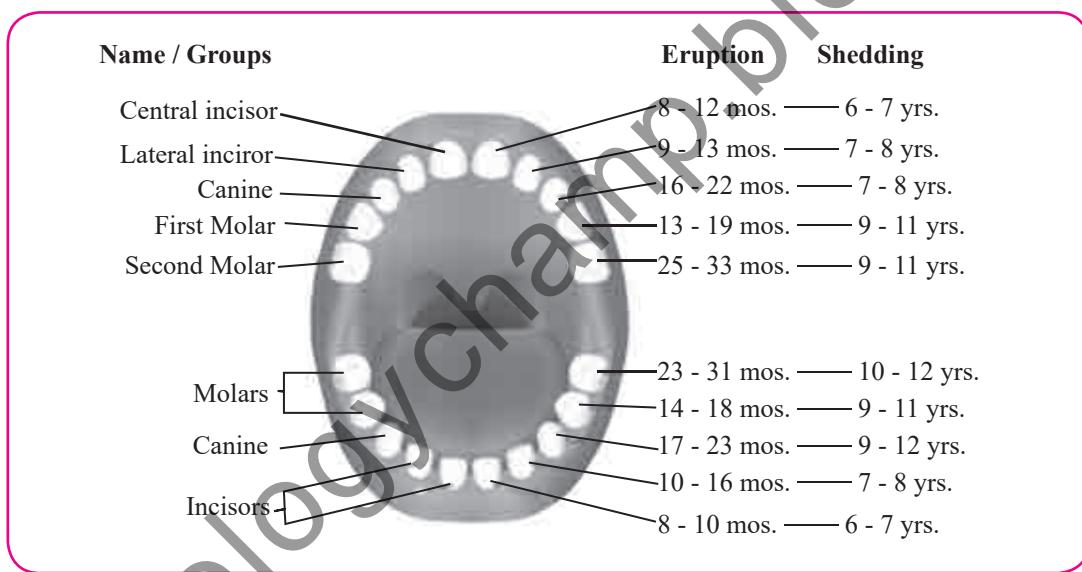
Each tooth is made up of root and crown. The crown is covered with an enamel. The body of the tooth is made up of dentine beneath which lies the central cavity containing blood vessels, nerves and pulp.

Aim : To study the Dentition of Man

Material : Human teeth (Experiment to be performed in partnership between two students)

Method : Study the teeth of your partner and write down the observations.

Figure :



Observation:

- (1) Human dentition is heterodont i . e . shows 4 different types of teeth viz incisors , canines , premolars and molars .
- (2) A human adult has a dental formula 2 : 1 : 2 : 3 .
- (3) The total number of teeth in an adult human are 32 .
- (4) The teeth help in mastication of food and mixing it with saliva .
- (5) Each tooth is made up of root and crown . The crown is covered with an enamel .

Questions

Q. 1 How many teeth does an average human adult have?

An average human adult having 32 teeth

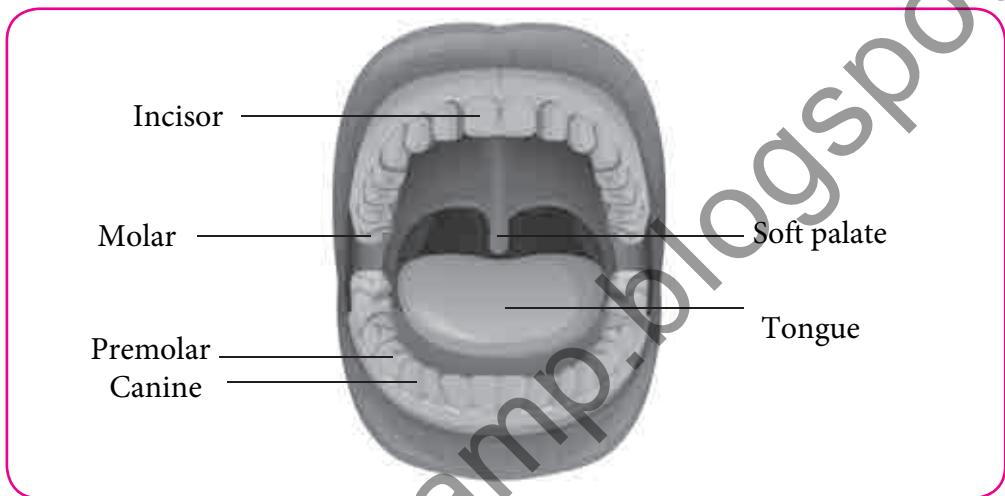
Q. 2 Write the dental formula of an average adult man

2:1:2:3 is the dental formula of an average adult man

Q. 3 What is the meaning of the term diphyodont?

The term diphyodont refers to presence of 2 sets of teeth in the lifespan

Q. 4 Label the diagram given below.



Multiple choice questions

1. _____ are used for biting the food.
a. Molars b. Incisors
c. Canines d. Premolars
2. The dentition of man is of _____ type.
a. Homodont b. Thecodont
c. Monophyodont d. Polyphyodont
3. Premolars and Molars are used for _____.
a. Cutting b. Grinding
c. Biting d. Shearing
4. ◊ are also referred to as 'Wisdom Teeth'.
a. Premolar b. 3rd Molars
c. Incisors d. Canines
5. There are _____ incisors in permanent dentition of upper jaw.
a. 4 b. 2
c. 6 d. 8

Remark and Signature of Teacher

10. To Study the effect of enzymes on starch, egg albumin and fats

Date :

A. Effect of Salivary Amylase on starch

Aim: To study the action of salivary amylase on starch.

Principle :

Amylase is an enzyme, which acts on the polysaccharide starch and converts it into the disaccharide maltose. Salivary glands secrete salivary amylase and pancreatic glands secrete pancreatic amylase. Amylase acts at 37°C in pH 6.7.

Materials: Test tubes, water bath, pipettes, test tube stand, Starch solution (1 gm in 100 ml distilled water), Phosphate buffer of pH 6.7, Salivary amylase (Rinse mouth with lukewarm saline water, gargle for some time and collect in a beaker, filter to remove mucous), Lugol's Iodine solution, Dilute HCL acid.

Procedure:

1. Prepare three test tubes and label them 1,2,3.
2. Add 5 ml starch and 3ml of buffer solution in each test tube.
3. In the first tube add 3 ml salivary amylase solution
4. In the second test tube add 3 ml of distil water.
5. In the third test tube add 3 ml distil water and 10 drops of dilute HCL.
6. Place all three tubes in a 37 °C water bath for 15 to 20 mins to incubate.
7. Test the solutions for the presence of undigested starch by Lugol's test.— Add a few drops of Lugol's iodine solution to each of tubes. If the solution has an amber coloration, then there is no starch present.
8. If the solution turns blue or black, starch is present in the solution .The absence of starch will indicate that the starch has been converted into maltose.

Observe and note down the changes in the test tubes. Write down your inference.

Observation Table:

No.	Test	Observation	Inference
1.	5 ml starch solution+ 3 ml buffer solution+ 3 ml amylase solution+ few drops of Lugol's Iodine solution	Amber colour	Starch is digested by the enzyme.
2.	5 ml starch solution+ 3 ml buffer solution+ 3 ml distilled water+ few drops of Lugol's Iodine solution	Dark blue colour	Starch remains undigested in absence of enzyme.
3.	5 ml starch solution+ 3 ml buffer solution+ 3 ml of amylase solution+ 10 drops of dil HCl+few drops of Lugol's Iodine solution	Dark blue colour	Starch remains undigested as the enzyme is not active as very low pH.

Conclusion:

1. In the first test tube, amylase acts on starch to produce maltose at the appropriate pH of 6.7
2. Second test tube without enzyme shows presence of starch as indicated by blue black colour.
3. Third test tube with enzyme but at acidic pH shows presence of starch as it remains undigested.

B. Effect of Pepsin on egg white.

Aim: To study the action of enzyme pepsin on egg white (egg albumin).

Principle :

Pepsin is a protease enzyme that begins digestion of proteins, breaking them into peptides.

Pepsinogen, is secreted by gastric glands of the stomach into the stomach and converted into pepsin due to HCl.

Materials: Test tubes, water bath, pipettes, test tube stand, dilute HCl, Pepsin (1%), dilute NaOH.

Procedure:

1. Prepare three testtubes and label them 1,2,3.
2. Add 3 ml of egg white solution in all of them.
3. In the first tube add 5 ml of HCl acid.
4. In the second test tube add 3 ml of pepsin solution and 2 ml of dilute HCl.
5. In the third test tube add 3 ml pepsin solution and 2 ml of NaOH solution.
6. Shake well and place all three tubes in a 37 °C water bath for 30 minutes to incubate.
7. Observe and note down the color change in the test tubes and write your inferences.

Observation Table:

ations Table :

Test tube	Test	Observation	Inference
1.	3 ml egg white solution+ 5 ml HCl solution	Milky white solutin	Proteins are not digested
2.	3 ml egg white solution+ 3 ml pepsin +2 ml dil HCl solution	Clear solution	Proteins are disgested
3.	3 ml egg white solution+ 3 ml pepsin solution+ 2 ml NaOH solution	Milky white solution	Proteins are not digested

Conclusion:

- 1.Test tube shows undigested proteins due to absence of pepsin
2. Test tube shows clear solution as the egg albumin is digested by pepsin at appropriate acidic pH.
3. Test tube 3 shows undigested proteins as pepsin fails to work in alkaline medium

C. Emulsification of fats by bile juice.

Aim: To study the action of bile on fats.

Principle : When the pre-digested food from the mouth and the stomach reach the intestine, it mixes with bile and pancreatic juice. The bile is produced in the liver , concentrated and stored in the gall bladder. It is secreted in the intestine when required. Bile helps in the emulsification of oil and fats leading to faster digestion of fats.

Material : Test tubes, test tube stand, pipette , water bath, bile, oil, distilled water.

Procedure:

- 1.Prepare two test tubes and label them 1,2.
- 2.Add 3 ml of oil to each of them.

3. In the first test tube add 3 ml of distilled water.
4. In the second test tube add 3 ml of bile juice.
5. Shake well. Observe and note down the inference.

Observation Table:

Test tube	Test	Observation	Inference
1.	3 ml of oil + 3 ml of distilled water, shake well	Oil and water are seen as separate layer	Oil is not emulsified
2.	3 ml of oil + 3ml of bile juice, shake well	Fine droplets of oil are seen suspended in water	Oil is emulsified

Conclusion:

1. Test tube 1 shows oil and water as two separate layers
2. Test tube 2 with bile shows tiny droplets of oil suspended in water

Questions

1. What is an enzyme?

Enzymes are biocatalysts which accelerate the rate of a biochemical reaction without undergoing any change in them.

2. Where is bile stored?

bile is produced by liver and stored inside gallbladder

3. At what pH does amylase shows its effect.

The optimum pH for amylase activity is 6.7

4. What will happen if you add Conc. HCl to the substrate during amylase activity?

Conc HCl reduces the pH of the reaction mixture as a result amylase enzyme cannot act on starch

5. What is the inactive form of the enzyme pepsin?

Inactive form of pepsin is Pepsinogen

Multiple choice questions

1. Inactive pepsinogen is converted into active pepsin by _____

- a. NaOH
- b. Citric acid
- c. HCl
- d. Water

2. Salivary amylase works at a pH of _____

- a. 4.2
- b. 1.3
- c. 14
- d. 6.7

3. Bile helps in the _____ of fats during digestion

- a. Digestion
- b. Diffusion
- c. Emulsification
- d. Breakdown

4. Proteins are converted into peptides and amino acids by the enzyme _____

- a. Lipase
- b. Amylase
- c. Creatinine
- d. Pepsin

5. _____ Enzyme converts lipids and fats into fatty acids and glycerol.

- a. Lipase
- b. Amylase
- c. Creatinine
- d. Pepsin

Remark and Signature of Teacher

11. To test Urine sample for Normal and Abnormal Constituents

Date :

Aim : To test the presence of urea, sugar, albumin and bile salts in urine.

Principle:

The metabolic functioning of the body generates many products and byproducts. The byproducts are removed from the body mainly through faeces and urine. Urine analysis is routinely used for diagnosis of number of metabolic disorders. The normal urine contains urea of about 60-150 mg per liter (2%). The sugar is abnormal component of urine. The analysis includes physical and chemical tests. Normal urine is pale yellow due to the presence of pigment urochrome. Its PH ranges between 4.8 to 8.0. It contains 95% water and 5% solutes in the form of sodium, potassium, magnesium and ammonia present in dissolved state.

Certain substances are always present in the urine and called normal constituents. They are salts of sodium, potassium, magnesium, ammonium and calcium. Many organic compounds like urea, uric acid, creatinin etc. are also present. Abnormal constituents are sugar, albumin, bile pigments, blood, pus etc.

A. Test for Urea

Requirements: Beakers, test tubes, test tube holder, spirit lamp etc.

Chemicals required: Phenolphthalein, sample of urine, soyabean or gram flour as a source of urease enzyme.

Procedure: Take a test tube and add 2ml of urine, to this add a pinch of soybean or gram flour (freshly ground) and 1 drop of phenolphthalein indicator. Keep it for 5 min warm if necessary.

Observation :

The mixture turns Pink

Conclusion:

In given sample of urine Urea is present

Explanation and clinical significance:

The urea is produced in liver as normal catabolic process of excess amino acids. This urea is filtered out by kidneys and its presence indicates normal functioning of excretory system.

Urea is broken down by enzyme urease to produce ammonia and carbon dioxide. The test uses soybean flour as source of urease. The ammonia released in the process makes solution alkaline which is detected by phenolphthalein indicator.

B. Test for Sugar

Chemicals required : Benedict's solution.

Procedure: Take 2 ml of urine in test tube , add 1 ml of Benedict's solution in test tube. Boil it for 2 min. in water bath or on spirit lamp. The appearance of coloured precipitate indicates the presence of sugar. The colour of precipitate depends on the concentration of glucose.

Observation :

blue colour turns Green/Yellow/Red /Brick red and after some time coloured ppt. settle at bottom of test tube

Conclusion :

In given sample of urine glucose is present

Explanation and clinical significance:

Sugar present in blood is in the form of glucose. Its level is kept at the permissible normal limit by hormone insulin. Due to deficiency of insulin the glucose level rises in blood. This glucose finds its way in urine. This condition is diabetes mellitus.

The sugar is reducing agent. It reduces copper sulphate into cuprous oxide. As per the quantity reduced it gives different colour precipitate.

If there is no change in colour remains blue, then sugar is absent.

But if 0.5% sugar is present then the colour turns yellow.

1% sugar gives orange precipitate.

1.5% sugar gives brick red precipitate.

C. Test for albumin (Proteins)

Chemicals Required: Sample of urine, conc. Nitric acid

Procedure: Take 1 ml of conc. Nitric acid in a test tube. Hold test tube at 45° angle and Add 2 drops of urine sample from the sides of test tube.

Observation:

A white brown ring is produced at the junction of two solutions

Conclusion:

In given sample of urine Proteins are present

Explanation and clinical significance: Albumin in urine is precipitated with nitric acid. Albumin is one of the proteins found in blood. Normally during urine formation these large molecules never escape ultrafiltration. If presence of albumin is detected then it indicates damage to nephron as in nephritis or urinary tract infection.

D. Test for bile salts

Chemicals Required: Sample of urine, sulphur powder

Procedure: Take 3 ml of urine sample and plain water in another test tube. Sprinkle a very small quantity of sulphur powder on the surface of both the samples.

Observation:

Sulphur powder sinks at the bottom of test tube

Conclusion:

In given sample of urine **bile salts** are present

Explanation and clinical significance: This test is termed as Hay's sulphur powder test. Bile is the secretion produced by liver. The chief role of bile is emulsification of fats. The bile salts are not normally found in detectable quantity in urine. More than 90% of the bile salts are actively reabsorbed. The liver normally clears 20 g of bile salt from the blood each day. However, when the liver is impaired, the blood levels of bile salts are increased. Due to liver infections like jaundice the bile salts are produced in much larger quantity. These salts are then excreted as part of urine. The presence of bile salts reduce the surface tension of the solution making the sulphur powder sink. The common bile salts are sodium glycocholate and sodium taurocholate.

Questions

Q. 1 What is the role of urease enzyme in detection of urea?

Urea is broken down by enzyme urease to produce ammonia and carbon dioxide. The ammonia released in the process makes solution alkaline which is detected by Phenolphthalein indicator.

Q. 2 Which hormone regulates blood glucose level and how?

Insulin hormone regulates blood sugar level. Due to deficiency of insulin the glucose level rises in blood,

Q. 3 Name two bile salts present in the bile.

1. Sodium glycocholate
2. Sodium taurocholate

Q. 4 Why are proteins absent in urine sample?

Healthy kidneys do not allow proteins to pass through their filtrate. They are big molecules and hence can not move out through the walls of the glomerulus. Presence of proteins in urine indicates damage to kidney.

Q. 5 Which cells of pancreas secretes insulin?

Beta cells (B cells) produce insulin and are the most abundant of the islet cells present in pancreas

Q. 6 What are the causes and symptoms of diabetes mellitus?

Sugar present in blood is the form of glucose. Its level is kept at the normal level by hormone Insulin. Due to deficiency of insulin the level rises in blood. This glucose enters in urine. This condition is known as diabetes mellitus.

Multiple Choice Questions

1. The process of formation of urea is called as
a. Ammonotelism b. Ureotelism
c. Uricotelism d. Guanotelism
2. The structural and functional unit of kidney is
a. Malpighian tubules b. Seminiferous tubules
c. Urineferous tubules d. Haversian canal
3. Presence of sugar indicate
a. Diabetes mellitus b. Diabetes insipidus
c. Jaundice d. Hypertension
4. Urea is produced in
a. Pancreas b. Kidney
c. Liver d. Gall bladder
5. Urea is produced by cycle.
a. Ornithine b. Crabs
c. Kelvin d. Inosinic pathway

Remark and Signature of Teacher

B. STUDY/OBSERVATION - SPOTTING

1. Study of specimens and identification with reasons.

Aim : Study of specimens and identification with reasons.

Date :

Salient features of Kingdom - Monera

1. These are unicellular organisms with Prokaryotic cellular organization.
2. The organisms don't have well defined nucleus.
3. They are found in all types of environment.
4. Their mode of nutrition may be Heterotrophic or Autotrophic.
5. In Autotrophic mode of nutrition they should Photoautotrophs and Chemoautotrophs.
6. DNA exists as a simple double stranded circular single chromosomes called nucleoid.
7. Membrane, endoplasmic reticulum are absent.
8. Mode of reproduction is asexual, binary fission or budding and very rarely sexual reproduction is by conjugation method.
9. On the basis of evolution bacteria can be classified as Archaeabacteria and Eubacteria. e.g. bacteria.
e.g. cyanobacteria - *Nostoc* and *Oscillatoria*

Activity : Observe the given specimen and write its characters.

Examples :

e.g. *Oscillatoria* :

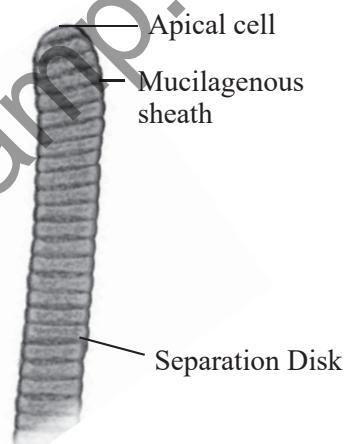


Fig. Oscillatoria

- (1) Oscillatoria is a fresh water blue green alga .
- (2) The thallus is filamentous . Filaments are unbranched covered with mucilaginous sheath .
- (3) Each filament is called trichome and is made up of cylindrical cells arranged end to end .
- (4) Each cell has prokaryotic organization .
- (5) Mode of nutrition is autotrophic .
- (6) The trichomes of oscillatoria shows a number of double concave gelatinous discs called separation discs .
- (7) The trichomes break at the separation discs to produce hormogonia .
- (8) Hormogonia give rise to new trichomes of oscillatoria .

Sailent features of Kingdom - Protista

1. Most of the organisms are unicellular and eukaryotic.
2. The organisms have well defined nucleus.
3. The organisms are Plant like - Diatoms, Animal like - Paramoecium, Fungi like - Gonyaulax.
4. Cell organelles like Plastids and Mitochondria are present.
5. Mode of nutrition is Autotrophic and heterotrophic.
6. Most of the organisms reproduces asexually. While in few sexual reproduction is present.

e.g. **Diatoms**

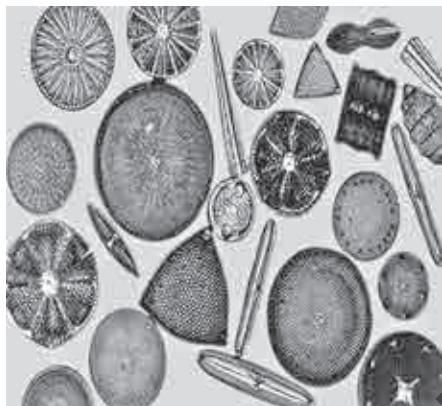
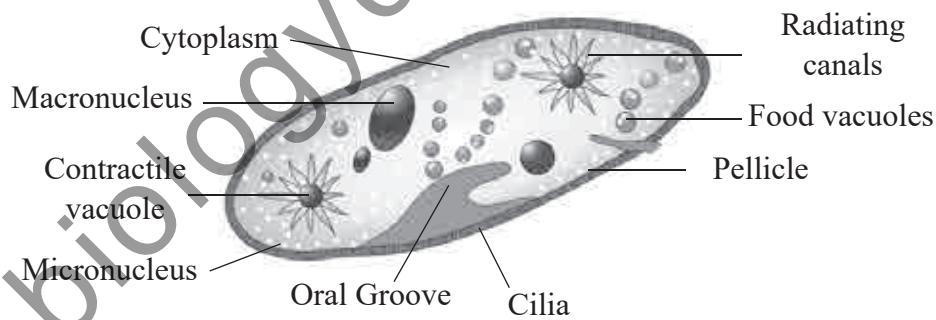


Fig. Diatoms

- (1) Diatoms are single celled, eukaryotic photosynthetic organisms,
- (2) They possess cell wall made up of silica. It is called frustule,
- (3) Reproduction by asexual method of multiple fission
- (4) Photoautotrophic pigments are carotenoids and fucoxanthin.
- (5) Shells of dead diatoms constitute diatomaceous earth which has industrial importance in fine polishing and liquid filtration

e.g. **Paramoecium**



- (1) Paramoecia are microscopic free living unicellular, eukaryotic protozoan, commonly called Paramecia
- (2) The body is covered with a flexible, thin & firm membrane called pellicle
- (3) Multiple, small, hairlike projections called cilia are present all over the body (holotrichous)
- (4) There is a large, shallow, oblique depression on lateral side called peristome or oral groove
- (5) There are two types of vacuoles contractile vacuole for osmoregulation & excretion while food vacuole for nutrition
- (6) Reproduction asexually by binary fission and sexually by conjugation

Salient features of Kingdom - Fungi

1. These are eukaryotic heterotrophs showing extracellular digestion.
2. They may be unicellular or multicellular showing long thread like structures called hyphae.
3. Large fungi - such as mushrooms have compact mass of cells.
4. They exhibit heterotrophic mode of nutrition mostly they are saprophytic some are parasitic or predators.
5. They reproduce asexually as well as sexually.
6. Some fungi are symbiotic either live with algae as lichens or as mycorrhiza in association with roots of higher plants.
7. They some edible fungal organisms like mushrooms are consumed as a food.

e.g. Agaricus

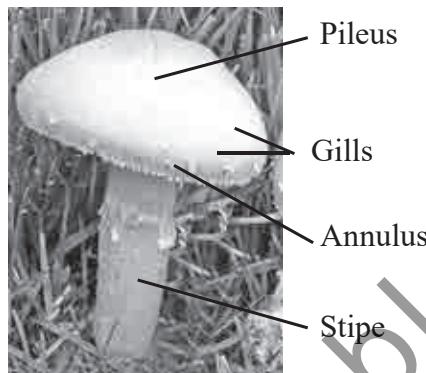


Fig. Agaricus

- 1) Agaricus is a saprophytic fungus Which grows in humus rich soil and on rotten woodenlogs.
- 2) It has a separate, underground mycelium which produces white, creamish, umbrella shaped fruiting bodies or basidiocarp above the substratum.
- 3) Basidiocarp has two parts a stalk called stipe and a cap like structure called pileus.
- 4)The pileus bears a number of plate like structures called gills. The gills produce basidiospore.
- 5) A ring like annulus is present on the stalk
- 6)Some species of mushroom are edible while other are poisonous.

e.g. Fruticous Lichens : e.g. Usnea

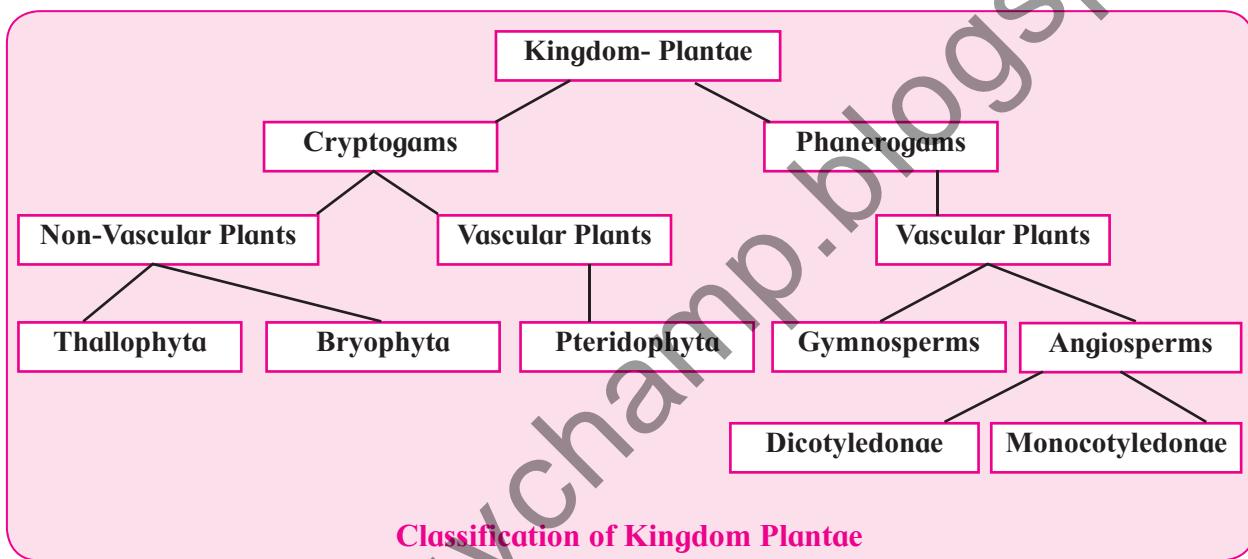


Fig. Lichens

- 1) Usnea is a fruticose type of lichen which grows on rocks, stones, tree barks, etc.
- 2) It generally grows hanging from tree branches.
- 3) It represents the symbiotic association between an alga and a fungus.
- 4) Algae produces food and fungi gives shelter.
- 5) Thallus is cylindrical and branched.
- 6) The tips of branches bear saucer shaped apothecia.
- 7) Usnic acid obtained from usnea is used as antibiotic.

