# I. BIOLOGICAL DRAWINGS

Biological drawings are simple and flat drawn on a plain paper. During practical examination you are sometimes provided with a specimen and asked to make an accurate drawing out of it. Draw what you see and not a memorised drawing from a textbook.

When you are making a drawing, draw accurate proportions and accurate number of subunits. For instance, a human foot has five toes and a drawing showing more or fewer would be inaccurate.

Your drawing should be large enough, at least half of the available space on your paper. Use a sharp pencil and a clean rubber.

HINTS ON DRAWING

It has to have the following things to qualify for good marks:

- Drawing must have a title
- Drawing must be done in pencil
- Drawing must be large enough to show parts clearly
- Parts should be accurately positioned
- Label lines should point exactly to the item labeled with no arrows
- Label lines must not cross each other
- Drawing must be neat
- Drawing should not be shaded or coloured unless you are told to do so.
- Use a free hand and not a ruler and join up lines smoothly.

Below are three diagrams of a wing feather, a bean seed and a fish which tries to depict some of the features which a good biological drawing must show.

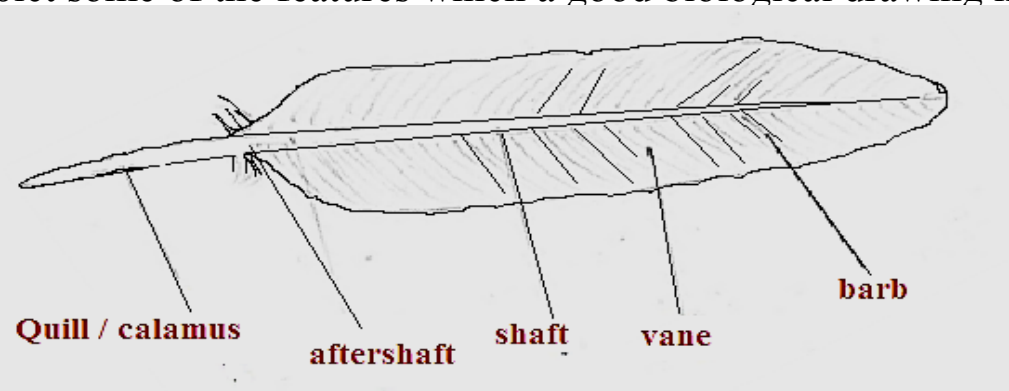
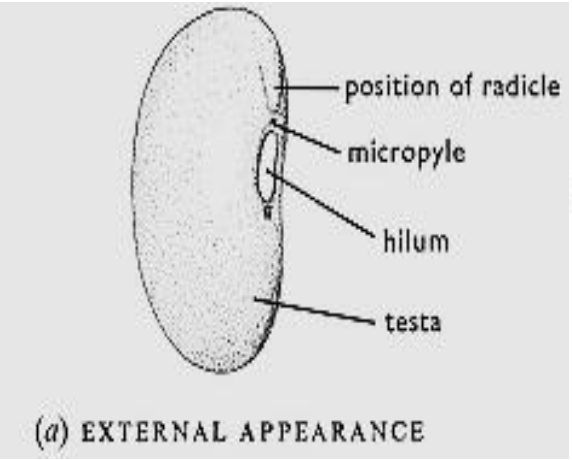



**Diagram of a wing feather**



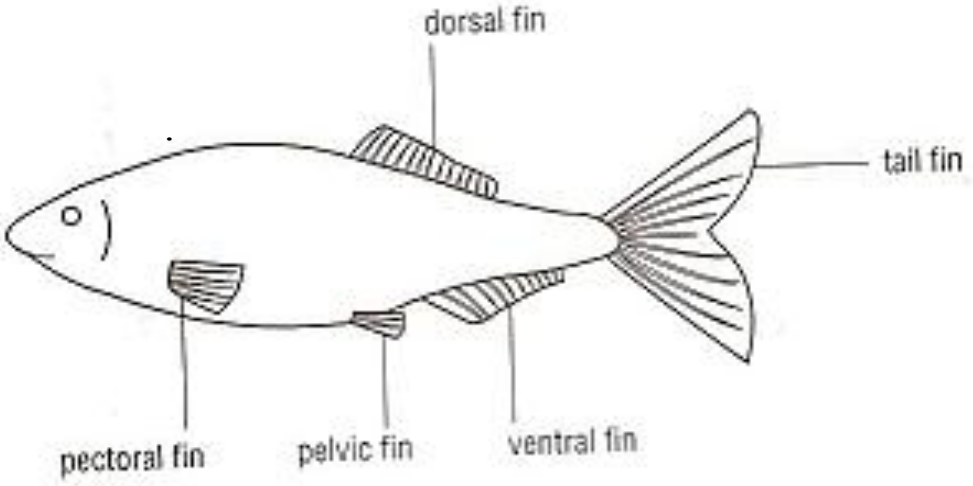




**Diagram of fish showing structures for locomotion**

**Activity 1:**

In the diagram of a fish, give any one structure that has not been shown in the diagram. (1 mark)

Draw a well labeled diagram of a grass leaf and a potato tuber and label any three parts in each diagram. (4 marks)

(Three marks are for correct labels and one mark for accuracy).

**NOTE:** If you are drawing an organism with a complicated repeating structure such as the branches and twigs on a tree, you do not need to draw them all, only one or two to show detail.

# II. MAGNIFICATION

This is the extent to which a drawing has been enlarged compared to the actual specimen.
Magnification shows how bigger or smaller your drawing is compared to the real object. To know how large the original object or specimen had been we need to write the size or work out the magnification or scale.

**Formula for calculating magnification:**

$$\text{Magnification} = \frac{\text{Length of drawing}}{\text{Actual length of specimen}}$$

- Measure length of your drawing,
- Measure length of the specimen
- Then divide length of drawing by length of specimen

**NB:** you can also use the formula for magnification to calculate the third figure when given two others, i.e.

Length of drawing = Length of specimen x Magnification

$$\text{Length of specimen} = \frac{\text{Length of drawing}}{\text{Magnification}}$$

Please note that magnification has no units and remember to put a multiplication sign before the number e.g. x 4