Salient features of Kingdom - Plantae

1. This kingdom is dominated by autotrophs.
2. Most of the members are multicellular having eukaryotic cellular organisation.
3. Cells have cellulosic cell wall.



CRYPTOGAMS

i. Thallophyta

e.g. *Chlamydomonas* :

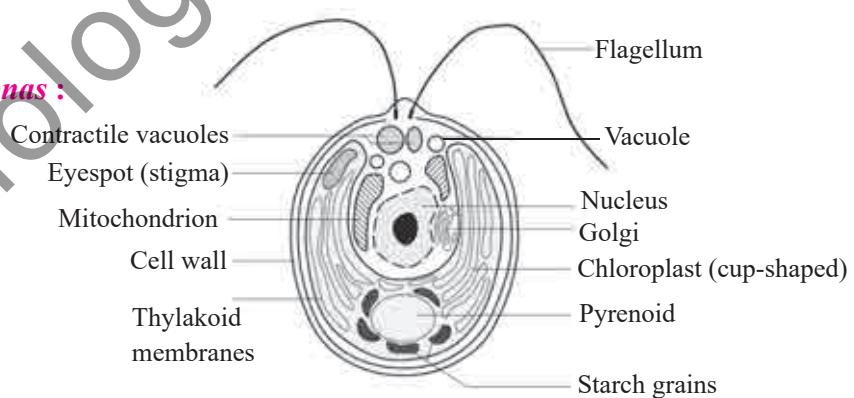


Fig. Chlamydomonas

- 1) Unicellular, free living green alga found in soil, ponds & ditches.
- (2) The cell is oval shaped With non-cellulosic wall called the, a stigma (eyespot) and a cup-shaped chloroplast.
- (3) It is biflagellate.
- (4) Asexual reproduction by zoospores While sexual reproduction by gamete formation.

e.g. *Sargassum* :

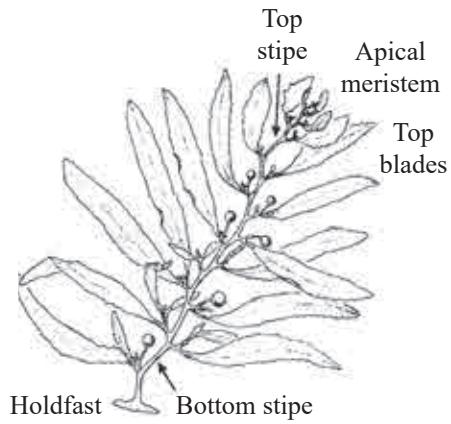


Fig. *Sargassum*

1. Multicellular, brown algae found in marine habitats.
2. It is highly branched with photosynthetic pigments such as chlorophyll - a,c, carotenoids and fucoxanthin.
3. The cell wall is made up of cellulose.
4. Reserve food is laminarin & mannitol.
5. Vegetative reproduction by fragmentation.
6. Asexual reproduction occurs by biflagellate zoospores.
7. Sexual reproduction by gamete formation.

e.g. *Batrachospermum* : Carposporangia

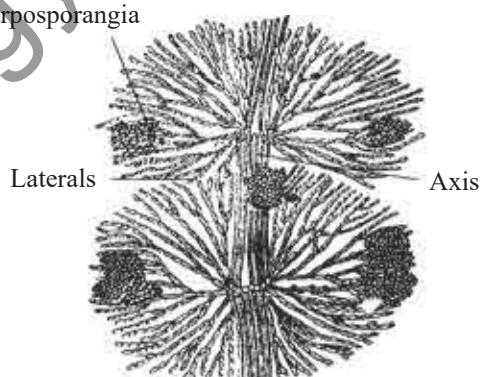


Fig. *Batrachospermum*

1. It is a multicellular, fresh water algae found in deeper water
2. Thallus is filamentous, profusely branched .
3. Cell wall is made up of cellulose.
4. Photosynthetic pigments are chlorophyll-a, chlorophyll-e phycoerythrin etc.
5. Reserve food is floridean starch.
6. Asexual reproduction by non-motile monospores
7. Sexual reproduction is oogamous.

ii. Bryophyta

e.g. Funaria :

- (1) Funaria grows in moist, shady and damp soil.
- (2) The plant body is a haploid gametophyte.
- (3) It is differentiated into rhizoids, cauloids and phylloids.
- (4) Rhizoids are for anchorage and absorption of water and minerals.
- (5) Cauloid is the main axis which bears leaf like appendages called phylloids.
- (6) Gametophyte has male and female sex organs called antheridia and archegonia respectively.
- (7) Fertilization results in the formation of diploid zygote which develops into sporophyte.
- (8) The diploid sporophyte is partially dependent upon the gametophyte.
- (9) The sporophyte has a capsule which produces haploid spores.
- (10) The spores germinate to produce a gametophyte.
- (11) Dried moss plants are used as a substitute to soil by nursery owners in hanging plant baskets.

Diagnostic features:

- (1) Gametophyte is represented by a filamentous protonema and adult leafy gametophyte.
- (2) Rhizoids branched and obliquely septate.
- (3) Sporophyte is a partial parasite upon the gametophyte.

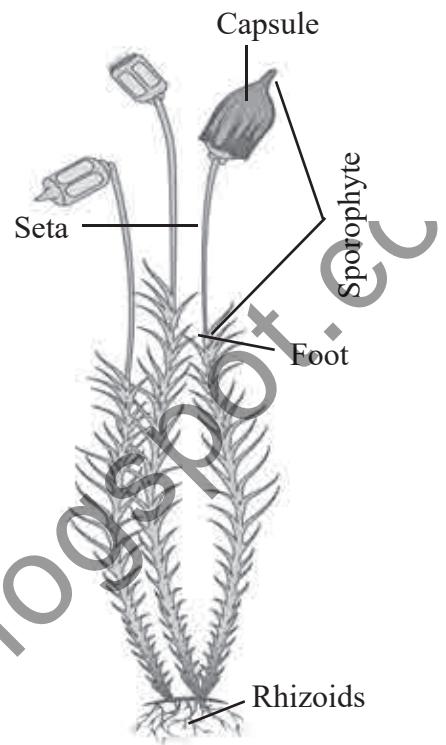


Fig. Funaria

iii. Pteridophyta

e.g. Nephrolepis

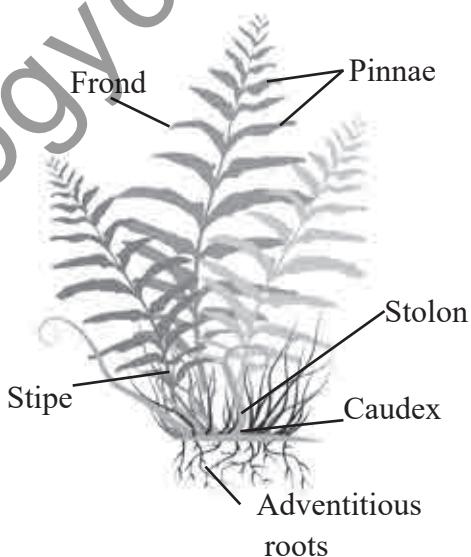


Fig. Nephrolepis

1. Nephrolepis is a common tropical and subtropical fern which grow in moist, cool and shady places.
2. The plant body is a diploid sporophyte which is differentiated into roots, stem and leaves.
3. It is covered with multicellular, hair like structures called ramenta.
4. The roots are adventitious, well-developed and help in fixation and absorption.
5. The stem is underground, obliquely placed rhizome, commonly called root stock or caudex.
6. Leaves are large, pinnately compound with a central axis or rachis bearing leaflets.
7. Each leaflet is sessile dorsiventral, with a prominent mid-vein and forked lateral veins.
8. The leaflet bears several dark-brown sori ventrally and white, oval hydathodes dorsally at the vein endings.
9. Each sorus has several sporangia, containing a number of haploid spores.
10. These haploid spores germinate to produce autotrophic gametophyte which bears the male and female sex organs.
11. Sex organs produce gametes which unite to form zygote.
12. Zygote produces diploid sporophyte.

PHANEROGAMS

I. Gymnosperms

e.g. Cyacs :



Female cone



Male cone



Fig. Cycas

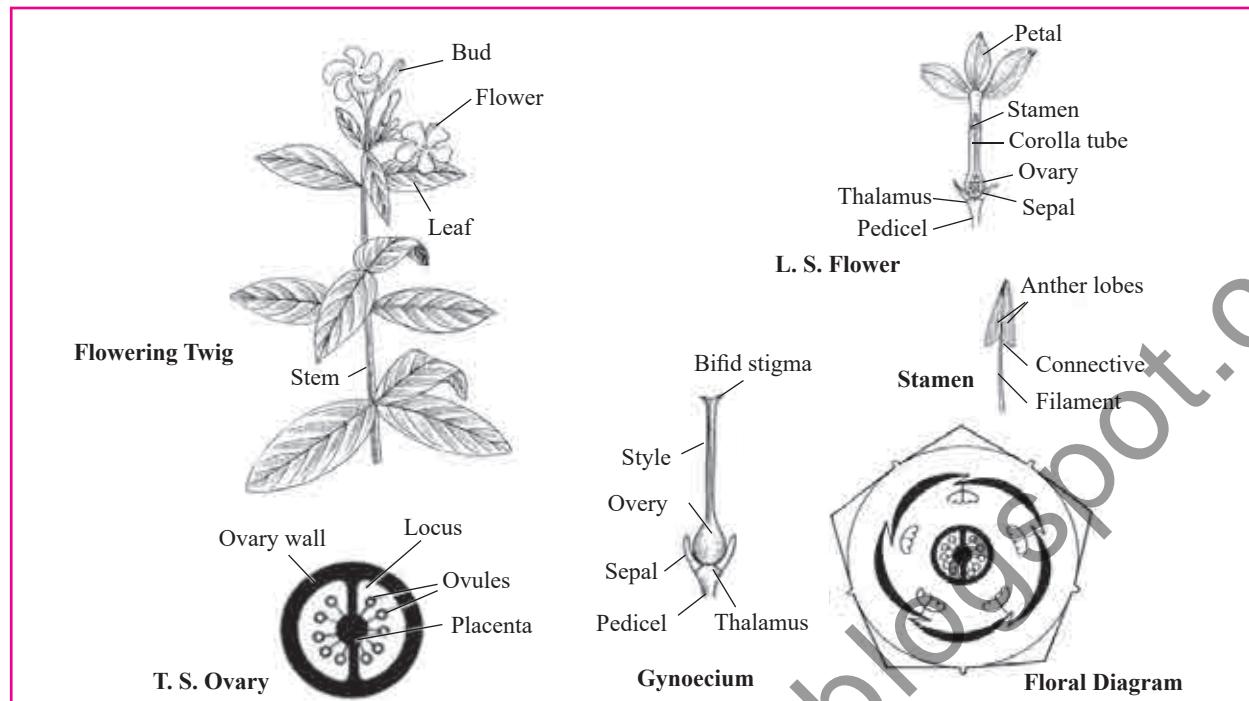
1. Habit:- It is a slow growing, long-lived, evergreen tree with an unbranched woody stem with a crown of compound leaves at its apex. Stem surface is covered with an armour of persistent leaf bases.
2. Leaves: (i) Cycas has 2 types of leaves, foliage leaves and scale leaves.
 (ii) Scale leaves are small, rough, dry and protective in function.
 (iii) Foliage leaves are pinnately compound and form a terminal crown.
- (3) Reproduction:- (i) Vegetative reproduction by bulbils.
 (ii) Sexual reproduction through seeds.
 (iii) Cycas is dioecious (male and female plants separate) and heterosporous.
 (iv) Male cycas plant produces a single male cone at the apex. It consists of several spirally borne microsporophylls. Each microsporophyll bears several microsporangia each packed with numerous microspores. Pollination occurs by wind. Microspores produce male gametes.
 (v) Female cycas plant bears loose, spirally arranged megasporophylls each bearing ovules / megasporangia. Each megasporangium develops into female gametophyte containing an egg.
 (vi) Fertilization leads to the formation of a diploid zygote which develops into a seed.

Diagnostic features:

- (1) Palm like, tropical and ornamental plant.
- (2) Reproductive organs are cones.
- (3) Seeds are naked.

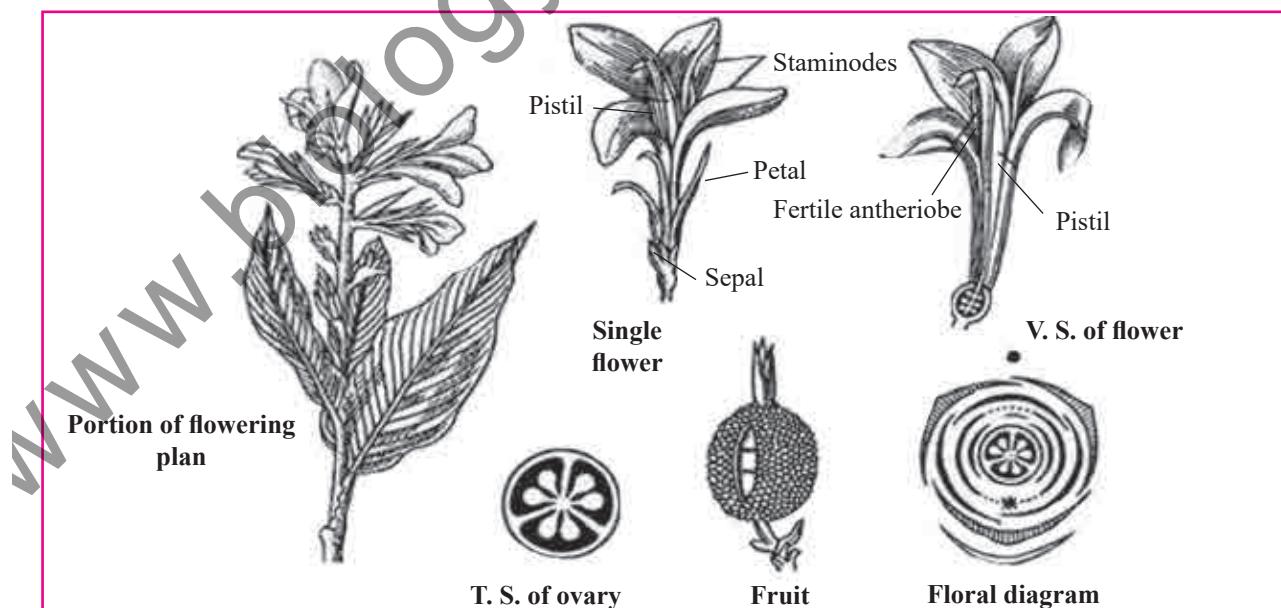
II. Angiosperms

e.g. *Catharanthus roseus* (Dicotyledonous angiosperm):



1. A small, erect, everblooming, ornamental herb with tap root system.
2. Stem-cylindrical, branched with milky latex
3. Leaves-simple, exstipulate, opposite , decussate
4. Inflorescence-Solitary axillary cymose
5. Flowers-Pedicellate, Actinomorphic, bisexual hypogynous.
6. calyx - 5 sepals, polysepalous
7. Corolla - 5 petals - gamopetalous
8. Andrecium - 5 stamens Epipetalous
9. Gynoecium-bicarpellary, syncarpous, superior ovary, fruit folite

e.g. *Canna indica* (Monocotyledonous angiosperm)



- (1) A perennial plant with branched rhizome.
- (2) Leaves simple alternate with parallel venation.
- (3) Flowers are zygomorphic, bisexual, bracteates.
- (4). Calyx-3, free green sepals.
- (5) Corolla-3, free petals which are inconspicuous. There are false petals called staminodes.
- (6) Androecium-one staminode has half another.
- (7) Gynoecium-tricarpellary syncarpous inferior ovary.

Multiple Choice Questions

1. Prokaryotic cellular organisms are found in kingdom _____
a. Protista b. Monera
c. Fungi d. Plantae
2. Diatoms shown various types of ornametations on their wall due to deposition of mineral _____.
a. Silica b. Carbonate
c. Bicarbonate d. Carbon
3. Cup shaped chloroplast is present in _____
a. Chlamydomonas b. Diatoms
c. Batrachospermum d. Sargassum
4. Sargassum belongs to class _____
a. Pheophyceae b. Rhodophyceae
c. Chlorophyceae d. Achlorophyceae
5. Fruticase lihen shows association between _____
a. Algae and Fungi
b. Algae and Bacteria
c. Algae and Bryphyte
d. Algae and Pteridophyte
6. Nephrolepis belongs to division _____
a. Bryphyta
b. Pteridophyta
c. Thallophyta
d. Gymnosperms

7. Reproduction in moss - Funaria is with the help of _____
 a. Spores b. Seeds
 c. Bulbils d. Rhizoides
8. Branched stem is characteristic feature of _____ plant.
 a. Monocot b. Dicot
 c. Sugar cane d. Jowar
9. Canna shows _____ type of venation in leaves.
 a. Parallel
 b. Reticulate
 c. Reticulate unicostate
 d. Reticulate multicostate
10. Trimerous flowers are absent in _____
 a. Monocot b. Dicot
 c. Canna d. Onion

Activity : Describe Kingdom Plantae in detail with examples.

Kingdom Plantae

Kingdom Plantae includes green, brown and red algae, liverworts, mosses, ferns and seed plants with or without flowers. They have the following characteristics:

They are multicellular organisms with walled and frequently vacuolate eukaryotic cells.

These contain photosynthetic pigment in plastids. The principle mode of nutrition is photosynthesis.

They are primarily non-motile and live anchored to a substrate.

Reproduction is primarily asexual or sexual. The reproductive organs are multicellular. They form a multicellular embryo during development from the zygote. Algae lack the embryo stage.

The life cycle consists of alternating haploid gametophyte and diploid sporophyte generation. This phenomenon is called the alternation of generation.

Thallophyta (Algae)

They are simple, autotrophic non-vascular plants. They have unicelled sex organs and no embryo formation.

These grow in specialized habitats:

Cryophytes: These grow on snow or ice.

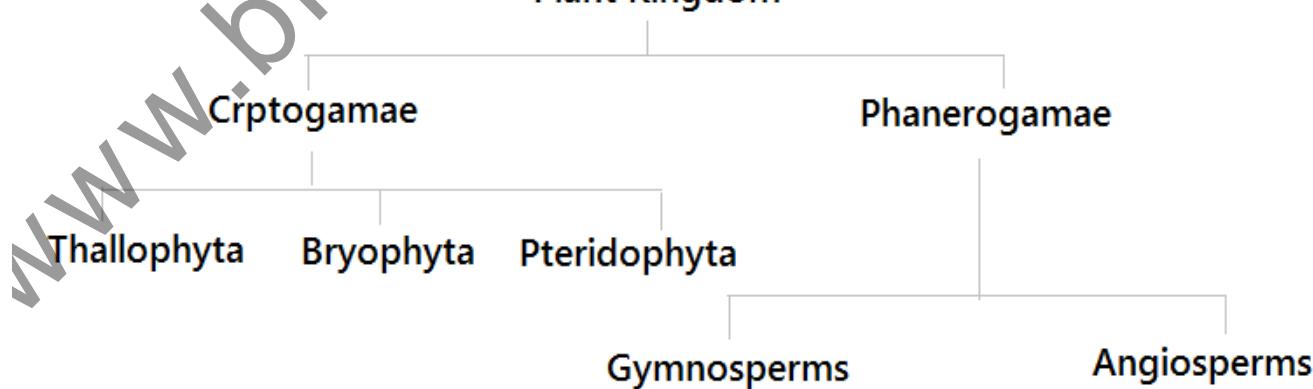
Thermophytes: These grow in hot water.

Epiphytes: These are those algae that grow on other plants (algae, angiosperms). Examples include Oedogonium, Cladophora, Vaucheria, etc.

Endophytes: Some blue-green algae grow as endophytes inside other plants e.g., Anabaena growing inside the leaf of Azolla (fern).

Parasites: The alga Cephaleuros virescens grows a parasite on the tea leaves.

Plant Kingdom



Remark and Signature of Teacher

2. Study of specimens and their identification

Date :

Aim: Study of specimens and their identification

Identify the specimens given below, label the diagrams and write down the characters.

Kingdom- Animalia (Heterotrophic , Multicellular)

PHYLUM – PORIFERA

1. Cells are independent and without any tissue formation.
2. They are asymmetrical or radially symmetrical.
3. They are aquatic animals found in freshwater or sea water.
4. Body is perforated. These pores are called **ostia**. hence the name of the phylum is porifera.
5. Water leaves the body through a single large opening called **osculum**.
6. Body is supported by skeleton of silicious or calcareous **spicules** and sponging fibers.
7. Spicules are either needle shaped, dumbbell shaped or star shaped.

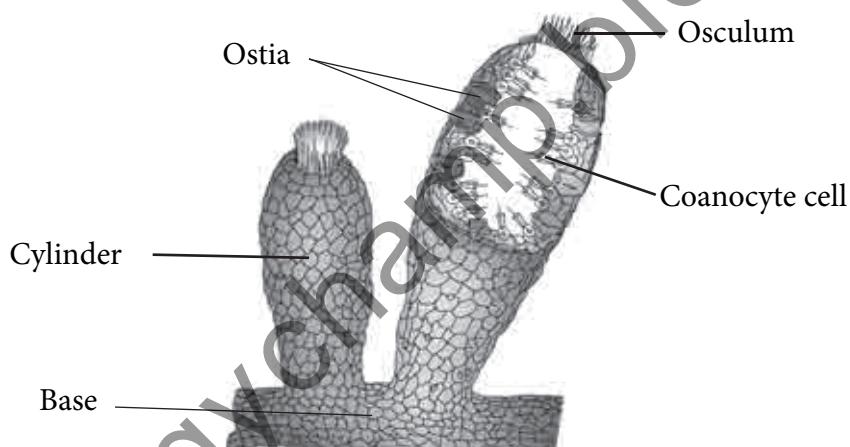


Fig. (Sycon)

e.g. - Sycon

- (1) Sycon is a marine sponge found attached to rocks.
- (2) It occurs as a colonial sponge with several cylindrical hollow branches.
- (3) The body is vase - like with an opening called osculum at the free end. Around the osculum there is an oscular fringe of spicules.
- (4) The body is porous and the pores are called dermal ostia which lead into a system of canals in the body wall. These pass into the internal cavity called spongocoel.
- (5) The skeleton of the body is made up of calcareous needle like structures called spicules.
- (6) Sycon is hermaphrodite and reproduces by asexual and sexual methods.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. **spongilla** ,**Euplectella**, **bath sponge**.

PHYLUM COELENTERATA (Cnidaria)

1. They are aquatic – marine or fresh water forms.
2. They may be solitary or colonial.
3. Body- diploblastic, radially symmetrical.
4. Body cavity is called **coelenteron** or gastrovascular cavity.
5. There are two forms- **polyp** and **medusa**. Polyp is tube like and medusa is umbrella like.

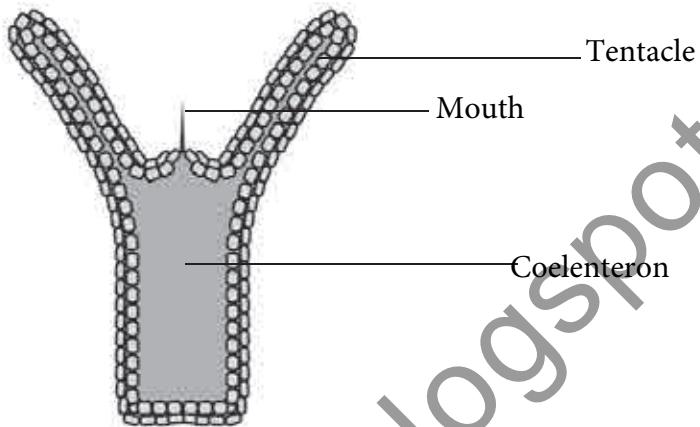


Fig. Hydra

e.g. -Hydra

- (1) Hydra is a fresh water form found attached to submerged objects in ponds and pools.
- (2) Body is radially symmetrical, polyp form, cylindrical, soft and elastic.
- (3) The body is tubular (polyp). The attached end forms the basal disc. The free end has a hypostome bearing the mouth.
- (4) There is a circlet of six to eight tentacles just below the mouth. They are provided with nematocysts.
- (5) Hydra is diploblastic, acoelomate animal,
- (6) Budding is its asexual method of reproduction. It produces gametes during sexual reproduction.
- (7) The animal shows the reproductive organs - ovary and testes. The ovary lies towards the posterior end while the testis lie towards the anterior end. Animal is hermaphrodite because male & female sex organs are within the same body of the animal.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. jelly fish, sea anemone

PHYLUM-PLATYHELMINTHES

1. Most of the members are parasitic and very few are free living.
2. They are triploblastic, bilaterally symmetrical and acoelomate.
3. Digestive system is incomplete and branched.
4. Body is dorsoventrally flattened they are called Platyhelminthes.

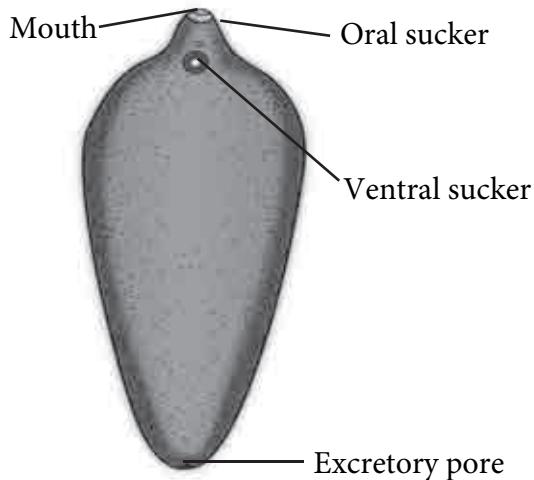


Fig. Liverfluke

e.g. - Liverfluke

- (1) Liver fluke is a flat leaf like endoparasite, found in bile duct of sheep causing the disease liver rot.
- (2) It has a pair of suckers. The anterior sucker surrounds the mouth and the ventral sucker for attachment.
- (3) A genital aperture occurs between the two suckers. An excretory pore is found at the extreme posterior end of the body.
- (4) Body is covered by cuticle with spinules.
- (5) The animal is hermaphrodite and has two hosts a vertebrate sheep and invertebrate snail.
- (6) Several larval stages occur in its life

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. Planeria , Taenia

- Write the parasitic adaptations found in Liverfluke.

1. A thick and permeable tegument is present in liver flukes. This tegument protects the animal from the enzymatic actions of the digestive juices of the host. On the other hand this tegument is permeable to water to be able to get the nutrients from the surroundings
2. Absence of locomotory organs as they are not needed by the animals. Some of the free swimming larval forms like miracidium has cilia which help in movement
3. Alimentary canal is without anus as there is no undigested food to be egested. Branched intestine helps in distribution of the digested food to all parts of the body
4. Oral sucker, acetabulum and spines of the body wall of the adult worm used for attachment to the host tissues
5. The adults lack, circulatory system, respiratory system, sensory organs as they are not necessary
Nervous system is poorly developed as it is not completely utilized. But free swimming miracidium larva has sensory eye-spots
6. Respiration is anaerobic type, due to the lack of free oxygen
7. Egg shells of these animals are resistant to protect the developing zygote from unfavorable environmental conditions
8. Self-fertilization is ensured by hermaphroditism even in the absence of another companion for copulation.

PHYLUM- ASCHILOMINHES

1. Most of the members are parasites and very few free living.
2. Body is triploblastic, bilaterally symmetrical and pseudocoelomate.
3. Digestive system is complete with mouth and anus.
4. Sexes are separate.

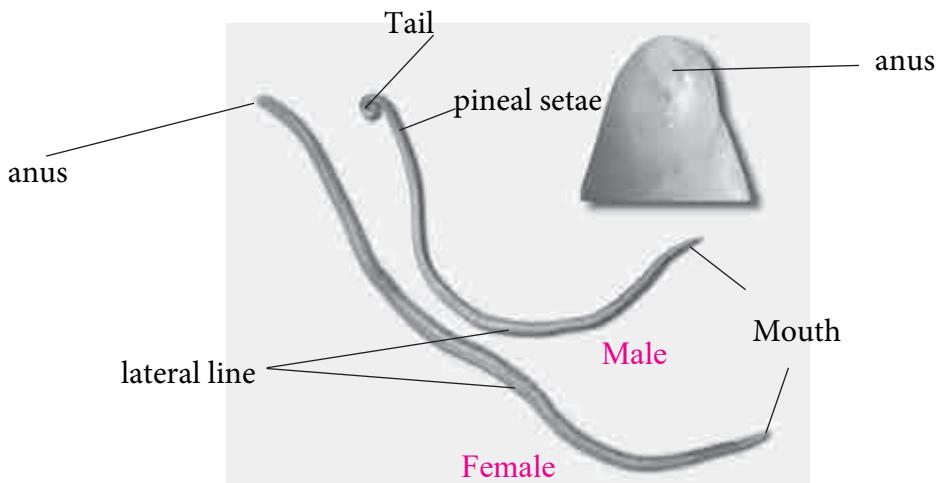


Fig. (Ascaris)

e.g. - **Ascaris**

- (1) Ascaris, the round worm occurs as an endoparasite in the intestine of man. Its Excretory body is cylindrical and unsegmented.
- (2) Sexes are separate. Male measures about 10 - 15 cm and the female measures 20 - 30 cm.
- (3) The posterior end of the male is coiled and is provided with a pair of penial spicules. There is a cloacal aperture.
- (4) The female has separate anal and reproductive openings.
- (5) In both sexes there is a mouth at the anterior end bordered by three lips. Behind it there is an excretory opening.
- (6) The body is covered by a thick cuticle and is marked by four longitudinal stripes, which Spicules are dorsal, ventral and lateral in position.
- (7) Man becomes infected by swallowing the eggs of Ascaris with food and drink.

Activity :

- **Observe the given specimen and complete the labels in above diagram.**
- **Find any two more examples of this phylum.**

e.g. **Ascaris, Planeria**

- **Give the parasitic adaptations of round worm.**

1. The body is long and cylindrical, pointed at both ends.
2. The mouth is bounded by three lips which help the parasite to attach with mucous membrane of the host's intestine
3. The parasite is devoid of locomotory organs as the parasite lives in the intestine where protection from enemies and food supply are ensured.
4. The body wall of Ascaris is covered with cuticle, resistant to the digestive enzymes of the host.

PHYLUM-ANNELIDA

1. They are aquatic, terrestrial.
2. They are free living or ectoparasites.
3. Body is triploblastic. Bilaterally symmetrical, and coelomate.
4. Body is metamerically segmented.
5. Digestive system is complete.
6. Circulatory system is of closed type.
7. Nervous system is ventral and ganglionated. It consists of nerve ring and ventral nerve cord.

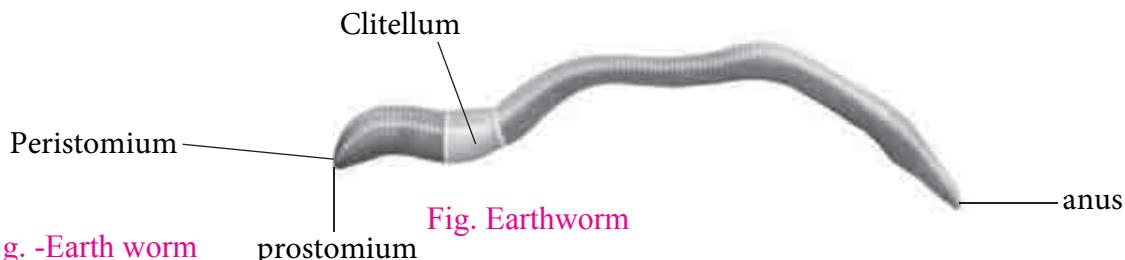


Fig. Earthworm

- (1) The body of earthworm is cylindrical, elongated, bilaterally symmetrical and metamerically segmented. It measures about 15 cm in length and is made up of about 100 to 120 segments or metameres.
- (2) The skin is soft, moist and pinkish brown in colour without exoskeleton.
- (3) Each segment except the 1", last and clitellum shows a complete ring of microscopic setae in the middle.
- (4) The body shows a pointed anterior end and blunt posterior end. Distinct head and appendages are absent.
- (5) The dorsal side is marked by a dark mid-dorsal line and the ventral side shows the genital apertures and papillae. In a mature worm the segments 14, 15 and 16 show a girdle like, thick dark brown glandular band called clitellum which helps in burrowing and cocoon formation. It also has taxonomic importance and forms important landmark on the body.

On the basis of clitellum the body is divisible into three regions, like

- (i) Pre-clitellar region - from 1st to 13th segments
- (ii) Clitellar region - 14th, 15th & 16th segments.
- (iii) Post-clitellar region - 17th to the last segment.



Fig. Leech

- (1) Leech is an ectoparasite seen in ponds, lakes, rivers and in moist soils.
- (2) It sucks blood from cattle and other mammals.
- (3) The body is composed of 33 segments, including the oral and the posterior suckers. Each segment is further divided externally into annuli.
- (4) The oral sucker bears the mouth and three jaws.
- (5) The posterior sucker helps in locomotion and in attaching to the body of the host.
- (6) It is a hermaphrodite.
- (7) The salivary glands secrete a compound Hirudin which prevents blood clotting while sucking.

Activity :

- **Find any two more examples of this phylum.**

e.g. Earthworm, Lugworms

- **Give the parasitic adaptations of Leech.**

1. Both ends of the body are provided with suckers, which are the clinging organs by which leech gets firm grip of the host. These suckers, are also helpful for locomotion.
2. Parapodia and setae are completely absent, because there is no need of these organs. Thus, the host remains unaware of the parasite.
3. There are three jaws inside the mouth. These act as semicircular jaws and cause a 1'-shaped wound in the skin of the host. Through this wound blood is let out.
4. Blood is sucked up by pharynx as it acts as a suction pump.
5. Salivary glands produce hirudin, which does not allow the blood to coagulate. Thus, a continuous supply of the blood is maintained.

- **Give the difference between Leech and Earthworm.**

EARTHWORM-• Earthworms are worms that belong to the sub class Oligochaeta.

- Earthworms can regenerate through asexual reproduction.

- Earthworms perform their role in ecology by keeping the soil aerated and fertile.

LEECH

- Leeches are worms belonging to sub class Hirudinae.

- Unlike other Annelids, Leeches only reproduce sexually but can't regenerate.

- Some types of leeches are used for medical purposes.

PHYLUM –ARTHROPODA

They are omnipresent. Body is triploblastic, Coelomate, bilaterally symmetrical and

1. metamerically segmented.

2. Chitinous exoskeleton and jointed appendages are present.

3. Circulatory system is of open type.

4. Body can be divided into head, thorax and abdomen.

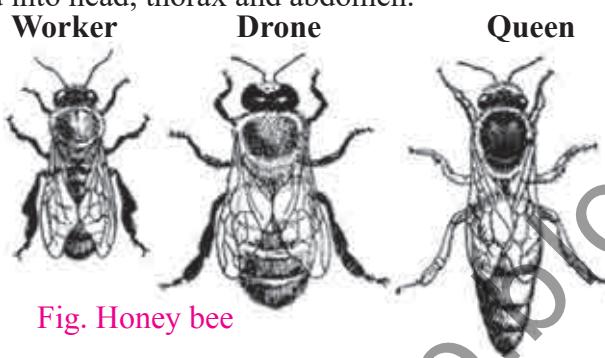


Fig. Honey bee

e.g. - Honey bee

(1) It is a social insect and lives in a colony showing great division of labour.

(2) there are three types of individuals, i.e. queen, drones and workers are seen in the colony.

(3) The drone is smaller in size as compared to the queen. It fertilizes the eggs laid by the queen bee. Drones are haploid males.

(4) The queen bee is the largest bee in the colony with a long abdomen. It only lays eggs.

(5) The worker bee is a sterile female. It is the smallest among all the bees.

(6) Body is divisible into head, thorax and abdomen.

(7) The head bears a pair of antennae, and a pair of compound eyes.

(8) Thorax has 3 pairs of legs and 2 pairs of wings.

(9) Mouth parts are rasping and lapping type, modified for collecting the nectar and pollen. The worker bees have a sting at the posterior end of the body.

(10) Economically it is important as we get honey and wax from it.

Activity :

- Find any two more examples of this phylum.

e.g. Cockroach, Butterfly, Ant

- Write down the Economic Importance of Insects.

1. Insects play a major role in plant reproduction (pollination), recycling, biological control, food,

decomposition. 2. The main food product that we get from insect Honeybee is honey. 3. Some insects act as

scavengers which get nutrients from dead animal and vegetable matter. 4. The famous silk material is

produced from the insects called Bombyx and Eupterote (silk moths). 5. Most of the plant pollination is done by insects. This process is called as Entomophily. Eg: Beetles, Flies, Ants, Moths, Butterflies.

PHYLUM-MOLLUSCA

1. They are semi aquatic or terrestrial.

2. Body is bilaterally symmetrical or asymmetrical, coelomate, and without segmentation.

3. Body is soft (so molluscs) and protected by shell.

4. Locomotion by muscular foot.

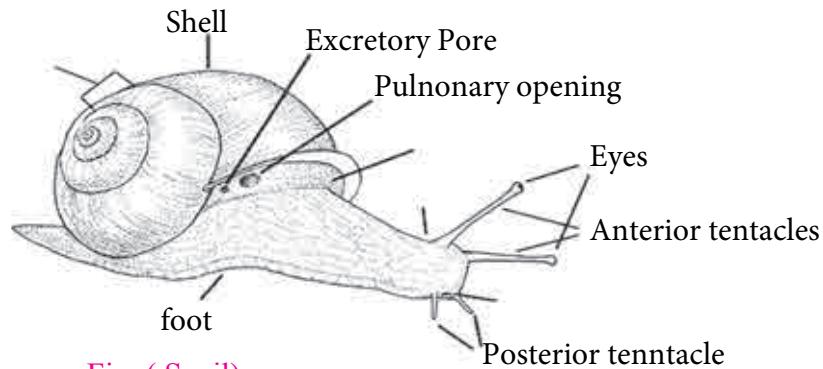


Fig. (Snail)

e.g. -Snail

1. The snail is a gastropod, soft-bodied, with head and flattened foot.
2. The soft body is protected by a hard shell.
3. They are found in sea, fresh water.
4. They have two pairs of tentacles on the head.
5. Snails have light sensitive eyespot located on each of the largest tentacles. The smaller pair of tentacles are used to sense smell and touch.
6. Snails move by crawling, swimming, or floating with currents.
7. Snails feed on decaying plants, while some are scavengers.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. **Pila, snail, bivalve**

PHYLUM-ECHINODERMATA

1. They are exclusively marine.
2. Body is radially symmetrical (pentamerous).
3. Skin is covered with hard plates and movable spines.
4. Head is not distinct. Locomotion is with the help of tube feet and water vascular system.

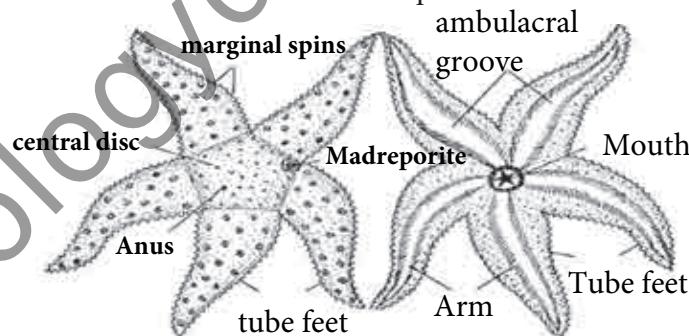


Fig. Star fish

e.g. - Star fish

- (1) Star fish is a free living marine animal, showing radial symmetry.
- (2) The body of Star fish is star shaped with five radiating arms.
- (3) Mouth Des in the centre of the central disc on the oral side whue anus and madreporite lie on the aboral side.
- (4) The locomotory organs are tubefeet which are arranged in rows in the ambulacral arque
- (5) The body is covered by calcareous plates or ossicles. They bear very short spines.
- (6) Sexes are separate without sexual dimorphism.

Activity :

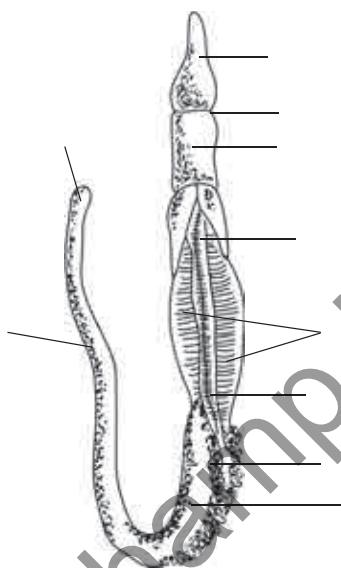
• Observe the given specimen and complete the labels in above diagram.

• Find any two more examples of this phylum.

e.g. Brittle star, featherstar, Sea-cucumber

PHYLUM- HEMICHORDATA

1. This phylum is considered as a link between non- chordates and chordates. It has characters resembling to both the groups of animals.
2. These are exclusively marine, bilaterally symmetrical and coelomate animals.
3. They live in U-Shaped Burrows.
4. Body is divided into proboscis, collar and trunk.



e.g. - **Balanoglossus**

Fig. **Balanoglossus**

- (1) Balanoglossus is marine, solitary, burrowing hemichordata found in sandy costal water of the sea.
- (2) Body is soft, worm like and unsegmented.
- (3) The body is divisible into a short proboscis, a short collar and a long trunk.
- (4) Mouth lies on ventral side between proboscis and collar.
- (5) Anterior part of trunk shows 'U' shaped gill slits.
- (6) Trunk contains genital ridge in which gonads are located.
- (7) At the posterior end of trunk, anus is situated.
- (8) It feeds on microorganisms.
- (9) Sexes are separate.
- (10) Its an example of a connecting link between Nonchordata and Chordata.

Activity :

• Observe the given specimen and complete the labels in above diagram.

• Find any two more examples of this phylum.

e.g. **Saccoglossus ,Cephalodiscus, Atubaria.**

• Give the Chordate and Nonchordate characters seen in above specimens.

Balanoglossus is considered an important connecting link between chordates and non-chordates (vertebrates and invertebrates) as they have notochord, gill-slits (branchial openings) and the dorsal tubular nerve cord which are the three main characteristics of chordates.

PHYLUM - CHORDATA

1. These are higher triploblastic coelomate, bilaterally symmetrical animals with tube within a tube body plan.
2. They show presence of notochord at least in the early embryonic life. They show presence of pharyngeal gill slits.
3. Circulatory system is of closed type with red blood cells having haemoglobin.

Sub Phylum – Vertebrata

1. Notochord is replaced by vertebral column.
2. Brain is lodged in the cranium.

A. Superclass : Pisces

1. They are aquatic, present in fresh, marine and brackish water.
2. Pisces are poikilothermic (body temperature changes according to the change in temperature of surrounding).
3. Locomotion is by muscles and fins. Caudal fin helps in pushing body forward and paired fins are used for steering.
4. Exoskeleton is of dermal scales. Endoskeleton is either bony or cartilaginous.
5. Body is stream lined, boat-shaped this feature helps to reduce resistance during swimming.
6. Mouth is terminal or ventral in position.
7. Respiration is by gills.
8. Sexes are separate. Most of the fishes are oviparous, some are viviparous.

e.g., _____

Super class pisces is divided into two classes as follows :

a . Class : Chondrichtyes (chondron =cartilage, ichthyes = fish)

1. Their endoskeleton is formed of cartilage hence they are called as cartilaginous fishes.
2. These are always marine.
3. Exoskeleton is formed of minute placoid type of scales.
4. Mouth is ventral in position. There are two dorsal fins.
5. Tail fin is formed of two unequal lobes i.e heterocercal (asymmetrical)
6. Five to seven pairs of gill slits are present. Gill slits are not covered by an operculum.
7. Male copulatory organs called claspers are present.
8. Ferilization is internal. They are viviparous.

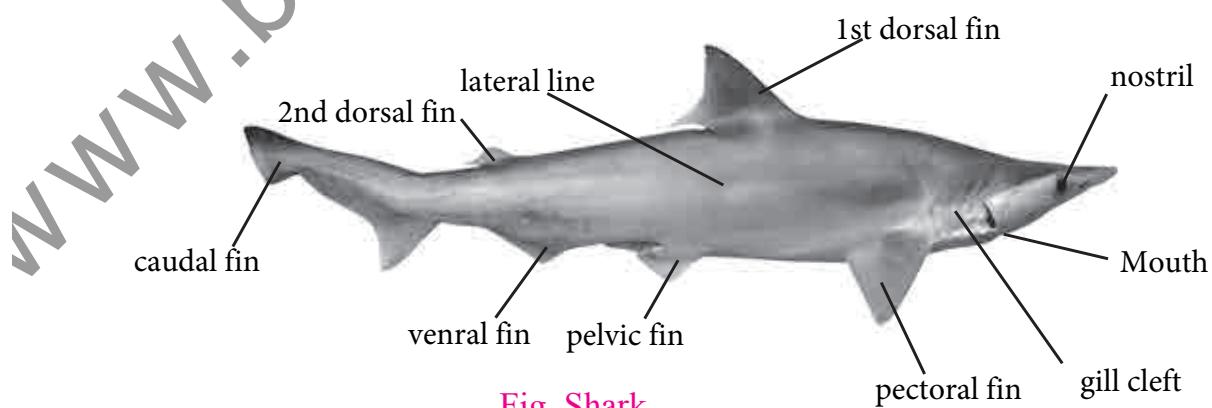


Fig. Shark

e.g. Scoliodon

- (1) Shark is also known as Dog fish found in the coastal waters of India.
- (2) The body is spindle shaped and compressed laterally. It is divisible into a head, trunk & tail. There is no neck.
- (3) The head bears a pair of eyes on the lateral sides. The mouth and nostrils are on ventral side.
- Lateral line sense organs are present.
- (4) There are five pairs of vertical gill slits at the back of the head.
- (5) Two mid dorsal, one mid ventral, one caudal and two pairs of lateral i.e. pectoral and pelvic fins are present for swimming.
- (6) The tail fin has unequally developed fin lobes and hence known as heterocercal.
- (7) The skin is covered by backwardly directed minute placoid scales.
- (8) Sexes are separate. The males have claspers in pelvic region. These are copulatory organs.
- (9) Sharks are viviparous i.e. give birth to young ones.
- (10) It is edible.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. stingray , electricray

b. Class : Osteichthyes (Osteon = bone, ichthyes = fish)

1. They are aquatic. Present in both fresh and marine water.
2. Endoskeleton is mainly bony, hence they are called osteichthyes. Exoskeleton is formed of cycloid or ctenoid scales.
3. Mouth is terminal in position. They show single dorsal fin..Claspers are absent.
4. Tail fin is formed by two equal lobes i.e homocercal (Symmetrical)
5. Four pairs of gills slits are present, covered by an operculum.
6. Fertilization is external and they are oviparous.

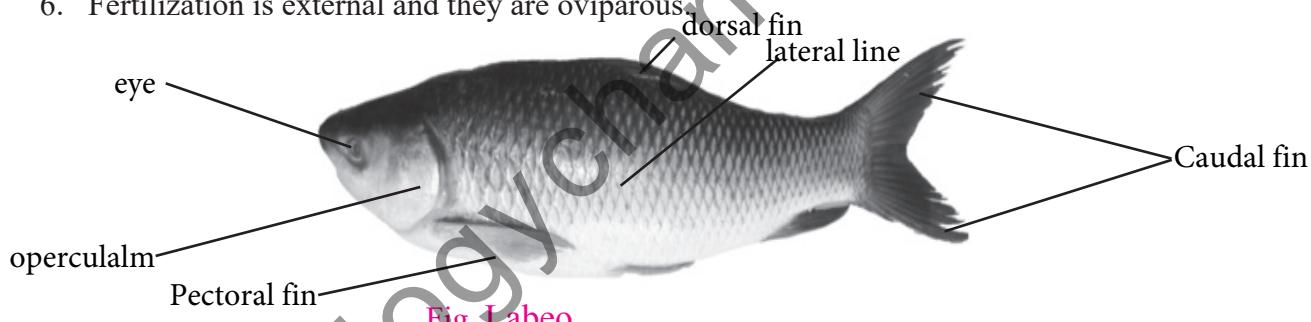


Fig. Labeo

e.g. -Labeo

- (1) It is fresh water fish commonly called Rohu fish, widely used as food fish in our country.
- (2) Body is somewhat flattened and streamlined.
- (3) It is covered with overlapping cycloid scales.
- (4) Mouth is sub-terminal and ventral. A pair of nostrils and large lateral eyes without eyelids are present.
- (5) There are five pairs of gill slits covered by an operculum.
- (6) Three median - dorsal, ventral, caudal and paired pectoral and pelvic fins are present for swimming.
- (7) The tail fin is homocercal i.e. caudal fin is equally lobed.
- (8) Lateral line sense organs are present.
- (9) Sexes are separate. The males are without claspers.
- (10) They are usually oviparous.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find any two more examples of this phylum.

e.g. Sardines, Codfish, Salmon

- Differentiate between Cartilegenous and Bony Fish.**

	Cartilegenous Fish	Bony Fish
Endoskeleton	cartilage	bones
Exoskeleton	placoid scale	cycloid or ctenoid scales
Tail	asymmetrical	symmetrical
Clasper	present	absent

B. superclass. :Terapoda

These animals bear two pairs of appendages.

Superclass Tetrapoda includes 4 classes :

a. Class : Amphibia (Amphi = both, bios = life)

It includes the animals which live on land as well as in water.

- They are exclusively fresh water animals . they are carnivores.
- They are poikilothermic.
- Skin is moist, glandular with mucous glands and has no exoskeleton.
- Two pairs of limbs arise from the pectoral and pelvic girdles respectively. They help in locomotion. Body is differentiated into head, trunk and tail, neck is absent. In some, tail is absent in adults.
- External ear is absent. Prominent ear drums or tympanic membranes are present on lateral sides of head.
- Mouth is devoid of teeth. Intestine and digestive glands are well developed.
- Circulatory system is of closed type. heart is three chambered, RBCs are biconvex, nucleated.
- Respiration is by skin, lungs, buccopharynx.
- Nervous system is well developed.
- Sexes are separate. They are oviparous. Fertilization is external. Development occurs in water
- They show metamorphosis.

e.g. Frog

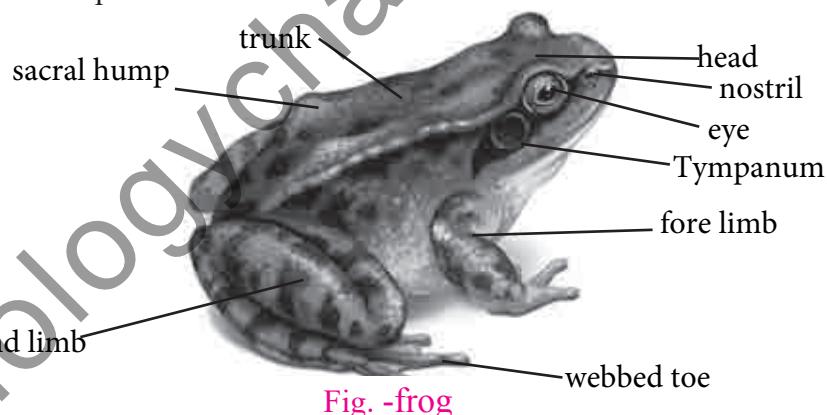


Fig. -frog

- The body is bilaterally symmetrical. Body is divided into head and trunk.
- The head is dorso-ventral and triangular. The two nostrils are situated on either side of head. large and bulging. The upper eyelids are thick pigmented while the lower eyelids are rudimentary. The third eyelid or nictitating membrane covers the eye.
- The circular tympanic membrane is behind the eyes.
- It consist of fore limbs and hind limbs Fore limbs, are shorter than hind limbs, which are longer and stronger as required to hop on the land.
- The fore limbs consist of four digits while hind limbs consist of five digits. The hind limbs consist of membranous web in between the toes.
- In male frog, during breeding season, a copulatory pad develops along the inner edge of the first finger.
- A cloacal aperture lies towards the posterior side of the body.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Give two additional examples of Amphibians.
- e.g. newt , Hyla, salamander
- Explain the difference between Frog and Toad.

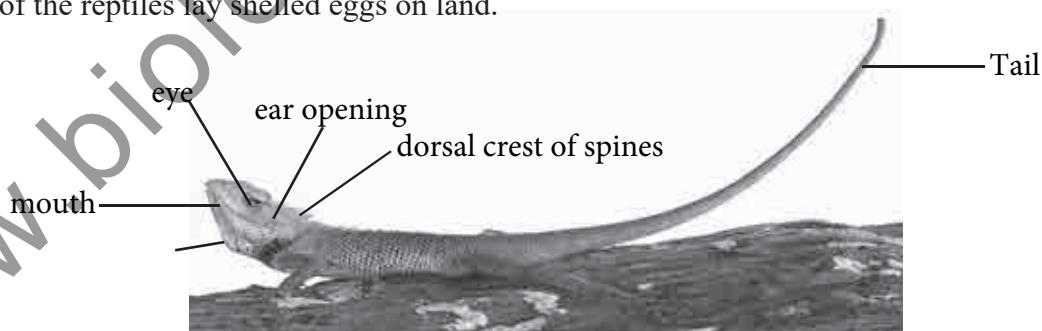
Frogs:-1. Need to live near water 2. Have smooth, moist skin that makes them look “slimy”.3. Have a narrow body 4.Have higher, rounder, bulgier eyes 5. Have longer hind legs 6. Take long high jumps
Have many predators
7. Toads: 1.Do not need to live near water to survive2.Have rough, dry, bumpy skin 3.Have a wider body
Have lower, football shaped eyes4. Have shorter, less powerful hind legs 5.Will run or take small hops rather than jump6.Do not have many predators. 7.Toad’s skin lets out a bitter taste and smell that burns the eyes and nostrils of its predators, much like a skunk does.

- Explain economic importance of Frogs.

Frogs are right in the middle of the food chain and provide a very efficient transfer of solar energy. They play an important role in consuming insects and are an important food source for birds, snakes, and other animals throughout the food web.

b. Class : Reptilia (Repere= to creep or to crawl).

1. These are crawling animals. These are the first true terrestrial vertebrates. Few may be aquatic or semi- aquatic, also found in marshy areas.
2. They are poikilotherms.
3. Skin is dry. Non-glandular and covered by an exoskeleton of epidermal scales or plates or scutes.
4. Locomotion occurs by limbs. The limbs have well developed pentadactyl digits and claws. They help the animal to walk or creep. Snakes, however are limbless. They crawl on their belly.
5. External ear absent Ear drum is depressed.
6. Circulatory system. Circulation is of closed type. Heart is ventral in position.
7. It has two complete auricles but ventricles are incompletely partitioned. Therefore, heart is not perfectly four chambered (except in crocodile and tortoise, heart is four chambered.) they show respiration by lungs.
8. Sexes are separate and they show prominent sexual dimorphism. Fertilization is internal. They are oviparous.
9. Most of the reptiles lay shelled eggs on land.



e.g. Lizard

Fig. lizard

- (1) It is commonly called garden lizard or girgit found in open fields. It feeds on insects.
- (2) Body is covered with imbricate epidermal horny scales.
- (3) Head is triangular, consisting of eyes, nostrils and external ear openings (tympanum).
- (4) A crest of sharp spines is present on the dorsal surface of the neck and back.
- (5) Body is divisible into head, trunk and tail. Tail is extremely long and cylindrical.

- (6) It changes colour of the body. The normal colour is olive green but in courtship or threat the body becomes yellow and neck and sides of the head becomes red.
 (7) It is oviparous animal.

Activity :

- Observe the given specimen and complete the labels in above diagram.
- Find two additional examples of Reptiles.

e.g. snake, wall lizard

- Find out more about role of snakes in an ecosystem.

Snakes play an important role in our ecosystem by maintaining a balance to the food web. Because snakes are both predator and prey, they keep the pest population down by feeding on mice and other small rodents that damage crops and carry disease. Snakes also provide food for larger mammals, birds and even other snakes.

c. Class : Aves (Avis = bird)

Birds are aerial in habitat. In order to live an aerial mode of life the bird acquire certain characters known as "aerial adaptation".

1. They are homootherms i.e. they keep the body temperature constant.
2. The mode of life is aerial
3. Forelimbs are modified into wings for flying. Hind limbs are used for walking and running.
4. Aquatic birds have webs between their toes. E.g. Duck.
5. Body is differentiated into head, neck, trunk and a tail.
6. Body is streamlined (boat shaped) to reduce resistance during flight.
7. Their exoskeleton is made up of feathers. Scales are present on hind-limbs.
8. Skin is thin, dry, non-glandular.
9. Bones are pneumatic with air cavities. It keep the body light.
10. Jaws are modified into beaks. Teeth are absent. Special structures such as crop and gizzard are present.
11. Respiration takes place by lungs which are connected to air sacs.
12. Brain is enlarged and has a well developed area for equilibrium (cerebellum). Optic lobes well developed while olfactory lobes are poorly developed.
13. Sexes are separate. Sexual dimorphism is very prominent. They are oviparous and lay shelled eggs with yolk and albumin. Fertilization is internal.

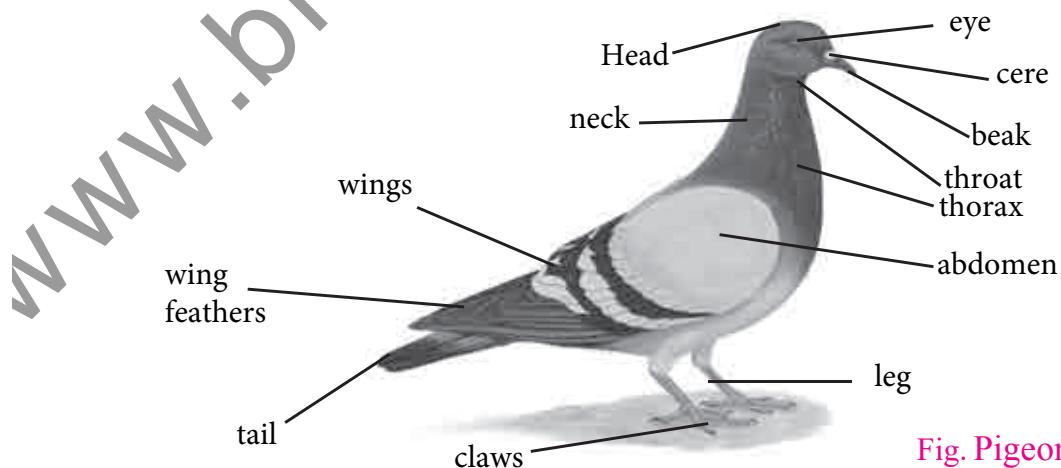


Fig. Pigeon

e.g. Pigeon

- (1) Body is divided into head, neck, trunk and tail.
- (2) Head consists of slit-like nostrils, large eyes.
- (3) The beak is stout, teeth are absent.
- (4) Fore limbs are modified into wings for flying.
- (5) The hind limbs are short, the digits show the presence of claws which are curved and help to hold the grip while perching on the bark of the tree.
- (6) Body is stream-lined and made light due to the presence of air cavities in the bones (pneumatic bones).

Activity :

- **Observe the given specimen and complete the labels in above diagram.**
- **Find two additional examples of Aves.**

e.g. Peacock, crow, hen

- **Find Scientific names of any five birds in your area.**

1. Bulbul-Molpastes cafer
2. Crow-Corvus Corone
3. Dove-Columbidae Columbiformes
4. Duck-Anatidae Anseriformes
5. Koel-Eudynamis scolopaccus

- **Find out more about the role of birds in an ecosystem.**

birds help maintain sustainable population levels of their prey and predator species and, after death, provide food for scavengers and decomposers. Many birds are important in plant reproduction through their services as pollinators or seed dispersers.

d. Class: Mammalia (Mammea = breasts, nipples).

1. Mammary glands are present for the nourishment of the young ones.
2. Body is differentiated into head, neck, trunk and tail.
3. They are homoiotherms. Exoskeleton is in the form of hair, fur, nails, hooves etc.
4. Skin is glandular. They have sweat glands and sebaceous (oil) glands. Mammary glands are modified sweat glands.
5. Body cavity is divided into two parts-thoracic cavity and abdominal cavity by a diaphragm.
6. They show presence of external ear (pinna).
7. Teeth are of different types, incisors, canines, premolars and molars.
8. Brain is highly developed. Cerebrum shows a transverse band called corpus callosum.

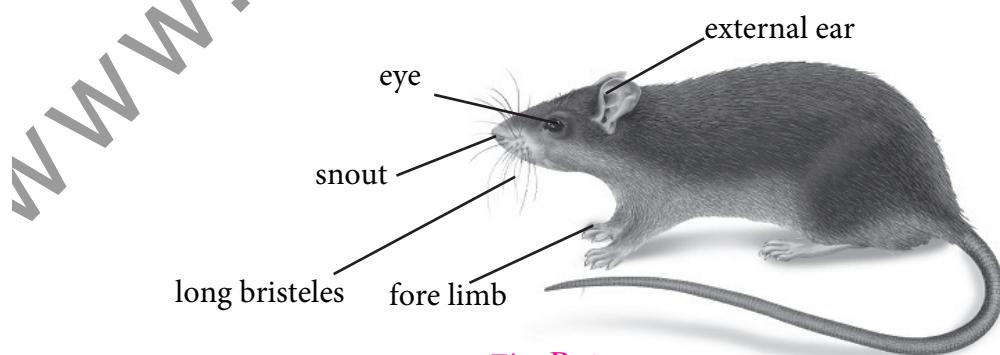


Fig. Rat

e.g. Rat

- (1) The body is divided into head, neck, trunk and a cylindrical tail.
 - (2) The body is covered by fur.
 - (3) The black rats are Rattus rattus and the brown rat is Rattus norvegicus.
 - (4) It has well developed hind limbs and fore limbs with claws. Each limb has five digits.
 - (5) Eyes are with eyelids and are large.
 - (6) They show the presence of external ear (pinna) which are large.
- Snout is prominent with bristles, and the nostrils at the tip.

Activity :

- Observe the given specimen and complete the labels in above diagram.
 - Find the scientific name of any five mammals in your area.
- 1.Bison-Bos gaurus 2.Cat-Felis domesticus 3. Cheetah-Acinonyx jubatus
4.Giraffe-Giraffa camelopardalis 5.Horse-Equus caballus
- Find out which of the mammals found in India are covered under the protection of wild life Act.

Mammals like Tigers and Lions are the species that are protected under the act of wildlife.

Multiple Choice Questions

1. _____ is a diagnostic features of phylum Porifera.
 - a. Presence of spicules for skeleton.
 - b. Incomplete digestive system
 - c. Exclusive marine habitat
 - d. Asexual reproduction
2. Physalia, ‘Portuguese Man of War’ are an example of Phylum _____.
 - a. Cnidaria
 - b. Porifera
 - c. Pisces
 - d. Chordata
3. ◆ is an example of Free living flat worm.
 - a. Fasciola
 - b. Planaria
 - c. Taenia
 - d. Ascaris
4. Presence of setae for locomotion on the body segments is seen in _____.
 - a. Leech
 - b. Ascaris
 - c. Earthworm
 - d. Parrot
5. Chitinous exoskeleton and jointed appendages are seen in _____.
 - a. Cockroach
 - b. Snail
 - c. Earthworm
 - d. Starfish

6. Giant african snail "Achatina" belongs to phylum _____.
a. Arthropoda b. Mollusca
c. Echinodermata d. Porifera
7. Tube Feet and water vascular system are found in _____.
a. Echinodermata b. Mollusca
c. Porifera d. Cnidaria
8. _____ phylum shows mixed characters of Non-chordates and chordates.
a. Cephalochordata b. Urochordata
c. Hemichordata d. Chordata
9. Bony fish can be differentiated from cartilegenous fish, by studing the external features of _____.
a. Skeleton b. Fins
c. Eyes d. Body shape
10. Cycloid scales are found in _____ fish;
a. Bony b. Cartilegenous
c. All d. Any and Every
11. Naked, moist skin is characteristic of class _____.
a. Chondrichthyes b. Amphibia
c. Reptilia d. Snake
12. Example of Four- chambered heart, in class Reptilia is _____.
a. Lizard b. Crocodile
c. Crow d. Snake
13. Homeothermic body, covered with feathers and scales is found in class _____ of phylum _____.
a. Aves, Hemichordata b. Amphibia, Hemichordata
c. Reptilia, Chordata d. Aves, Chordata
14. External ear/pinna and fur on the body are found in _____.
a. Frog b. Lizard
c. Dog d. Parrot

Remark and Signature of Teacher

3. Study of permanent slides of T.S. root's of sunflower and maize

Date :

Aim : Study of permanent slide of T.S. root of sunflower and maize.

Observe the permanent slide of T.S. root of sunflower and write Anatomical characters.

Anatomy of Dicot root:-

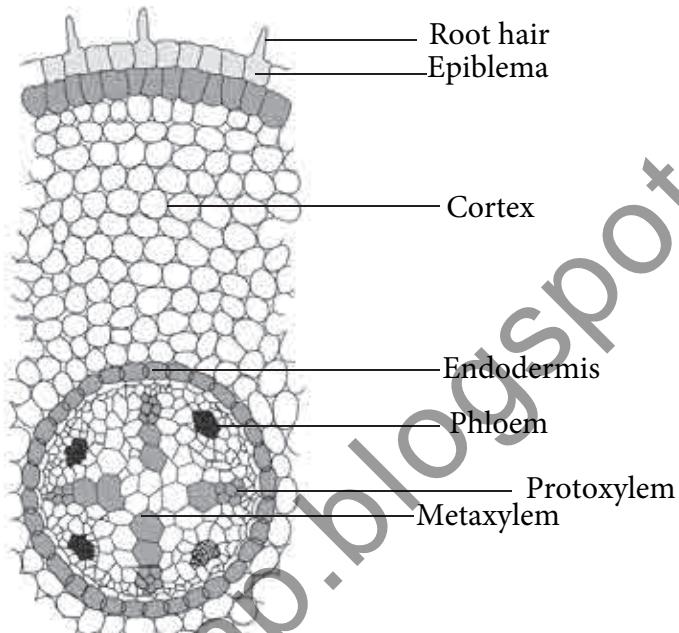
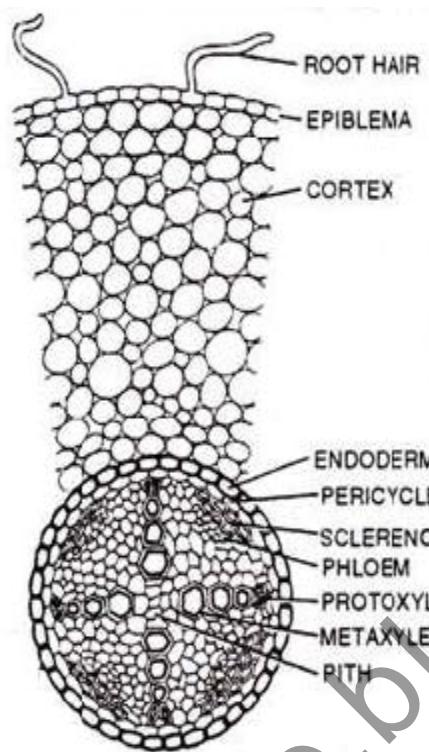


Fig- T.S. of dicot root

- 1. Epiblema or Epidermis** - It is the outermost covering of the root made up of a single layer of compactly arranged barrel-shaped parenchyma cells. The cells are thin walled. Cuticle and stomata are absent. Some cells possess unicellular projections called root hair. Hence this layer is also called piliferous layer.
- 2. Cortex** - It consists of several layers of loosely arranged parenchyma cells.
- 3. Endodermis** - It is the innermost layer of cortex. Most cells possess thickenings **of suberin** on their radial walls called casparyan thickenings. Some cells however remain thin walled and are called passage cells. These cells allow entry of water into xylem elements.
- 4. Pericycle** - it is a single layer of parenchyma cells.
- 5. Vascular bundles** - They are radial and polyarch with 8 bundles each of xylem and phloem arranged alternately. Xylem is exarch. Parenchymatous conjunctive tissue is present between xylem and phloem. Secondary growth is absent.
- 6. Pith** - Pith is large and well developed.

Observe the permanent slide of T.S. root of maize and write Anatomical characters.

Anatomy of Monocot Root:-



1. Epiblema or Epidermis - K'ku"j g"qwgto quv"eqxgtkpi qh"j g"tqqv'o cf g"wr "qh"c"ukpi ng"rc{ gt"qheqo r cevn" cttcpi gf 0'Dcttgnuj cr gf 'r ctgpej { o c"egm0Vj g"egm"ctg"j lp'y cmgf 0'Ewkeng"cpf "uvqo cvc"ctg"cdugpvUqo g"egm" r quuguu"wpklegnwt'r tqlgevqpu"ecmgf 'tqqv'j ck0J gpeg"j lu"rc{ gt"ku"cnq"ecmgf 'r kkhgtqwu"rc{ gt0

2. Cortex - K'eqpukuu"qh'ugxgtcn"rc{ gtu"qh'mqqgn"cttepi gf 'r ctgpej { o c"egm0

3. Endodermis - K'ku"j g"kpptgo quv"rc{ gt"qh"eqtvgz0O quv"egm"r quuguu"j kengpkpi u"qh"udgtkp"qp"j gt"tcf kcn"y cmu" ecngf "ecur ctkcp"j kengpkpi u0Uqo g"egm"j qy gxgt'tgo ckp"j kp y cmgf "cpf "ctg"ecmgf 'r cuuci g"egm0Vj gug"egm" cmqy "gpt{ "qh"y cygt"lpvq"z{ ngo"gnqo gpt0

4. Pericycle - It is a single layer of parenchyma cells.

5. Vascular bundles - Vascular bundles in dicot roots are radial and tetrarch with four group of xylem and phloem. Each xylem is exarch. Secondary growth is present.

6. Pith - Pith is narrow and made up of parenchymatous cells.

Multiple choice questions

1. Pith and cortex do not differentiate in
a. Monocot stem b. Dicot stem
c. Monocot root d. Dicot root

2. External protective tissue of plants are
a. Cork and Cortex
b. Cortex and Epidermis
c. Epidermis and Cork
d. Pericycle and Cortex

3. Caspary strips are present in
a. Cortex b. Epidermis
b. Stele d. Endodermis

4. Cambium is absent in
a. Monocot b. Dicot
c. Gymnosperms d. Higher Dicots

5. Which is correct in dicot root?
a. Vascular bundles are scattered irregularly in ground tissues.
b. The vascular bundles are open.
c. Cambium is absent.
d. Epidermis is absent.

6. Pith is composed of
a. Collenchyma
b. Parenchyma
c. Sclerenchyma
d. Aerenchyma

Remark and Signature of Teacher

4. Study of modifications of root, stem and leaf

Date :

Modifications of roots:

All the different types of roots in some plants have undergone certain modifications to perform modified or unusual functions.

Modified Tap Root for Storage

1. Fusiform root –

They are present in plants like radish (*Raphanus sativus*).

They have a swollen median part and tapering ends. They are spindle shaped.

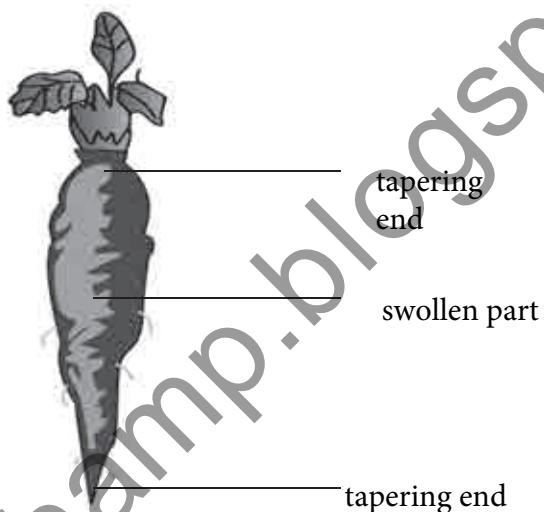


Fig. Fusiform root –Radish

2. Modified Fleshy Adventitious roots for food storage

Fasciculated roots – The roots are swollen into spindle shaped structures. They found in cluster. Such roots are seen in Dahlia and Asparagus.

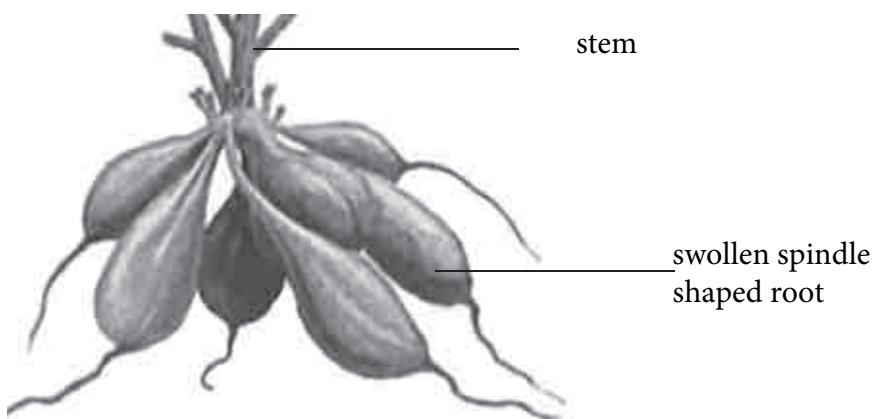


Fig. Fasciculated roots- *Asparagus*.

Activity :

Collect the information of different fusiform root and fleshy adventitious root's your surrounding area.

The part of embryo called radicle develops into root system of plants which the main function is absorption of water and minerals from the soil which is used by the plant to make its food.

But, sometimes roots not just follow their primary function but, also perform other functions as the storage of food etc this is called modification of roots.

Fusiform roots is an example when the roots are used for storage of food. The fusiform roots found in my area are Radish.

Similarly, adventitious roots develop from the parts of plants other than radicle of embryo. This is also used in storage of food. The examples of adventitious fleshy roots found in my area are sweet potato and ginger.

Observe and label the all diagram given bellow properly.

Epiphytic roots (Clinging and aerial roots) :



Fig. Epiphytic roots-vanda

Plants that grow on other plants (trees) are called epiphytes.

A group of plants called orchids and aroids have many epiphytes.

These aerial roots produced from nodes have a special tissue called velamen. The velamen is adapted to absorb atmospheric water vapour which is used by the epiphyte. e.g *Vanda*.

Haustorial or sucking roots :

Plants which are holoparasites or total parasites produce such haustorial roots from the stem.

The stem of the parasite coils around the stem of the host plant and the haustorial roots penetrates the xylem and phloem tissue of the host plant to obtain water and food respectively.

Such roots are produced by parasitic plants like *Cuscuta*.

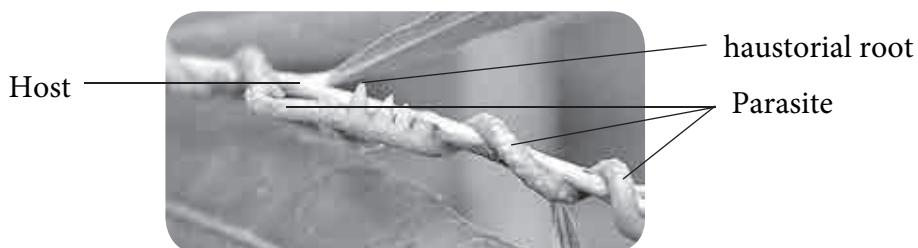


Fig. Haustorial root *Cuscuta*.

Stilt roots – These are seen in screw pine (*Pandanus*) and maize (*Zea mays*).

They develop from the lower nodes of the stem and grow down at angle in a oblique direction and supports the main stem.

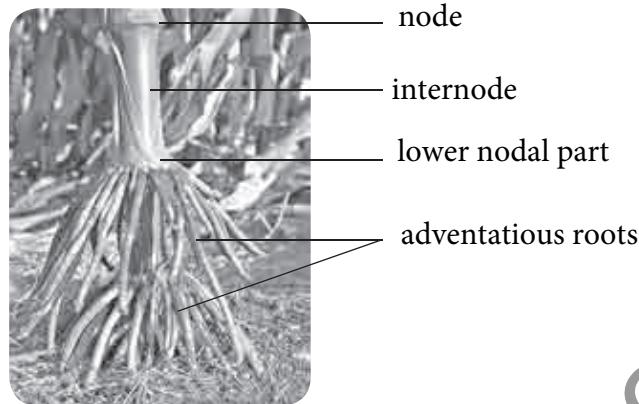


Fig. Stilt root –Maize

Respiratory roots :-

Pneumatophores – These roots are common in a group of plants called mangroves.

These plants grow in the sea coasts where the soil is covered with water.

As a result there is less soil aeration. From the underground lateral roots pneumatophores or breathin roots develop.

These roots come above the water level and through minute apertures present on the surface atmospheric air enters the entire root system.

Such roots are found in plants like *Rhizophora* and *Avicennia*.

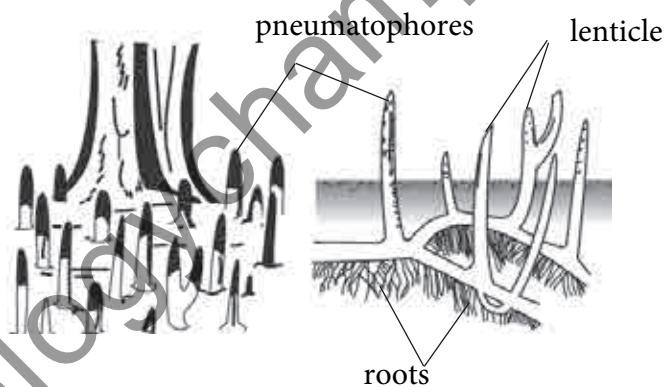


Fig. Pneumatophores - *Rhizophora*

Study of Different Modifications of Stem

Underground stems:

Many Plants have stems that are subterranean or underground. These stems help in the survival of the plants during unfavourable environmental conditions (= perennation), in vegetative propagation (=reproduction) and such stems also help in food storage. In fact, food storage is a requirement for perennation.

Rhizome : It is a horizontally growing underground stem with nodes and internodes. At the nodes non-functional (Photosynthetically non-functional) leaves are present. The leaves are scaly. Adventitious roots are produced from nodes. The axillary buds present in the leaf axils produce new rhizomes which help in vegetative multiplication of the rhizomes. During favourable environmental conditions the terminal bud produces aerial shoot system and flowers.

A rhizome that grows vertically in the soil is called a root stock. Rhizomes are seen in plants like ginger (Zingiber officinale), *Canna*, Turmeric (*Curcuma longa*.)

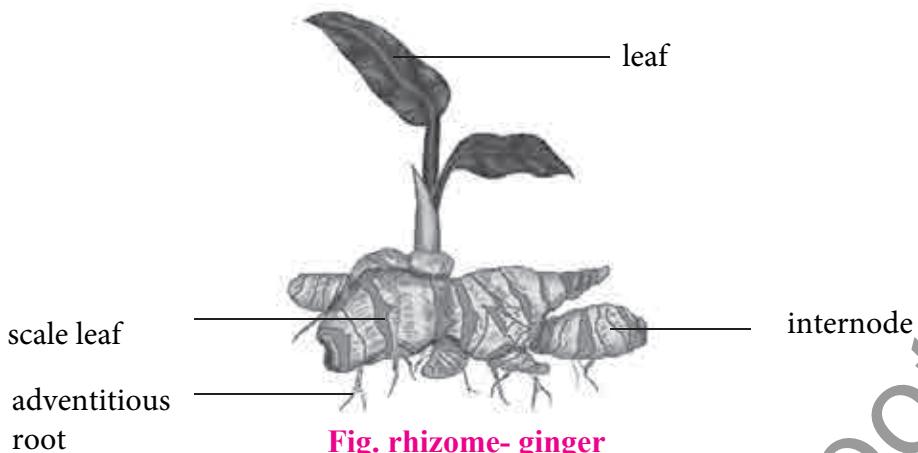


Fig. rhizome- ginger

Sub-aerial stems: These stems are found at the air soil interface and they bring about vegetative reproduction (=propogation) very rapidly.

Runner : They are slender stems developing from the axillary buds of parent plant. They grow out in all directions. They develop adventitious roots at the nodes and also new plants at the nodes. The runner creeps horizontally on the soil surface. It is seen in *Oxalis*, *Centella*. and *cynadon*.

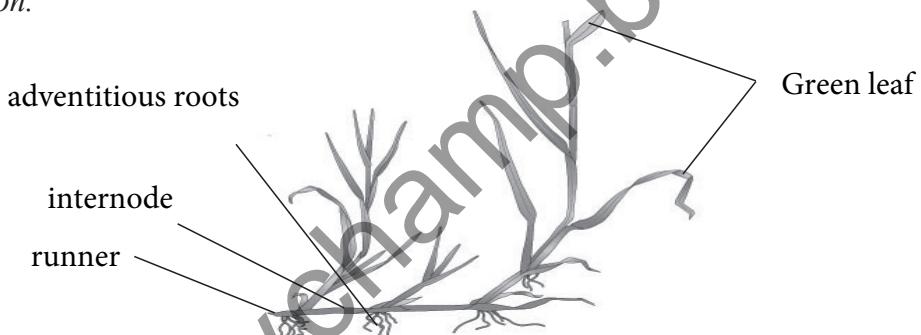


Fig. Runner - cynadon

Aerial stems : The aerial stems are variously modified to perform special fuctions like photosynthesis, protection, vegetative reproduction ad mechanical suppor.

Phylloclades : These modified stems are found in a group of plants called xerophytes (plants that grow in regions with a shortage of water). In most of these plants the leaves are reduced to scales to prevent water loss by foliar transpiration. In the absence of leaves of the stems becomes flat and green to harness maximum light for photosynthesis such a flat, green stem with many internodes is called a phylloclade. In prickly pear (*opuntia*) the phylloclade are fleshy.

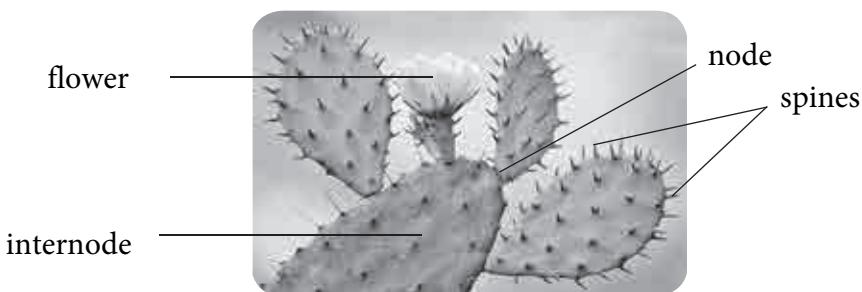


Fig. Phylloclade-opuntia

Cladodes - They are found in xerophytic plants like *Ruscus* and *Asparagus* the calode is a flat green stem similar to a phyllocaede. But unlike the phyllocaede which has many internodes a cladode had just one or two internodes.

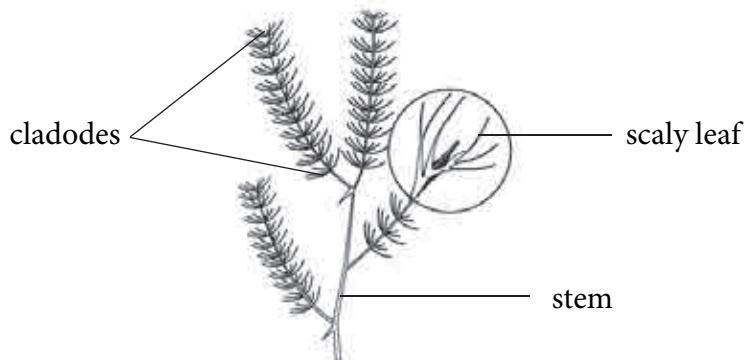


Fig. Cladode-Asparagus.

Tendrils - They are structures that help a plant to climb over objects vertically. Tendrils are produced by plants with weak stems. Tendrils may be produced from vegetative buds or from floral buds e.g. *Cucurbita*.

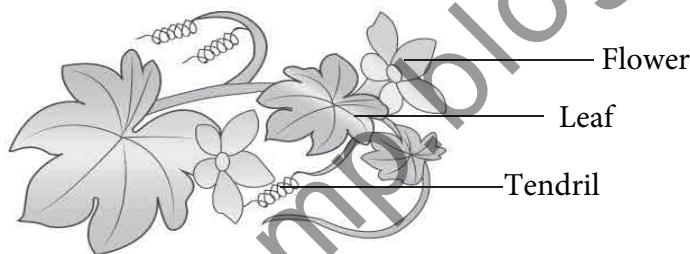


Fig. Tendril- *Cucurbita*.

Identify and study the different modifications of leaf and Phyllotaxy Also explain Inflorescence Seen in plants

Modifications of Leaves

Phyllodes : These are modifications that help a plant to conserve water (by reducing the rate of water loss by transpiration)

In species of *Acacia*, the Rachis and many Rachillae of the Bipinnately compound leaf become highly flattened and green phyllodes for photosynthesis.

Phyllodes are different parts of leaf like petiole, rachis or rachillae (which generally are cylindrical and non-green) but which in the plants mentioned above turn flat and green. They perform the function of the leaflets which fall off (to conserve water)

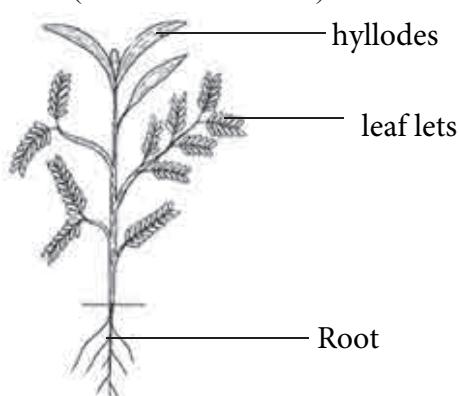
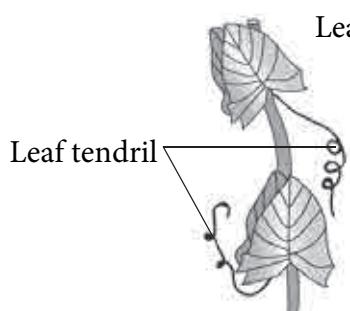


Fig. Phyllodes

Leaf tendrils : leaf as a whole or part of it or its associated parts are modified into tendrils.

In weak stemmed plants these tendrils help in climbing .

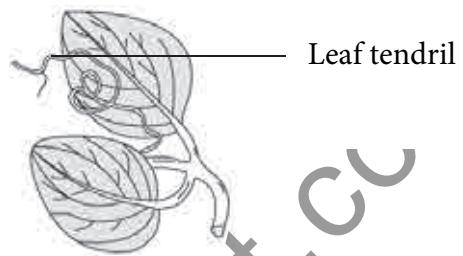
- In Lathyrus aphaca (Wild pea), the whole leaf is changed to tendril.
- In Pisum sativum (garden pea), some anterior leaflets are modified to tendrils.



Lathyrus aphaca leaf modified into tendril



Pisum sativum Upper leaflets modified into tendrils.



Naravelia. Terminal leaflet modified into tendrils.

Fig. Leaf Tendrils

Multiple choice questions

- Phyllodes are modification of _____.
 - Stems
 - Roots
 - Leaves**
 - Bud's
- Scale leaves are present on underground _____.
 - Stem**
 - Root
 - Fasciculated root
 - Bulbas root
- _____ is an example of subaerial modification of stem.
 - Straw berry**
 - Colocasia
 - Onion
 - Potato
- In orchid's clinging root's help's in _____.
 - Support**
 - Absorption of moisture
 - Negetative propagation
 - Sexual reproduction
- Stilt root is the midification for the purpose of _____.
 - Jowar**
 - Orchid
 - Mangroves
 - Cuscuta
- Fusiform root is the modification for the purpose of _____.
 - Storage of food**
 - Vegetative reproduction
 - Respiration
 - Support
- Pheumatophores is mangroves develop's lenticles for _____.
 - Photosynthesis
 - Respiration**
 - Additional support
 - Reproduction
- In cucurbita tendrils develops from modified _____.
 - Stem**
 - Root
 - Leaf
 - Stipule

Remark and Signature of Teacher

5. Study and identification of Inflorescence

Date :

Aim : Study and identification of Inflorescence.

Inflorescence : A group of flowers are variously clustered together on the reproductive axis (peduncle) is called inflorescence

There are two main types of inflorescence :

Observe the figure and table given bellow.

1] Cymose Inflorescence

1. It is determinate or definite inflorescence.
2. In this inflorescence tip of main axis terminates in a flower.
3. The arrangement of flowers is basipetal.
4. The arrangement of flowers in cyme head is centrifugal that is older towards the centre and the younger towards the periphery e.g. *Calotropis*
5. the centre and the younger towards the periphery e.g. *Calotropis*

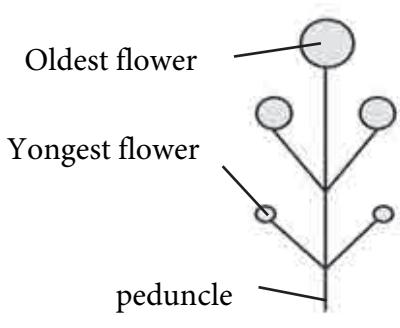


Fig. Cymose inflorescence- *Calotropis*

2] Racemose inflorescence

1. It is indefinate or indeterminate inflorescence. In this inflorescence growing point seldom ends in a flower .
2. The Arrangement of flowers is acropetal.
3. The Arrangement of flowers in a group is centripetal that is the younger flower are towards the centre and older towards outside. eg. *Caesalpinia*.

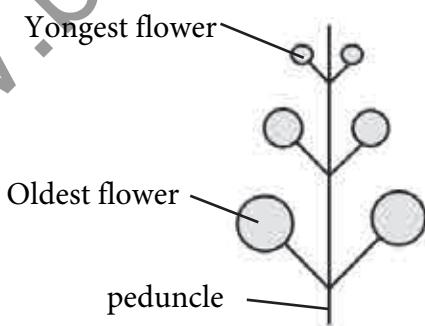


Fig. Racemose inflorescence- *Caesalpinia*

Questions

Q. 1 What is inflorescence.

The arrangements of flowers on a specialized branch of a plant are called inflorescence.

Q. 2 What are the significance of inflorescence.

1. Inflorescence provides more chances for pollination
2. It makes the flowers more conspicuous
3. Several flowers can be pollinated by an insect in a single visit

Q. 3 Enlist edible fruits in members of family solanaceae.

The family includes edible plants such as ground cherries cabbage, tomato

Q. 4 Which family is known as protein rich family?

Fabaceae is known as protein family

Mutipal choice Questions

1. One of the following characteristic of resmose inflorescence.
 - a. Centrifugal opening of flowers.
 - b. Basipetal succession of flowers.
 - c. Acropetal succession of flowers.
 - d. Simalteineaes opening of flower.
2. Inflorescence axis is _____
 - a. Petiole
 - b. Pedicel
 - c. Peduncle
 - d. Thalamus

Activity : Collect the information about inflorescence of different flowers/ plants and prepare chart.

Cymose Inflorescence	Racemose Inflorescence
Name of plants - Jasmine, Nyctanthes, Heliotropium, Bougainvillaea, Jasmine, Teak, Mirabilis, lily	Name of plants - crotalaria, mustard, banana, pam, Coriander, sunflower, marigold, Dahlia, Radish, Mustard, Maize, cassia, Tridax

Remark and Signature of Teacher

6. Study of animal tissues like blood smear, cartilage, mammalian bone and muscles (striated, non-striated and cardiac)

Date :

Aim: Study of animal tissues – T.S. of Hyaline Cartilage, T.S of Mammalian Bone, Mammalian Blood Smear, Striated, Non-striated and Cardiac muscles.

Activity : Observe the following diagrams label them.

1. T.S of hyaline cartilage :

1. It is found as rings within trachea, ends of long bones, sternal parts of ribs, nasal septum.
2. The cartilage forms the skeleton of vertebrate embryos and cartilaginous fishes. The outermost protective covering of cartilage is called as **perichondrium**. It is made up of white fibrous tissue and is supplied with blood vessels.
3. Below it, perichondrium-forming cells are present called **chondroblasts**, which are found in fluid filled spaces called **lacunae**.
4. Chondroblasts within lacunae are found scattered in the matrix of cartilages, called **chondrin**.
5. Chondrocytes or cartilage cells undergo division within the lacuna. Thus, one, two or four cells are seen within a lacuna.
6. Cartilage provides slight flexibility and rigidity to trachea, preventing it from collapsing.
7. At joints, it prevents friction between bones.

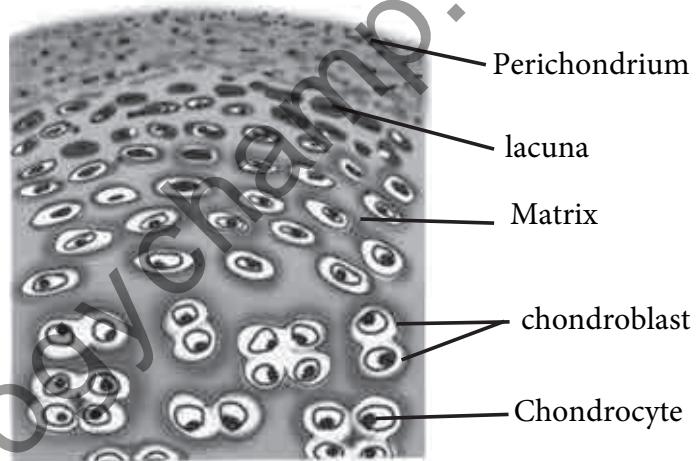


Fig. T. S. of Hyaline cartilage

2. T.S of mammalian bone :

1. The bones form the major part of endoskeleton in most vertebrates.
2. In mammalian bone, the outermost covering is **periosteum**.
3. The ground substance is called as matrix.
4. In the bone, number of **Haversian systems** are present. Each Haversian system consists of **Haversian canal** surrounded by concentric layers of matrix called **lamellae**.
5. Between lamellae spaces called **lacuna** are present. The bone cells or **osteocytes** are present in **lacuna**.
6. The osteocytes are connected to one another by **canalliculi**.
7. The processes given out by osteocytes pass through these canals.
8. Parallel lamellae are present at the periphery and interstitial lamellae are present in between the Haversian system.

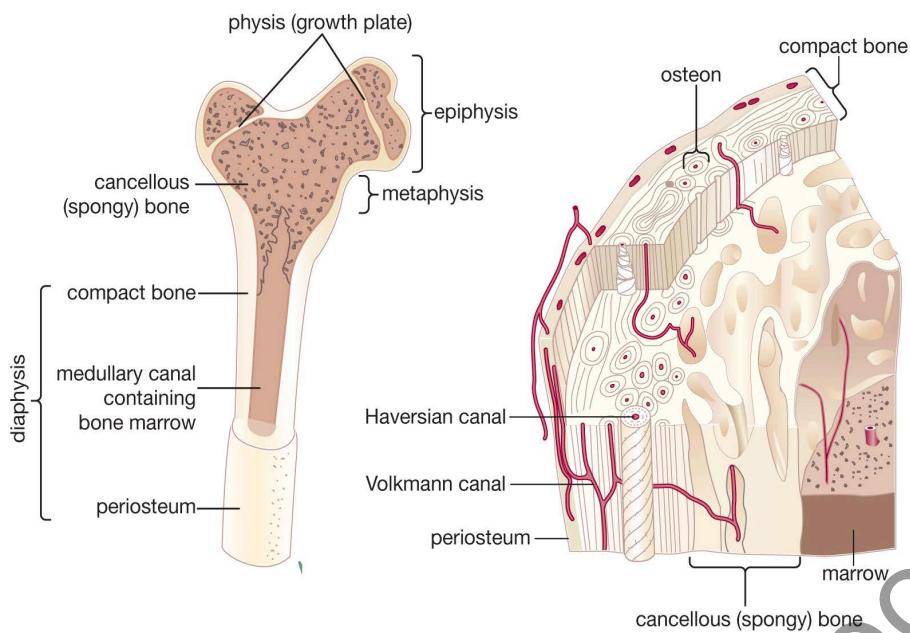


Fig. Structure of mammalian bone

3. Mammalian blood smear :

Blood is a fluid connective tissue. It shows matrix in the form of plasma and blood cells are suspended in it. Blood smear shows large number of small sized non nucleated RBCs and few large sized nucleated WBCs. WBCs are of five types namely, Neutrophils, Acidophils, Basophils, Monocytes and Lymphocytes.

Since neutrophils and lymphocytes are present in large number, they are commonly seen in the smear.

Neutrophils, acidophils and basophils show granular cytoplasm. Monocytes and lymphocytes show clear cytoplasm. Neutrophils can be identified by observing beaded nucleus and lymphocytes can be identified by observing large, spherical nucleus surrounded by very less tear cytoplasm.

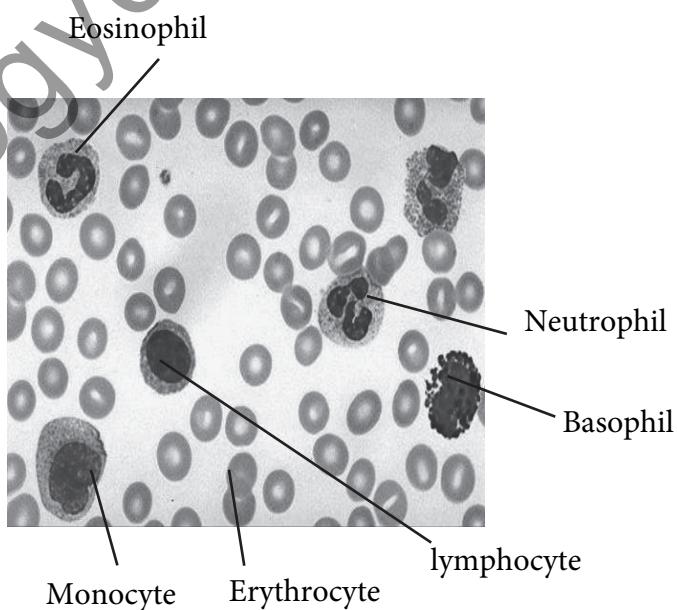


Fig. Mammalian blood smear

4. Striated or Skeletal Muscle Fibres [Voluntary Muscles]

1. These are number of elongated, cylindrical fibres, which lie parallel to each other.
2. Each muscle fibre shows alternate dark and light bands hence they look like striped or striated.
3. Many nuclei are present in each fibre.
4. Each fibre is surrounded by a thin sheath called **sarcolemma**.
5. Voluntary muscles of the body as those of hands, legs, face and tongue are made up of striated muscles.
6. They carry out voluntary movements of the body.

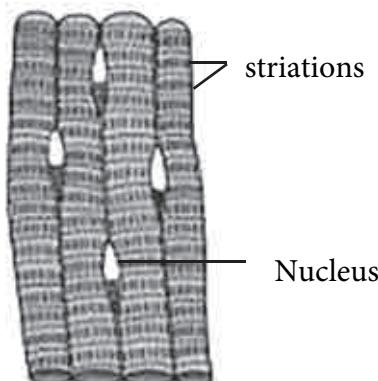
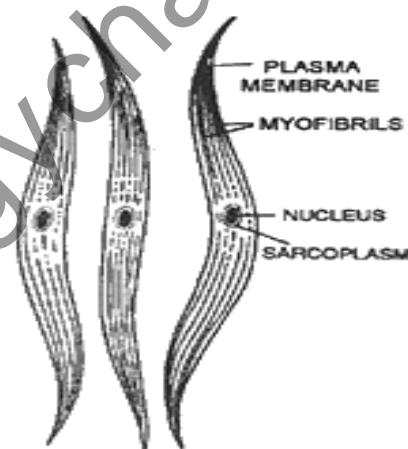


Fig. Muscular tissue

5. Non-striated or Smooth muscle fibres [Involuntary Muscles]

1. Each muscle cell or fibre is elongated; spindle shaped tapering at both the ends.
2. Each cell contains oval shaped nucleus situated centrally, which is surrounded by cytoplasm called **sarcoplasm**.
3. Each muscle fibre possess longitudinally arranged myofibrils.
4. Several muscle fibers are joined by loose connective tissue to form bundles.
5. The cells are covered by **sarcolemma**.



Nonstriated muscle fibres

Fig. Smooth muscle

6. Cardiac Muscle fibers

1. Cardiac muscle fibres are cylindrical.
2. The fibres are branched and unite with each other and are multinucleated.
3. The dark and light bands are present in each fibre but less prominent than that of the striated muscle fibres.
4. The two-adjacent cells are separated from each other by distinct **intercalated discs**.
5. Each fibre is covered by a very think sheath called **sarcolemma**.
6. These muscles form the wall of heart [myocardium].

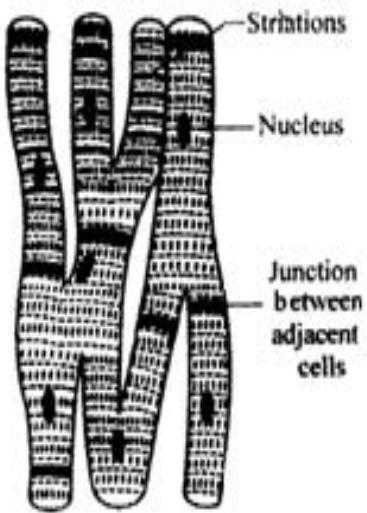
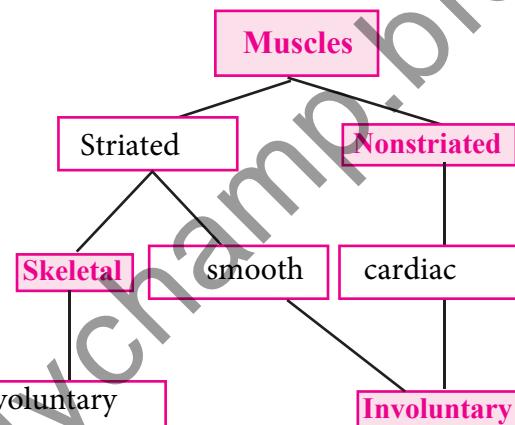


Fig. Cardiac muscles

Activity : Observe the different Muscles types under the guidance of teacher.

Questions

Q. 1 Observe the chart shown below and complete it.



Q. 2 What is muscle ?

A muscle is a group of muscle tissues which contract together to produce a force. A muscle consists of fibers of muscle cells surrounded by protective tissue

Q. 3 Observe the diagrams shown below and identify the muscle types.

Write characteristics of each type.



Cardiac muscle



skeletal muscle



smooth muscle

Cardiac muscle cell	-Rectangular in shape Single nucleus Contain many mitochondria Communicate via intercalated discs Present in myocardium (cardiac muscle)
Skeletal muscle cell	-Cylindrical Striated Multinucleated Contain many mitochondria Present in skeletal muscles
Smooth muscle cell	-Spindle shaped Single central nucleus Arranged in sheets Present in muscular layers of the vessels, and within internal organs

Q.4 Where are haversian systems found? Write the structure of Haversian system.

- 1.A haversian canal, osteocyte and lamellae form a Haversian system.
- 2.This system is found in the bone matrix of long bones like femur, humerus and others.
- 3.The haversian canals consists of veins, arteries, areolar tissues, nerves and lymph. It is also called as osteon.
- 4.Haversian canal remains surrounded by concentric rings of lamellar bone in which specialized cells called osteocytes are embedded in their lacunae.

Q.5 Why striated muscles are called skeletal muscles or Voluntary muscles sometimes?

Striated muscles are the skeletal muscles which are also known as voluntary muscles. They are called voluntary muscles because their action is under the control of the somatic nervous system and their movement can be controlled by our will.

Q.6 What is a normal blood smear?

A blood smear is considered normal when your blood contains a sufficient number of cells and the cells have a normal appearance. A blood smear is considered abnormal when there's an abnormality in the size, shape, color, or number of cells in your blood.

Q. 7 What is the main job of the red corpuscles in the blood?

The main job of red blood cells, or erythrocytes, is to carry oxygen from the lungs to the body tissues and carbon dioxide as a waste product, away from the tissues and back to the lungs. Hemoglobin (Hb) is an important protein in the red blood cells that carries oxygen from the lungs to all parts of our body.

Q. 8 What are the component of mammalian blood?

Mammalian blood is composed of plasma and three types of cells, red blood cells, white blood cells, and platelets.

Plasma

It is a light yellow-coloured alkaline liquid.

It mainly consists of water (90–92%), proteins (7–8%), inorganic salts (1%) and other substances (trace amounts).

Multiple Choice Questions

1. _____ is the largest cell in human blood having single & kidney shaped nucleus.
 - a. Lymphocyte
 - b. **Monocyte**
 - c. Neutrophil
 - d. Basophil
2. Voluntary movements of body are carried out with the help of _____.
 - a. Non-striated muscles
 - b. **Striated muscles**
 - c. Neutrophils
 - d. Acidophils
3. A spindle shaped muscle cell having single oval shaped nucleus is _____.
 - a. **Skeletal muscle fibre**
 - b. Smooth muscle fibre
 - c. Cardiac muscles
 - d. Nerve fibre
4. Presence of intercalated discs is characteristic of _____.
 - a. Striated muscle
 - b. **Unstriated muscle**
 - c. Cardiac muscles
 - d. Voluntary muscle
5. What is the difference between cartilage and bone?
 - a. Bone is flexible and cartilage is firm
 - b. **Cartilage is flexible and bone is firm**
 - c. Bone is a more primitive tissue than cartilage
 - d. Bone is inside the body and cartilage is outside
6. How do muscles attach to the bones move the body?
 - a. Automatically
 - b. Pull movement only
 - c. Push movement only
 - d. Push and pull
7. Which of the following statement incorrect?
 - a. Bone is where most blood cells are made
 - b. Bone serves a store house for various minerals
 - c. **Bone is a dry and non-living supporting structure**
 - d. Bone protects and supports the body and its organs
8. Blood smear is stained with _____ stain.
 - a. Methylene blue
 - b. Safranin
 - c. **Leishman stain**
 - d. Carbon fuchsine
9. The process of formation of blood corpuscles is called _____.
 - a. Haemolysis
 - b. Haemozoin
 - c. **Haemopoesis**
 - d. Haemoter

Remark and Signature of Teacher

7. To study the rate of respiration in flowering bud/ leaf tissues/ germinating seeds.

Date :

Aim : To study the rate of respiration in flowering bud/leaf tissues/germinating seeds.

Principle : The rate of respiration is always higher in younger actively growing meristematic tissues than that of older and mature parts. There is a direct relationship between the amount of protoplasm and the rate of respiration the greater the protoplasm, the higher is the respiration rate.

Materials required : Ganong's respirometer, fresh flower buds or leaves or germinating seeds, saline water, stand, KOH pellets, etc.

Figure :

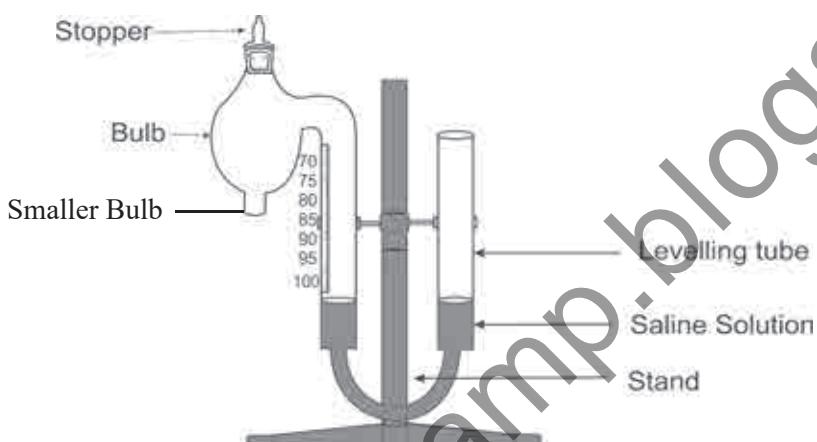


Figure : Ganong's respirometer

Procedure :

1. The Ganong's respirometer consists of a bulb like part and a bent tube.
2. Some germinating seeds are taken in the bulb and mouth of the bent tube is kept immersed in a beaker containing caustic potash (KOH) solution.
3. The respirometer is fixed in a stand.
4. The enclosed air in the flask is completely cut off from the outside atmosphere.
5. The apparatus is left undisturbed for a few hours.

Observation :

The rise in the level of water indicates that CO₂ is produced by germinating seeds during respiration. Actually, the germinating seeds respire and produce CO₂, which is absorbed by KOH solution. This creates a vacuum in the conical flask. The air present in the bent glass tube moves into the conical flask. This pulls the water in the bent tube further up.

Conclusion :

Fresh flower buds/leaves tissue/ germinating seeds use O₂ for aerobic respiration and evolve CO₂

Questions

Q. 1 Why the rate of respiration is higher in germinating seeds?

To fulfill the high-energy needs of a germinating seedling, cellular respiration increases as a seed emerges from dormancy and begins germinating. However, seeds respire at a lower rate throughout dormancy. As the seeds respire they take in oxygen and release carbon dioxide at roughly the same rate.

Q. 2 Why KOH is used in this experiment?

Potassium hydroxide is used in this experiment played the role of absorption of carbon-dioxide from the plant surrounding.

Q. 3 Why do the leaves show negligible rate of respiration in this experiment?

Respiration in plants happens throughout the day and night thereby carbon dioxide is produced. However, during the daytime, the amount of carbon dioxide released is negligible compared to the amount of oxygen produced as a result of photosynthesis.

Q. 4 Which apparatus is used to study the rate of respiration?

A Ganong's respirometer is a device used to measure the rate of respiration of a living organism by measuring its rate of exchange of oxygen and/or carbon dioxide.

Multiple Choice Questions

1. Which of the following show higher rate of respiration?

- a. Collenchyma
- b. Leaf
- c. Dry seeds
- d. Germinating seeds

2. For which of the following process presence of chlorophyll is not necessary?

- a. Photosynthesis
- b. Photorespiration
- c. Respiration
- d. Grana

3. During the aerobic respiration, the main thing required is

- a. Nitrogen
- b. O₂
- c. O₂ and some microbes
- d. Hydrogen

4. In aerobic respiration

- a. Glucose is the only substrate
- b. Glucose is a preferred substrate
- c. Glucose can not be used directly
- d. Any material which burns in air can be used as substrate

Activity : Paste photograph of experiment setup and write information / description about rate of respiration in your word.



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Remark and Signature of Teacher

8. To study the anaerobic respiration.

Date :

Aim : To study the anaerobic respiration.

Principle : Breakdown of food substances to obtain energy in absence of oxygen is called anaerobic respiration. It is observed in several anaerobic organisms like yeast and certain types of tissues in human body anaerobic respiration yield's much less energy per mole of glucose as compared to aerobic respiration.

Materials required : Test Tube, Petridish, Saffranin water (Add small quantity of saffranin in water to make coloured water.), Germinating seeds, saline water, stand, KOH pellets, etc.

Figure :

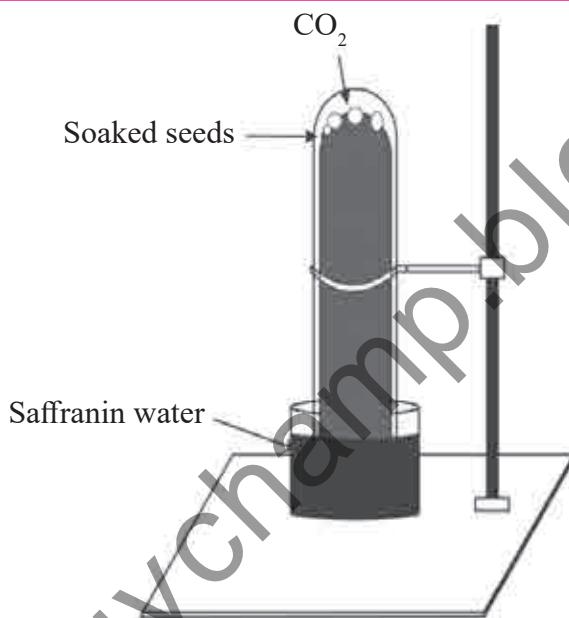


Figure: Demonstration of anaerobic respiration

Procedure :

1. Take a small test-tube and fill it with Saffranin water.
2. Invert this test tube over a petri dish containing Saffranin water.
3. Introduce germinating seeds at the base of test tube.
4. The germinating seeds are lighter than the Saffranin water so they float over the mercury in the test tube.
5. If the KOH pellets are introduced in the test tube the level of Saffranin water rises again because KOH absorbs CO₂.

Observation :

1. After few hours, the mercury level in the test tube falls down due to the accumulation of gas evolved during respiration of germinating seeds.
2. The evolved gas is CO₂. It is indicated by, if KOH pellet is introduced in the test tube, again the level rises. This indicates that anaerobic respiration has taken place.
Thus the germinating seeds respired even in absence of O₂, to evolve CO₂,

Conculation:

There is no air in the test tube, but the seeds respire anaerobically and release CO₂. Therefore level of mercury goes down. KOH pallete absorbs CO₂, and so the level rises when KOH pallete is introduced. This indicates that anaerobic respiration has taken place.

Questions

Q. 1 Why the rate of respiration is higher in germinating seeds?

To fulfill the high-energy needs of a germinating seedling, cellular respiration increases as a seed emerges from dormancy and begins germinating. However, seeds respire at a lower rate throughout dormancy. As the seeds respire they take in oxygen and release carbon dioxide at roughly the same rate

Q. 2 Why should the seeds be kept moist during the experiment?

The seeds are required to be kept moist so that there is enough amount of water for the growth and production of the new parts in the seeds. If there is no moisture, the cells in the seeds will dry up.

Q. 3 How does the use of KOH help to show that CO₂ is released during respiration in the above experiment?

Potassium hydroxide is used in the experiment for the absorption of CO₂ from the plant released during respiration. When KOH absorbs CO₂, it creates a vacuum in the flask. The air present in the bent glass tube moves into the conical flask. This pulls the water in the bent tube further up.

Q. 4 What would happen if test tube containing KOH solution is removed form the conical flask in the set up?

KOH solution absorbs the CO₂ released during respiration of seeds, which creates a partial vacuum in the conical flask, causing the rise in the water level of the U-shaped delivery tube. Rise in the level of water shows that CO₂ is released during respiration.

Multiple Choice Questions

1. In both aerobic anaerobic respiration which same product is formed
 - a. Lactic acid
 - b. **Pyruvic acid**
 - c. Citric acid
 - d. Organic acid
2. Only partial breakdown of glucose molecule takes place in
 - a. Aerobic respiration
 - b. **Aerobic respiration**
 - c. Passive respiration
 - d. Active respiration
3. Wastes of anaerobic respiration include
 - a. Lactic acid
 - b. Ethenol
 - c. **Carbon dioxide**
 - d. Energy

Remark and Signature of Teacher

9. To study the external features and Digestive system of cockroach (with the help of ICT / Charts/ Model/ Photographs)

Date :

Aim: To Study the external features of cockroach (*Periplaneta americana*)

Requirements: Cockroach model.

A. Classification : Systematic position

Kingdom : *Animalia* (Heterotrophic, Multicellular organisms)

Phylum : *Arthropoda* (Jointed legs, Body segmented and Chitinous exoskeleton)

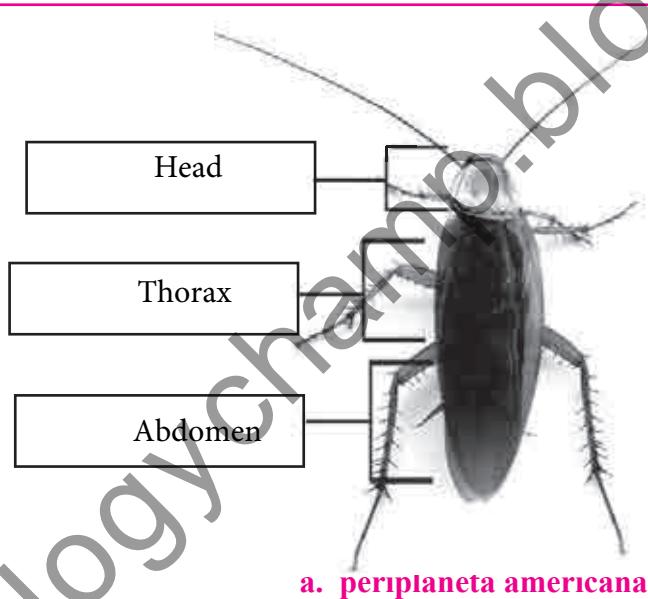
Class : *Insecta* (Two pairs of wings and Three pairs of walking legs are present for locomotion.)

Genus: *Periplaneta* (Straight wings, nocturnal animal, chewing and biting type of mouth parts)

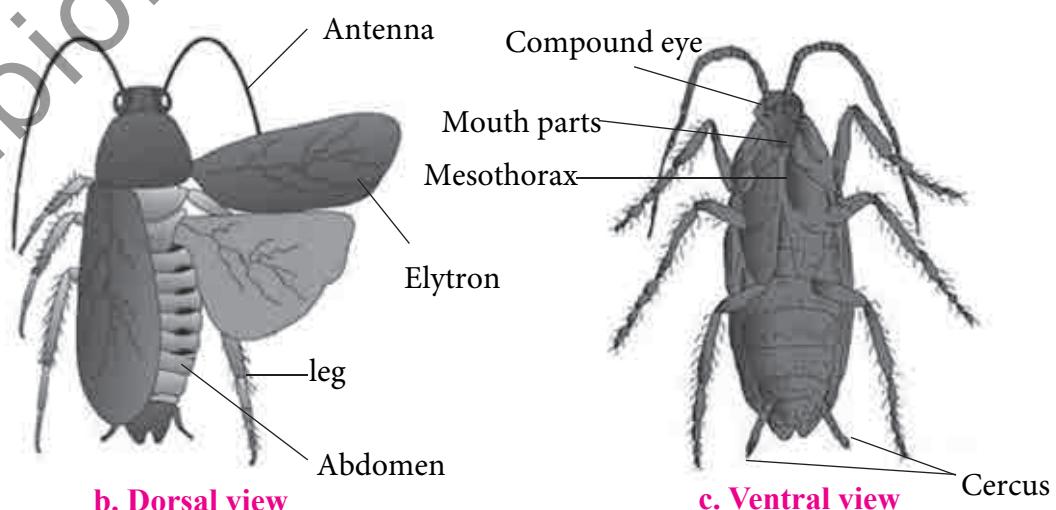
Species : *Americana* (Origin in Mexico, USA)

Figures :

Activity : Identify the different body parts of cockroach from fig. a,b and c. Label it.



a. *periplaneta americana*



b. Dorsal view

c. Ventral view

B. External features of cockroach : (*Periplaneta americana*)

Characteristics :

1. It is laterally symmetrical, reddish brown, coloured, triploblastic, coelomate animal.
2. Cockroach is common household pest.
3. It has nocturnal, omnivorous, cursorial i.e. it is fast runner.
4. It is elongated, dorsoventrally flattened body.
5. Body of cockroach is protected by hard, waxy, chitinous exoskeleton .
6. Each body segment has four plates - dorsal tergum, ventral sternum & two lateral pleura.
7. Body is segmented, and divided into head, thorax & abdomen.
8. Head is small & attached to the thorax by a short neck called cervicum.
9. Head bears compound eyes, antennae, fenestrae & mouth parts.
10. Compound eyes are with hexagonal facets called ommatidia.
11. Antennae are two, elongated, jointed structures useful for sense of smell.
12. Fenestrae are white spots present at the base of antennae.
13. Thorax is made up of three parts-prothorax, mesothorax & metathorax.
14. Thorax on dorsal side produce two pairs of wing – First pair is dark & thick while second pair is thin & transparent.
15. First pair of wings is protective & second pair is useful for flying.
16. Thorax on ventral side bears three pairs of jointed legs for walking & running.
17. Abdomen is made up of 11 segments, where 10th and 11th are fused.
18. Male cockroach bear a pair of anal styles in 9th segment.
19. In both male & female, 10th segment bear a pair of cerci, which are sensitive to movement of air, sound & vibrations.
20. Eight pair of spiracle are present in the abdomen.

Aim: To study the “Digestive system” of cockroach with the help of ICT/ Photograph/ charts/ model.

Requirement : Photographs or model or ICT of digestive system of cockroach.

Activity : Observe the figure given below and label the parts .

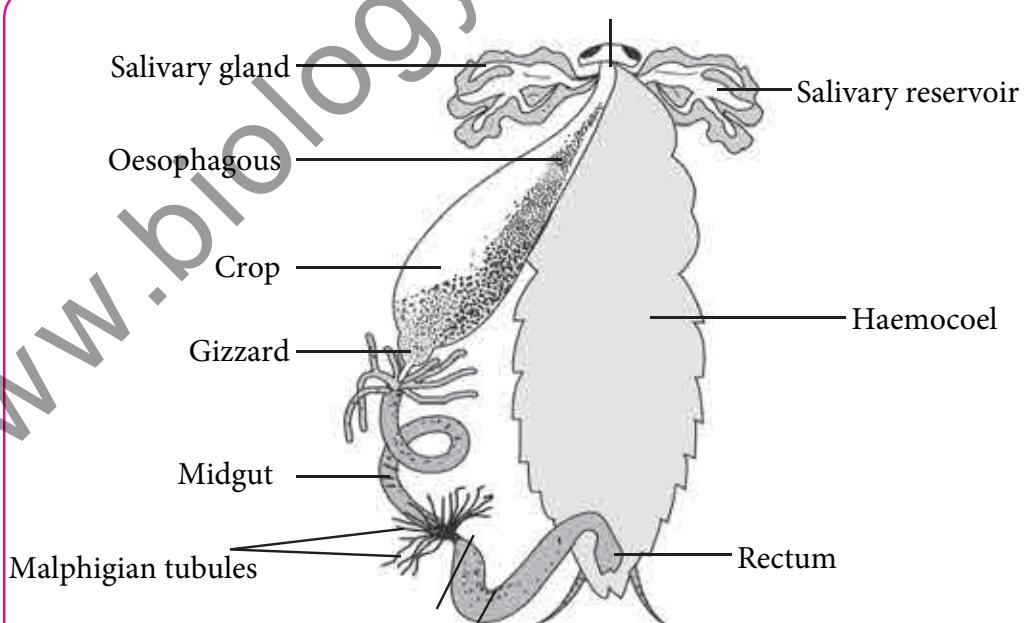


Fig. Digestive system of cockroach

Observation:

The digestive system of cockroach consists of the alimentary canal and the digestive glands.

The alimentary canal consists of following parts :

1. **Preoral cavity** : This cavity lies in front of the mouth and is bound by the mouth parts.
2. **Mouth** : It is small aperture at the anterior side. It opens into pharynx.
3. **Pharynx** : It is a short vertical tube opening into oesophagus.
4. **Oesophagus** : It is narrow tube running through the neck region.
5. **Crop** : The oesophagus dilates into large bag called the crop. It stores food for a short time.
6. **Gizzard** : It is thick walled, conical muscular organ for grinding and filtering the food.
7. **Hepatic caecae**: These are eight blind tubes lined internally by glandular cells. These open at the beginning of mesenteron. They secrete digestive enzymes.
8. **Mid gut [mesenteron]** : It is a short tube located between gizzard and hind gut. It is lined by endodermal cells. In mid gut, digestion and absorption of food takes place.
9. **Hind gut** : It consists of ileum (short and tubular), colon (long and coiled) and rectum (broad terminal part) which opens outside through the anus. At the junction of midgut and hindgut, there are seen 60-80 pale yellow, long hair like structures called Malpighian tubules (excretory in function).
10. **Salivary glands**: These are paired structures situated one on either side of crop having a pair of glandular portion and a receptacle or reservoir. Ducts arising from glandular portion unite to form a common duct. The reservoir of each side also gives off a duct, and the ducts form both the sides unite to form a common duct. The two common ducts join to form an efferent salivary duct which opens at the base of the hypopharynx.

Questions

Q. 1 Enlist the parts of Digestive system of Cockroach.

Mouth
Pharynx
Oesophagus
Crop
Gizzard
Malpighian tubules
Ileum
Colon
Rectum

crops is used to store the food. when the food is store in crop the wall of crop release some jucies for digestion

gizzards are the chitinous teeth which help in mastication of food finally hepatic caeca release the digestive juices too

Q. 3 Write the function malpighian tubules.

The main function of the Malpighian tubules is the excretion of nitrogenous products and other remains of metabolites.

Q. 4 Why is cockroach important in day to day life of human being?

Cockroaches are very important in humans day to day life because cockroaches are professional recyclers.

- Cockroaches contain protozoa bacteria in their digestive systems.
- This will help to convert the waste into easily absorbed nutrients.
- This is the main task for cockroaches in day to day life.
- Cockroaches play an important role in degrading the plant material.
- The most important role of cockroaches is decomposing without cockroaches more dirt would load all over the world.

Q. 5 Write the location of salivary glands in cockroach

The paired salivary glands in the cockroach are situated one on either side of the crop in the prothoracic region.

Q. 6 Give the names of parts of foregut.

1. Mouth
2. Pharynx
3. Oesophagus or crop
4. Gizzard
5. Pair of salivary glands

Q. 7 Write the function of first pair of wing and second pair of wing.

Cockroach have 2 pair of wings but both of them have different functions.

The 1st pair of wing is dark brown color and comparatively thick than the 2nd pair of wing which helps them to protect from environmental hazards or from the effect of microorganisms.

The 2nd pair of wing is thinner than the 1st pair of wings and mainly helps them to flight for a short distance.

Q. 8 How many pairs of leg are present in cockroach.

A cockroach has three pairs of walking legs

Q. 9 Give the names of three parts of thorax.

Thorax. The middle tagma, or thorax, comprises three large segments: prothorax (anterior most segment), mesothorax (middle), and metathorax (posterior)

Q. 10 What is difference between compound eye and simple eye.

Compound eyes are made up of clusters of ommatidia, but simple eyes are made up of only one single unit of eye.

Compound eyes are found in most of the arthropods, annelids and molluscs. However, simple eyes are found among many types of organisms including most of the higher vertebrates.

Compound eyes can cover a wider angle compared to simple eyes.

The types of simple eyes are more diversified than the compound eyes.

The polarisation of sunlight could be understood via compound eyes, but not through simple eyes.

Q. 11 What is the function of antennae in cockroach.

Cockroach antennae have been extensively used for studying the multifunctional sensory appendage that generates the olfactory, gustatory, tactile, thermal, and humidity senses.

Multiple Choice Questions

1. In cockroach, grinding of food material takes place in
a. Crop b. Oesophagus
c. Gizzard d. Pharynx
2. Hepatic caecae are located at the junction of
a. Foregut and midgut
b. Midgut and hind gut
c. Hind gut and foregut
d. Crop and rectum
3. In cockroach pre oral cavity leads into.....
a. Pharynx b. Oesophagus
c. Mouth d. Crop
4. Mesenteron is also called as
a. Gut b. Fore gut
c. Mid gut d. Hind gut
5. Cockroach belongs to class.....
a. Arachnida b. Myriapoda
c. Crustacea d. Insecta
6. The dorsal exoskeletal plates present in body segment of cockroach is called as
a. Pisclerites b. Pleura
c. Sterna d. Terga
7. Cockroach is
a. Omnivorous b. Carnivorous
c. Herbivorous d. Cannibalism
8. Eyes of cockroach are made up of.....
a. Retina b. Fenestrae
c. Oscillar sports d. Ommatidia

Remark and Signature of Teacher

10. Mounting of organs of Cockroach

Date :

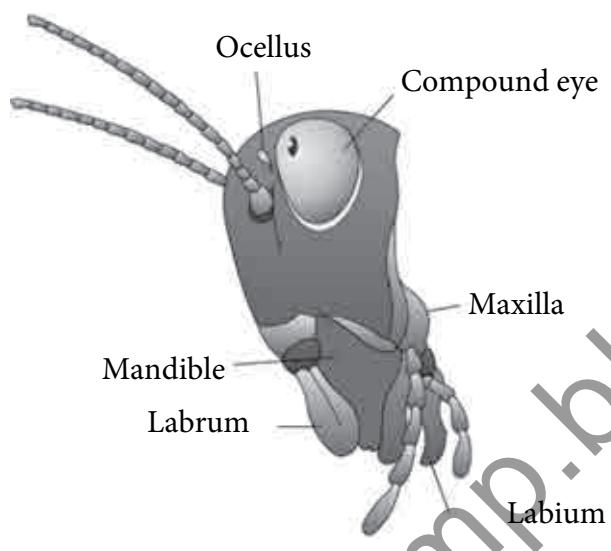
Aim: Study of Mouth parts , Gizzard and Trachia of Cockroach.

Requirements: Photographs, chart and ICT of mouth parts, Gizzard and Trachia of cockroach

Procedure: Mouth parts of cockroach (Trophy) :

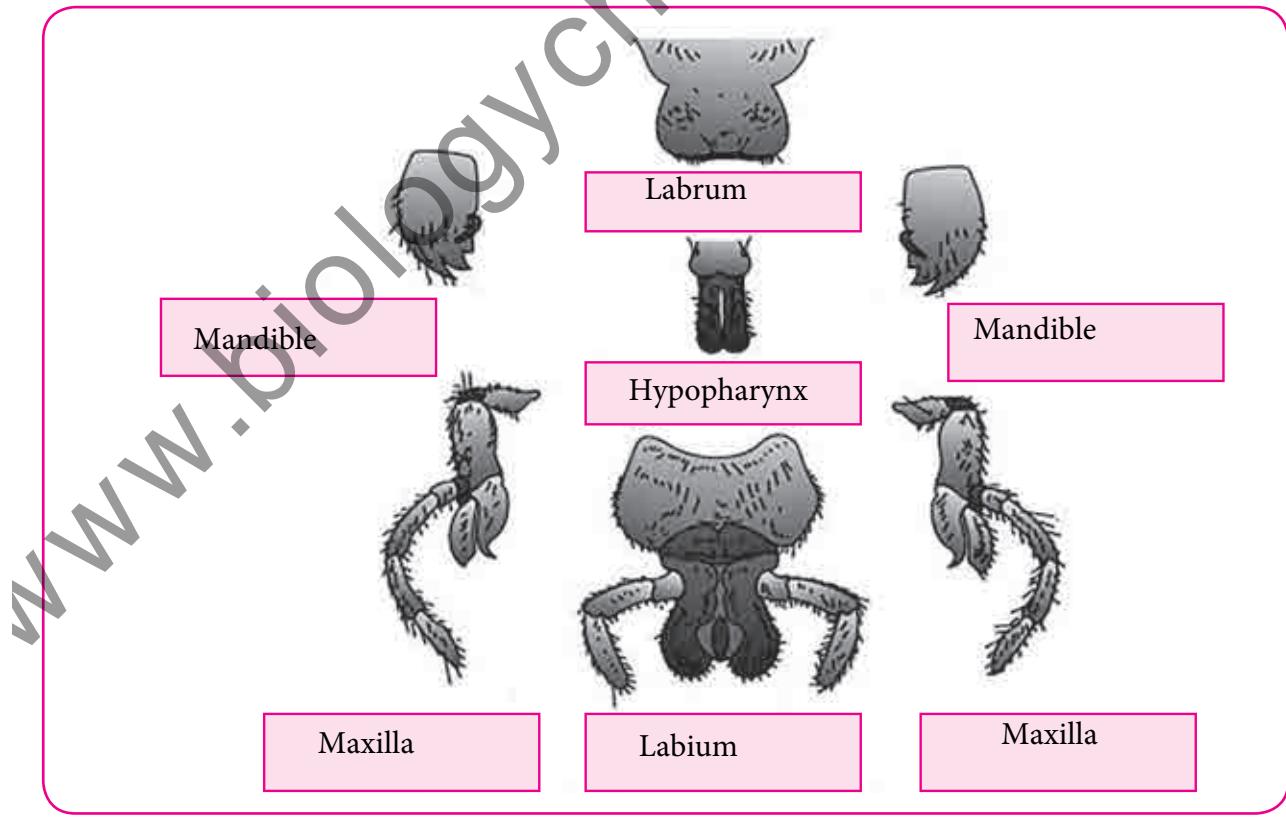
Observe the mouth parts of Cockroaches and label the parts in the activity.

Figure :



Mouth parts of cockroach

Activity : Observe the diagram given below and label the parts .



Mouth parts of cockroach are chewing & biting type. There are five segmented & movable types of mouth parts as follows...

1. **Labrum:** It is upper lip. It holds the food during feeding.
2. **Mandibles:** These are true jaws. These are hard, chitinous, structures with serrated margins. These are useful in cutting & crushing of food.
3. **Maxillae :** These are two accessory jaws on the either side, behind mandibles. These are sensory in function.
4. **Labium :** It is lower lip. It pushes the food in pre-oral cavity.
5. **Hypopharynx :** It is tongue, a long, prominent, medially placed appendage.

Gizzard of cockroach:

Wall of gizzard is made by circular muscles. Internal lining of gizzard is made up of hard cuticle arranged in six teeth like structures. Gizzard is meant for grinding the food.

Activity : Describe the structure of Gizzard.

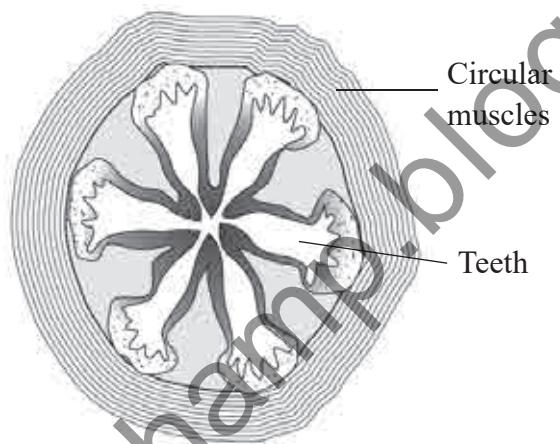


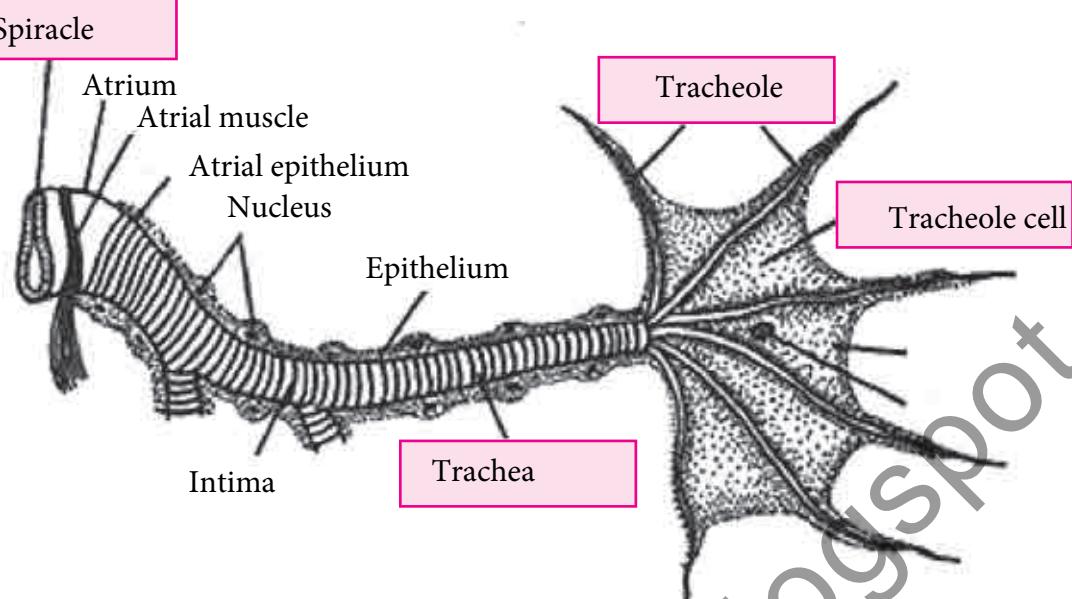
Fig. Everted Gizzard of Cockroach

- 1.The gizzard is a kind of muscular stomach in cockroach. It consists of sharp teeth which is able to grind the food into small parts.
- 2.It is covered with round thick wall with muscular chitins.
- 3.It consists of six teeth in the stomach which aids in the grinding of the food. It also aids in the mastication of the food.

Trachea of cockroach :

In cockroach the respiration is by means of trachea, which form a longitudinal & transverse network in dorsal, ventral & lateral side. On each segment, small openings, called spiracles are present. Spiracles connect to larger tubes called tracheoles. Each trachea branches into smaller tubes called tracheoles. Tracheoles surround all the body parts & tissues. Air enters through spiracle into trachea. From trachea air enter into trachea & from trachea oxygen diffuses into cells of tissue , diffuses out. Thus trachea are fine tubes internally lined by spiral thickening called intima.

Activity : Observe the diagram given below and label the parts .



Questions

Q. 1 Enlist the names of mouth parts of cockroach and give their functions.

The following are the parts of the mouth in cockroach:

1. Labrum: It is the part of the upper lip. It exhibits gustatory senses. It helps in tasting and handling of food.
2. Mandibles: These are important for the mastication of food.
3. First pair of maxillae: It is used for cleaning the antennae and the first pair of legs.
4. Labium: It is used for the fusion of second pair of the maxillae.
5. Hypopharynx: It performs the function of the tongue. It exhibits the salivary ducts for the mixing of food.

Q. 2 Why gizzard is called grinding machine for cockroach?

The gizzard is the next structure that is present after the crop. It is also called the proventriculus. It helps in grinding the food particles due to the presence of six chitinous plates called teeth.

Q. 3 What is the alternative name for tongue of cockroach? Why?

1. The alternative name for tongue of cockroach is hypopharynx.
2. Hypopharynx is considered as tongue in cockroach because it helps in movement of food in the pre oral cavity of cockroach.
3. The hypopharynx is found medially to the mandibles and the maxillae.
4. It is behind the preoral cavity and before the labium.
5. The hypopharynx is for the most part membranous and intently with the salivary organs and additionally salivary pipes.
6. The hypopharynx capacities as a tongue, moving nourishment around in the preoral pit.

Q. 4 How many spiracles are present in thoracic and abdominal region of cockroach?

1. The tracheal system of cockroach communicates with the exterior by ten pairs of openings called spiracles.
2. The first 2 pairs of spiracles are present in the thoracic segments, one pair in mesothorax and one pair in the metathorax.
3. The remaining 8 pairs of spiracles are present in the first eight abdominal segments.

Multiple Choice Questions

1. Which of the following is incorrect pair?
 - a. Labrum : Upper Lip
 - b. Gonapophyses : Tongue
 - c. Labium : Lower Lip
 - d. Mandibles : Jaws
2. The mouth parts in cockroach are of
 - a. Sucking type
 - b. Chewing & biting type
 - c. Siphoning type
 - d. Sponging type
3. The true jaw of cockroach is
 - a. Mandible
 - b. Maxille
 - c. Labrum
 - d. Labium

Activity : Write the discription of activity given on page 108.

Mouth parts of cockroach are chewing & biting type. There are five segmented & movable types of mouth parts as follows...

1. **Labrum:** It is upper lip. It holds the food during feeding.
2. **Mandibles:** These are true jaws. These are hard, ctitinous, structures with serrated margins. These are useful in cutting & crushing of food.
3. **Maxillae :** These are two accessory jaws on the either side, behind mandibles. These are sensory in function.
4. **Labium :** It is lower lip. It pushes the food in pre-oral cavity.
5. **Hypopharynx :** It is tongue, a long, prominent, medially placed appendage.

Remark and Signature of Teacher

11. Study of histology of digestive organs of mammals viz, T. S. of Pancreas, Small intestine and Liver.

Aim: To study the histology of organs

Date :

Requirements: Permanent slides of T. S. of Pancreas, Small Intestine and Liver.

Activity : Observe the slides under the microscope and write down your observation and label the parts of diagram.

1 TS of Pancreas :

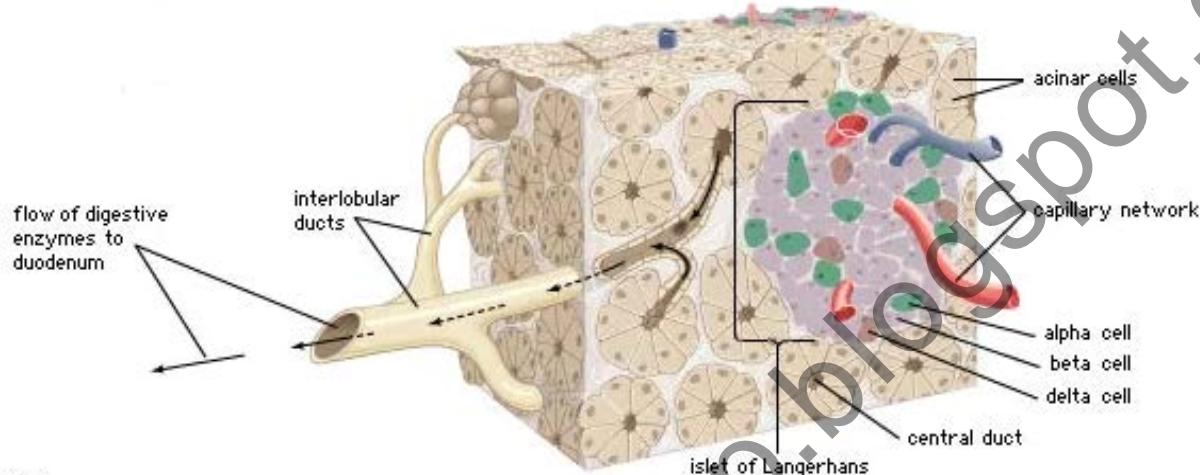


Fig. Histological structure of Pancreas

It is a composite (mixed) gland which functions as both exocrine and endocrine gland.

About 99% of pancreatic cells are arranged in clusters called acini (exocrine gland). These cells produce digestive enzymes which flow into gastrointestinal tract through a duct.

Scattered among exocrine acini are tiny groups of endocrine tissue called islets of Langerhans.

Two main types of cells in islets of Langerhans are α -cells and β -cells.

The α -cells secrete a hormone called glucagon whereas β -cells secrete insulin.

2. T.S. of Small Intestine :

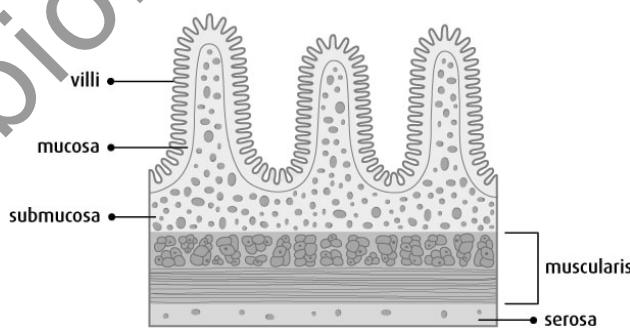


Fig. Histological structure of Small Intestine

The histological structure of the small intestine is similar to the other organs in the digestive tract. There are four main layers:

Mucosa (Innermost layer) – Contains the epithelium, lamina propria and muscularis mucosae.

Submucosa – Connective tissue layer, which contains blood vessels, lymphatics and the submucosal plexus.

Muscularis externa – Consists of two smooth muscle layers; the outer longitudinal layer and inner circular layer. The myenteric plexus lies between them

Adventitia (Outermost layer) – Comprised of loosely arranged fibroblasts and collagen, with the vessels and nerves passing through it. The majority of the small intestine adventitia is covered by mesothelium and is commonly called the serosa.

The small intestine is the major absorptive site in the gastrointestinal tract, and therefore has a number of modifications to aid its function. The mucosa and submucosa form large numbers of folds (or plicae) arranged in a circular fashion in the lumen (therefore called plicae circulares). Additionally, the plicae contain microvilli to further increase the surface area, which increases absorption.

3. T. S. of Liver :

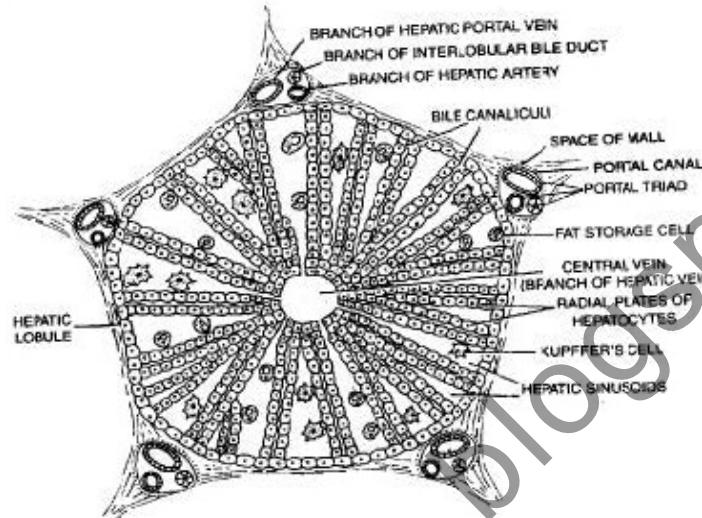


Fig. Histological structure of Liver

1. Liver is the largest gland of the body covered by a thin covering called Glisson's Capsule
2. Internally the liver lobes are divided into Several structural and functional units called hepatic lobules
3. Each hepatic lobule is polygonal in shape and contains cords of hepatic cells arranged around a central vein.
4. In between the cords of hepatic cells there are spaces called sinusoids filled with blood. They contain phagocytic Kupffer cells.
5. Hepatic cells produce bile juice which is stored in gall bladder.

Questions

1. Name the largest gland of the body.
Liver is the largest gland of our body
2. Name the cells responsible for secretion of bile.
Hepatic cells of liver are responsible for secretion of bile
3. What do acini secrete in Pancreas?
Acini of pancreas secrete pancreatic juice
4. Name the cells of islets of Langerhans.
Alpha cells, Beta cells and Delta cells

5. Name the layers seen in T.S. of intestine

The small intestine wall has four layers: the outermost serosa, muscularis, submucosa, and innermost mucosa.

6. What do pancreatic beta cell do?

Beta cells (β cells) are a type of cell found in pancreatic islets that synthesize and secrete insulin and amylin.

Multiple choice questions

1. _____ cells are responsible for the secretion of dil.HCl

- a. Chief cells
- b. Oxyntic cells
- c. Mucous cells
- d. Submucosa

2. The mucosa of the small intestine is folded into numerous finger like projections called _____.

- a. Microvilli
- b. Villi
- c. Lacteal
- d. Cilia

3. _____ gland is both endocrine and exocrine in nature.

- a. Pituitary
- b. Thyroid
- c. Liver
- d. Pancreas

4. Kupffer cells are seen in _____.

- a. Pituitary
- b. Thyroid
- c. Liver
- d. Pancreas

5. Which part of pancreas produces and secretes insulin?

- a. Glomerulus
- b. Bowman's capsule
- c. Islets of Langerhans
- d. Loop of henle

6. In pancreatic islets of Langerhans, alpha cells are found in _____ of the islet while beta cell are usually found in the _____ of the islet.

- a. Periphery , Center
- b. Center , Periphery
- c. Equally in both regions, periphery
- d. Periphery , Equally in both regions

7. Secretion of pancreatic juice is stimulated by _____ .

- a. Gastrin
- b. Secretion
- c. Enterokinase
- d. Enterogastron

Remark and Signature of Teacher

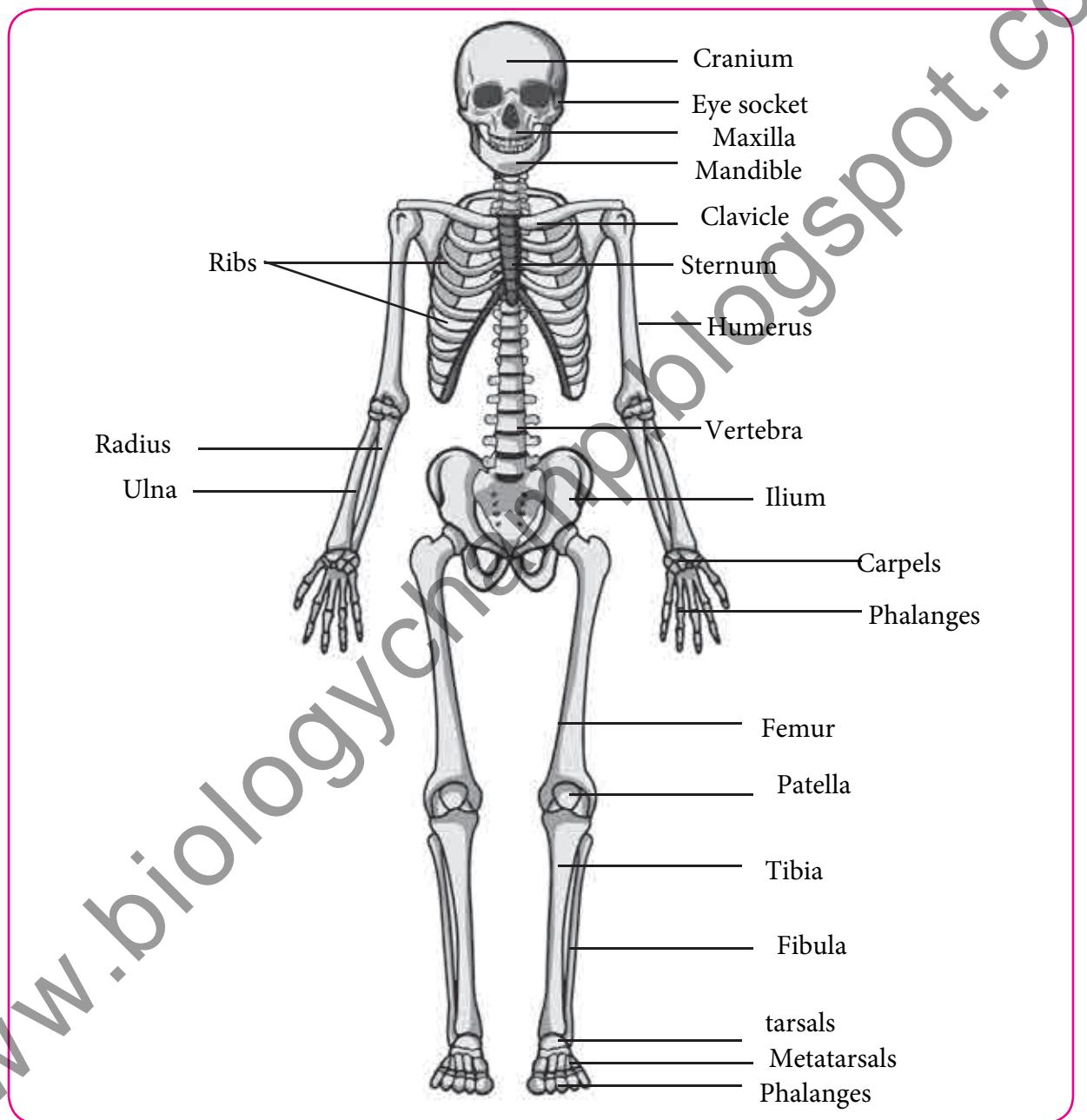
12. Study of Human skeleton

Date :

Aim: Study of specimens and their identification

Requirements : Human skeleton Actual / Model.

Activity : Observe the following diagrams as well as specimens/models and label it.



Human endoskeleton can be divided into two main sections.

1. **Axial skeleton** :- it includes parts lying along the median axis of body.
2. **Appendicular skeleton** :- it includes parts lying perpendicular to body axis such as girdles and limb bones.

Axial skeleton:

It comprises of skull, vertebral column and thoracic cage. Vertebral column is made up of 33 vertebrae. They are cervical (neck region), thoracic, lumbar, sacral and coccygeal.

Basic plan of typical vertebra :-

All vertebrae of human being are constructed on the same basic plan. The typical vertebra has two main parts- namely the centrum of body and neural arch.

a. Centrum or body :- it is thick, disc-shaped and present on anterior side. It has flat upper and lower surface (Amphiplatyan)

b. Neural arch :-

1. It is present on posterior side.
2. It is a bony ring formed by pedicles and lamina.
3. Neural arch encloses a cavity known as vertebral foramen.
4. Neural arch bears transverse processes, spinous process, superior and inferior articular processes.

Cervical vertebrae

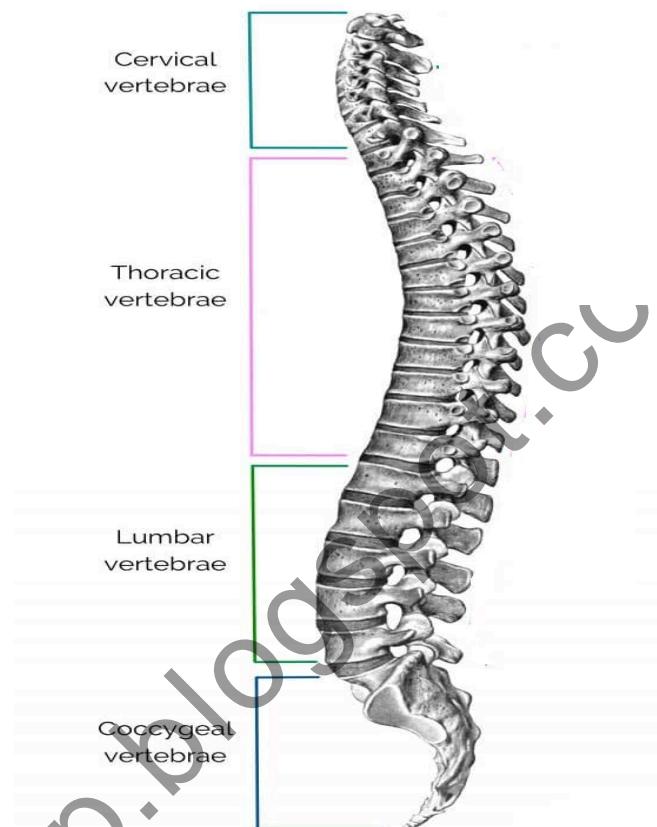
Seven vertebrae present in neck region are called Cervical vertebrae. 1st, 2nd and 7th vertebrae are called atypical while 3rd to 6th vertebrae are typical vertebrae and are called typical cervical vertebrae.

A. Typical cervical vertebra :-

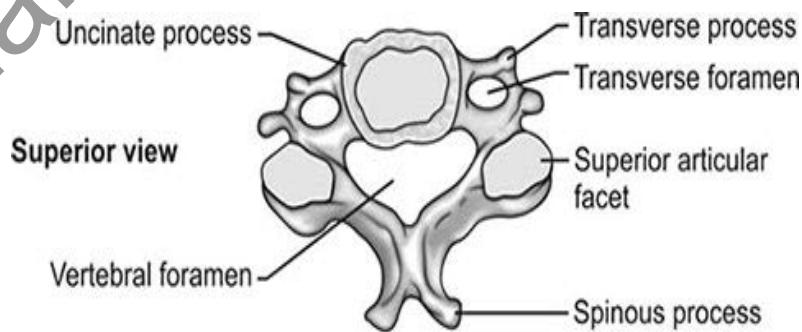
1. These are small in size and more in width than length.
2. Centrum is small and flat.
3. Vertebral foramen is triangular.
4. Spinous process is short and bifid i.e. split at tip.
5. Transverse processes are wider, short and bear foramen transversarium.

B. Atlas or 1st cervical vertebra :-

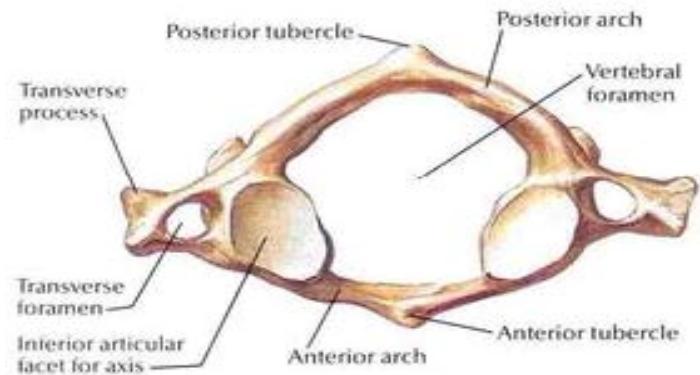
1. It is ring like vertebra.
2. Centrum or body is reduced.
3. Spinous process is reduced.
4. Vertebral foramen is large, divided into anterior odontoid foramen and posterior vertebral foramen by ligament.



Vertebral column of Man



Typical Cervical Vertebra

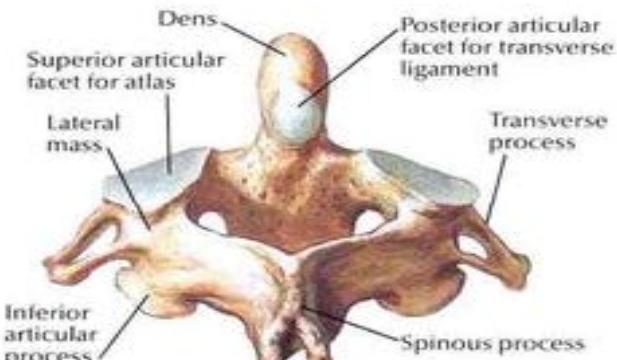


Atlas Vertebra

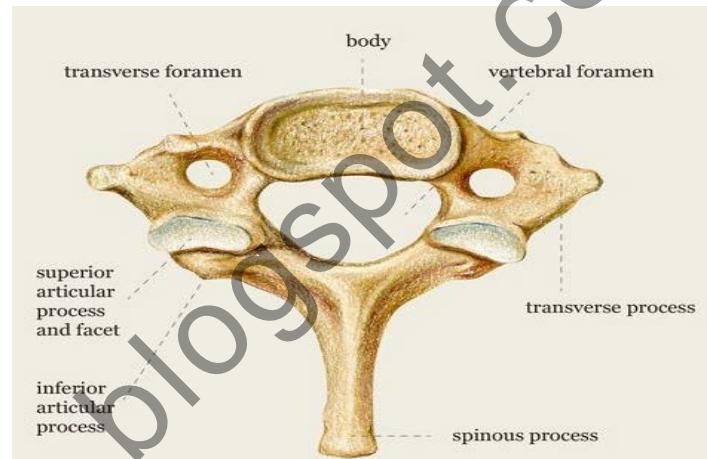
- Transverse processes are broad, short and they possess foramen transversarium.
- Superior and inferior articular facets present.

C. Axis or 2nd cervical vertebra :-

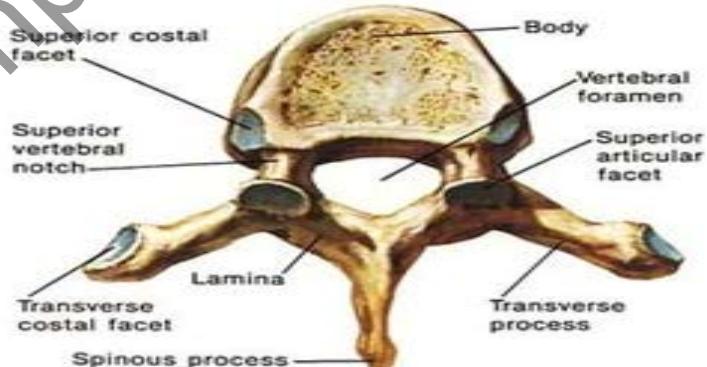
- It is small and characterised by presence of odontoid process.
- Odontoid structure arising from centrum and fits into odontoid foramen of atlas.
- Vertebral foramen is triangular.
- Spinous process is broad and slightly bifid.
- Transverse processes are short and broad with foramen transversarium.



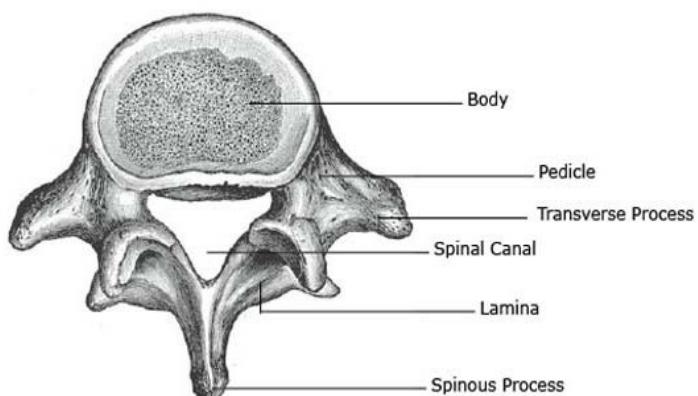
Axis Vertebra



7th Cervical Vertebra



Typical Thoracic Vertebra



Lumbar Vertebra

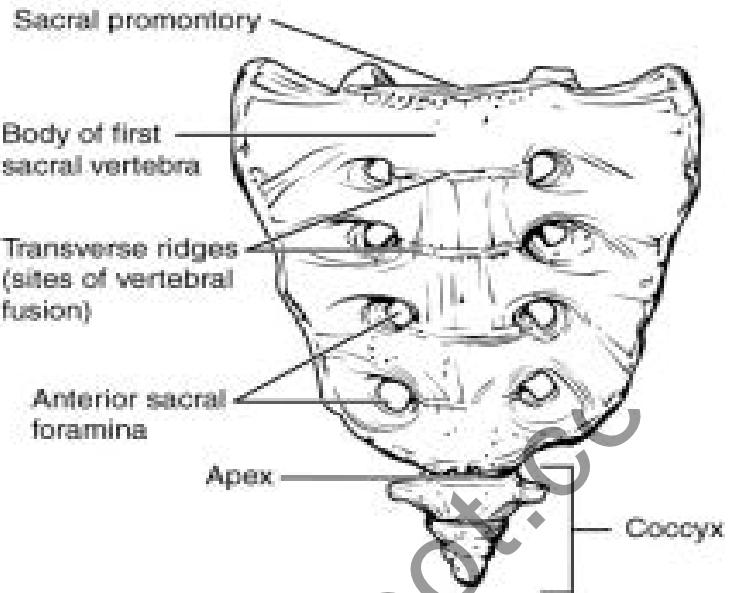
F. Typical lumbar vertebra:-

- Centrum is large massive and kidney-shaped.
- Vertebral foramen is triangular.
- Spinous process is flat, quadrangular
- Transverse processes are thin, slender and short.
- The vertebra is large in size.

G. Sacrum with coccyx (Synsacrum) :-

a. Sacrum :

1. It is triangular compact bone formed by fusion of five sacral vertebrae.
2. Paired sacral foramina are present in between these vertebrae and they are four in human.
3. Vertebral foramen is triangular.
4. Base of sacrum is broad and articulated with last lumbar vertebra while apex is narrow and connected with coccyx.
5. Laterally the two wing like alae of sacrum articulate with the pelvic girdle.
6. Anterior surface is concave and posterior surface is convex.
7. The centrum of 1st sacral vertebra projects anteriorly called sacral promontory.



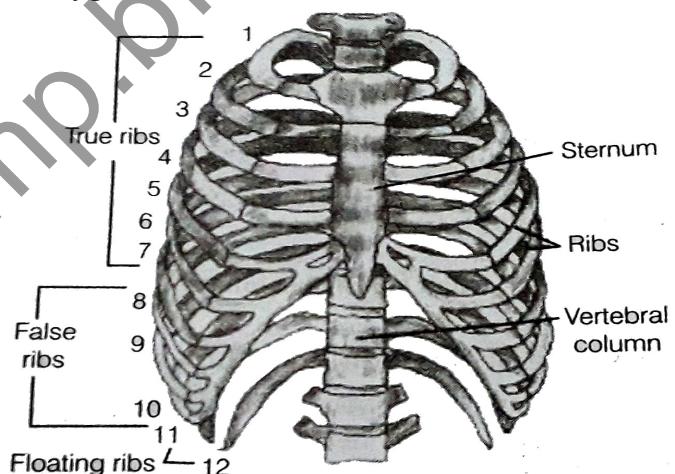
Sacrum and Coccyx

b. Coccyx :

1. It is tapering part of vertebral column.
2. It is small triangular bone formed by fusion of four coccygeal vertebrae.

H. Sternum :-

1. It is also called chest bone.
2. It is flat and elongated.
3. It consists of manubrium, body and xiphoid process.
4. Manubrium is an anterior part which articulates with clavicle and first two pairs of ribs.
5. The body of sternum is middle part which articulates with 5 pairs of true ribs. Xiphoid process is small cartilaginous terminal part of sternum. It is connected with diaphragm and abdominal muscles.



Sternum and Ribcage

I. Ribs :-

1. The ribs partially enclose and protect the chest cavity, where vital organs (the heart and the lungs) are located.
2. The rib cage is collectively made up of long, curved individual bones with connections to the vertebrae.
3. At the chest, many ribs connect to the sternum via costal cartilage, segments of hyaline cartilage that allow the rib cage to expand during inspiration.
4. The human rib cage is made up of 12 paired rib bones; each are symmetrically paired on a right and left side.
5. Of all 12 pairs of ribs, the first seven pairs are called as 'true.' These bones are connected to the costal cartilage, while the five other 'false' ribs are not.

- Three of those connect to non-costal cartilage, and last two are deemed to be ‘floating,’ which means they only connect to the vertebral column.
- While there are some cases of minor anatomical variation, men and women generally have the same amount of ribs. A differing rib count between the genders is largely a medical myth.

Study of appendicular skeleton

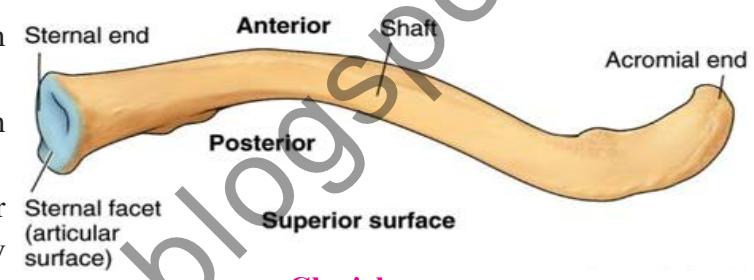
Appendicular skeleton is formed of pectoral girdle, pelvic girdle and the bones of limbs. It is formed of 126 bones.

A. pectoral girdle (shoulder girdle):-

The pectoral girdle consists of two bones, the anterior clavicle and the posterior scapula.

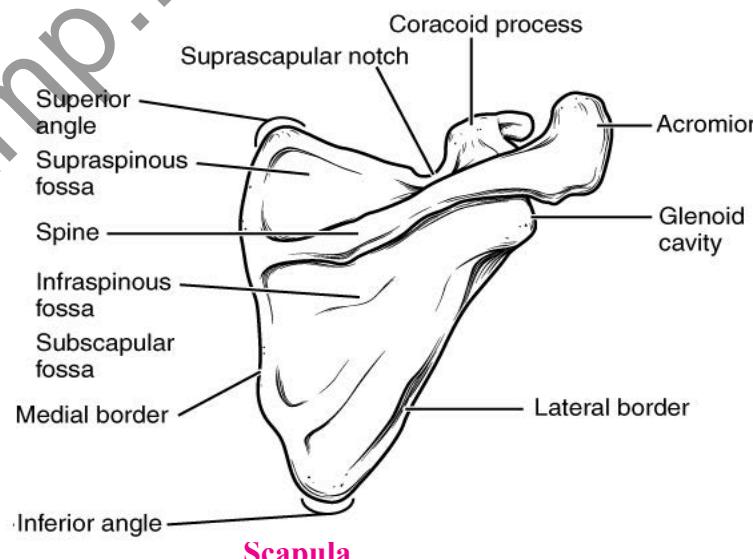
Clavicle:- (collar bone)

- It is long, cylindrical and slightly ‘s’ shaped bone.
- It extends horizontally across the upper thorax and at the base of neck.
- Medial end of clavicle articulates with manubrium of sternum.
- The lateral end of clavicle articulates with acromion of the scapula.
- Clavicle prevents the dropping of shoulder and provides free movements to the arm by keeping it away from the trunk.



Scapula:-

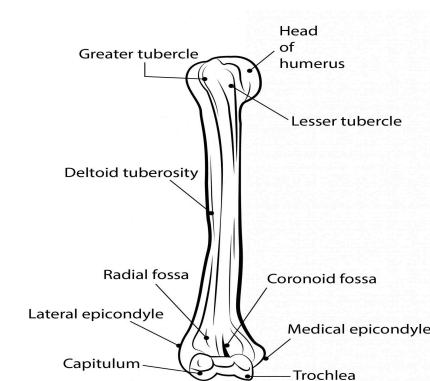
- It is flat and triangular bone.
- It is located on the dorsal side of thorax and it extends from 2nd to 7th ribs.
- It has superior, medial and lateral borders.
- The medial border is parallel to the vertebral column.
- Glenoid cavity is present at the junction of superior and lateral borders. It receives head of humerus, forming ball and socket joint.
- The posterior surface of the scapula bears sharp prominent spine
- The spine is expanded laterally into acromion process.
- Superior border bears scapular notch and hook-shaped coracoid process.



B. Bone of forelimb :-

a. Humerus:-

- It is elongated bone of the upper arm.
- It articulates with scapula at shoulder and with radius and ulna at the elbow.
- The proximal end of humerus has rounded head, greater and lesser tubercles (tuberousities).



Humerus

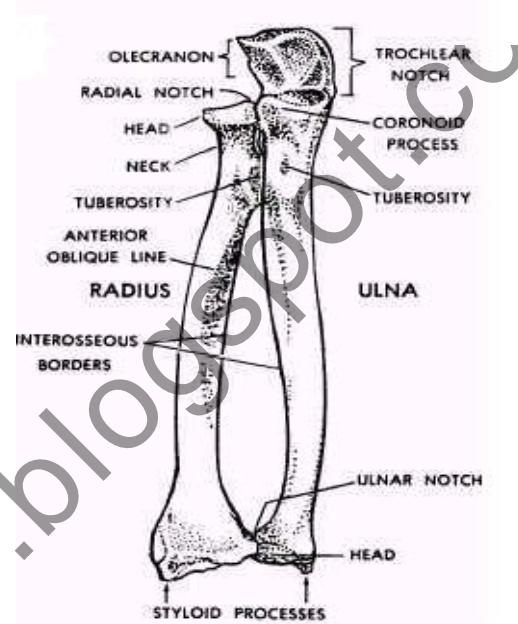
4. Head fits into glenoid cavity of pectoral girdle.
5. The shaft is cylindrical, long and it bears deltoid tuberosity and nutrient foramen.
6. Distal end of humerus consists of medial and lateral epicondyles. Capitulum and trochlea.
7. Lateral ball-like capitulum articulates with radius and medial pulley shaped trochlea articulates with ulna.

b. Radius-Ulna:-

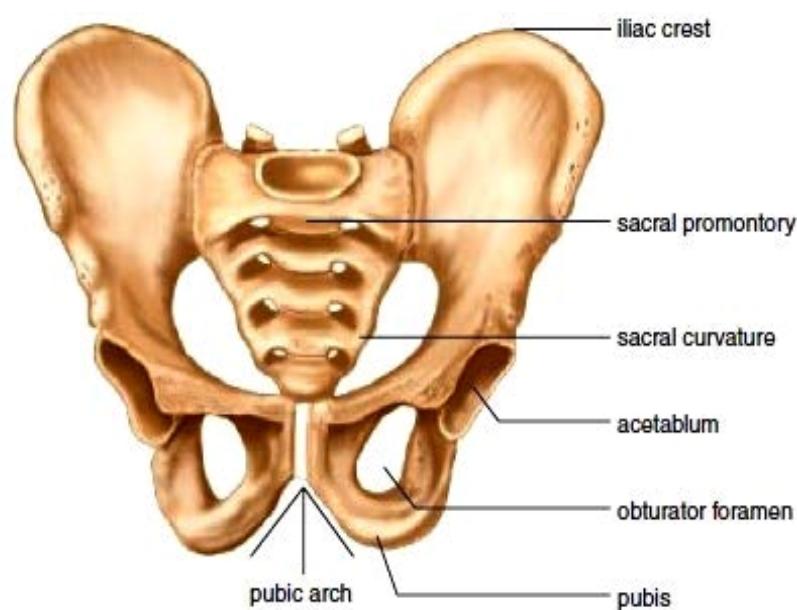
1. These are two long parallel bones forming the skeleton of forearm.
2. Radius is present on thumb side and ulna is present to little finger side.
3. The proximal and distal ends of these bones are articulated to each other.
4. The gap present between these two bones in the middle is filled with interosseous membrane.
5. The radius is short and its flat proximal end articulates with capitulum of humerus.
6. Proximal end of ulna has trochlear notch, coronoid process and olecranon process.
7. The olecranon process forms the elbow joint with humerus.
8. Distal ends of radius and ulna, are provided with styloid process.

C. Pelvic girdle (Hip girdle) :-

1. It is present in pelvic region of the body.
2. It is formed by two coxal bones or innominate bones known as hip bones.
3. Each hip bone is large, flat, irregular and consists of Ilium, pubis and ischium.
4. Ilium is situated dorsally and joined to sacrum by sacro-iliac joint.
5. Pubis is narrow flat bone present in front.
6. Two pubis bones join together to form a joint called pubic symphysis.
7. Ischium forms posterior and inferior portion of the hip bone. It supports the body weight in the sitting posture.
8. The pubis and ischium together form a ring like obturator foramen.
9. Lateral border of hip bone bears a cavity known as acetabulum. It receives the head of femur bone and forms ball and socket joint.



Radius - Ulna



Pelvic girdle

D. Bones of hind limb :-

Femur :-

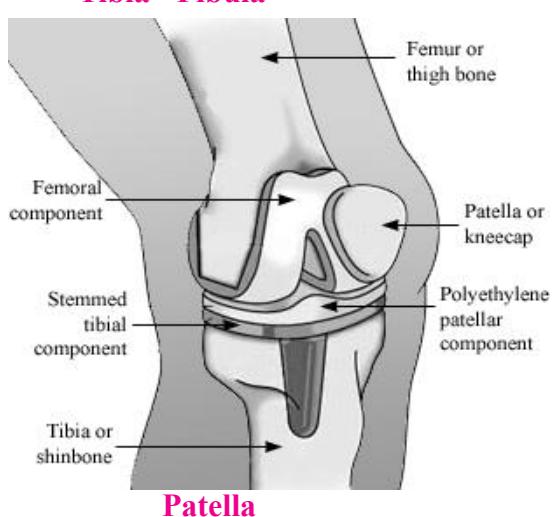
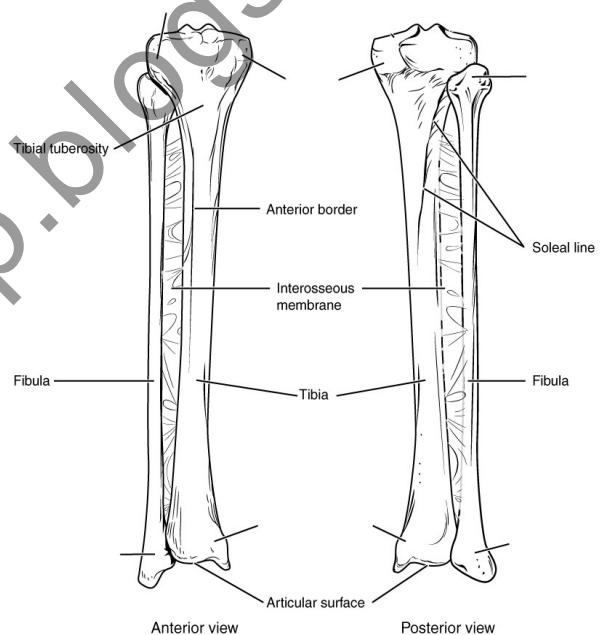
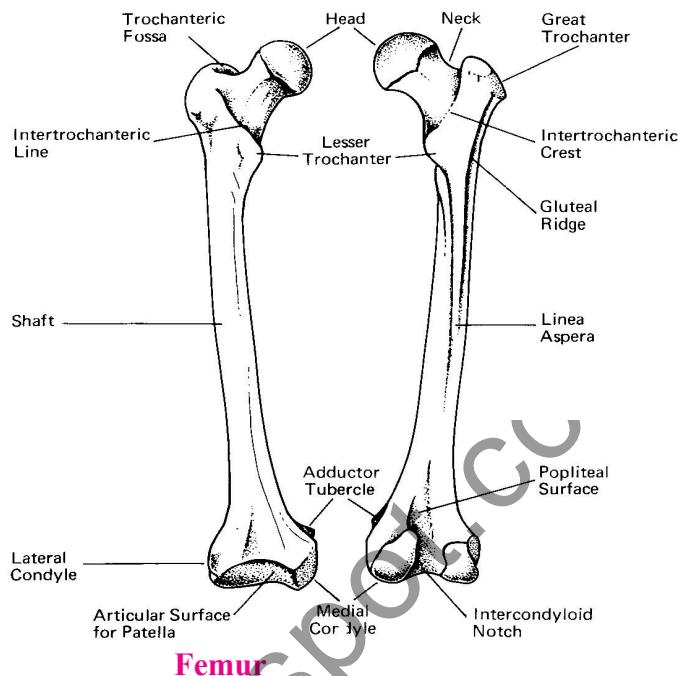
1. Femur is present in the thigh region.
2. It is the largest, longest and strongest bone of the body.
3. The proximal end of femur has head, neck, greater and lesser trochanters.
4. The head of femur is rounded and it fits into acetabulum of pelvic girdle forming ball and socket joint.
5. Trochanters provide surface for muscle attachment.
6. The shaft is elongated, cylindrical and it has ridge called linea aspera.
7. Distal end of femur consists of medial and lateral condyles and patellar surface for articulation with patella or knee cap.

Tibia-fibula :-

1. Tibia and fibula are the two bones present in the shank region.
2. These two bones are connected by an interosseous membrane and articulated with each other proximally and distally by ligaments.
3. Tibia is large and stout bone present on medial side.
4. Proximal end of tibia has medial and lateral condyles articulating with the corresponding condyles of the femur.
5. Distal end of tibia has strong process called medial malleolus.
6. Fibula is long, slender bone and it is present laterally.
7. Proximal end of fibula is rounded and it articulates with tibia.
8. Distal end of fibula develops lateral malleolus.

Patella:-

1. The patella is also known as the kneecap.
2. It sits in front of the knee joint and protects the joint from damage.
3. It is the largest **sesamoid bone** in the body, and lies within the quadriceps tendon.



Questions

Q. 1 In which part of the skeleton are fractures and dislocations more serious?

In ball and socket joint of the Skeleton are fractures and its locations are more serious .

Q. 2 In which part of the skeleton are fractures and dislocations more common?

They most commonly occur in the shoulder or hands, but also happen in the hip, knee, elbow, ankle, fingers and toes. Symptoms includes intense pain, swelling and bruising, limited movement and a joint that is visibly out of place. It is important to seek immediate medical attention for a joint dislocation.

Q. 3 What part make on the axial skeleton?

The axial skeleton is the part of the skeleton that consists of the bones of the head and trunk of a vertebrate. In the human skeleton, it consists of 80 bones and is composed of six parts; the skull (22 bones), the ossicles of the middle ear, the hyoid bone, the rib cage, sternum and the vertebral column.

Q. 4 What part make on the appendicular skeleton?

The human appendicular skeleton is composed of the bones of the upper limbs, the lower limbs, the pectoral girdle, and the pelvic girdle. The pectoral girdle acts as the point of attachment of the upper limbs to the body. The upper limb consists of the arm, the forearm, and the wrist and hand.

The pelvic girdle is responsible for bearing the weight of the body and is responsible for locomotion; it is also responsible for attaching the lower limbs to the body.

Q. 5 Describe the specific function of the appendicular skeleton?

1) Locomotion by the help of legs. 2) Attachment of hand & leg muscles. 3) Attachment of hands on shoulder & legs on hip. 4) Balance the body weight on hip bone. 5) There are many functions of fore limb alone.

Multiple Choice Questions

1. Lumber vertebra is found in _____.
a. Neck region b. Abdominal region
c. Hip region d. Thorax
2. The total number of vertebrae in man is _____.
a. 30 b. 31 c. 32 d. 33
3. In mammals number of cervical vertebra are _____.
a. 5 b. 7 c. 10 d. 12
6. Cranium of man is made ofbones.
a. 8 b. 12 c. 10 d. 16
7. Which of the following vertebra is formed from four vertebrae.
a. Sacrum b. Coccyx c. Atlas d. Axis
8. Number of bones in human skull is
a. 29 b. 28 c. 107 d. 26
9. Half of the lower jaw of man have..... Number of bones.
a. 1 b. 4 c. 6 d. 8
11. Joints of femur with pelvic girdle is _____.
a. Hinge joint b. Non-moveable joint
c. Pivot joint d. Ball and socket joint
14. Ball and Socket joint can be seen in _____.
a. Wrist b. Fingers
c. Neck d. Shoulder

Remark and Signature of Teacher.....

Guidelines for Projects and its report writing

PART : A

1. Select the topic for project based on feasibility.
2. Define the objectives of the project.
3. Plan the approach and Methodology for the project.
 - a. Primary sources – For information based projects.
 - b. Experimentation for collection, study of processes type project.
4. Formulated the data/ information gathered using various techniques so as to aid in Analysis.
5. Arrive at conclusion based on analysis of data prepare the final project report.

PART : B

1. Title of the project.
2. Name of the student and concerned details.
3. Acknowledgement's.
4. Table of contents.
5. Actual Report.
 - a. Introduction of the topic and need for the project.
 - b. Description of method used.
 - c. Data collected.
 - d. Analysis of collected data.
 - e. Conclusion.
 - f. Bibliography- references for all the information sighted in the project.

PROJECT TOPICS

1. Collect different types of Modified Stems/ Leaves/Root's from your surrounding area.
2. Collect ten different types of flowers from your area and draw its floral formula and floral diagram.
3. Collect the information on endangered plant and animal species from Maharashtra.
4. A project on Herpetological diversity of Maharashtra.
5. Collect the information of Bird's from your surrounding area.
6. To study different types of seed germination.
7. To collect seeds and fruits of different plants and study their mode of dispersion.
8. Visit your nearest Botanical garden/ Zoological park/Devarai/ Vanrai/ Natural forest. Write a report of this visit concerning with flora and fauna.
9. Take photographs of different inflorescence and classify them.
10. Prepare the Herbaria from your area of any Five-plant species.
11. Collect the information of economically important fungal organisms.
12. Collect the information of different Avenue tree's and their importance.
13. A project on Biopotential of fresh water invertebrates.
14. Collect the information of Migratory bird's visiting various habitat's in Maharashtra.

PROJECT

Title

Project Writing

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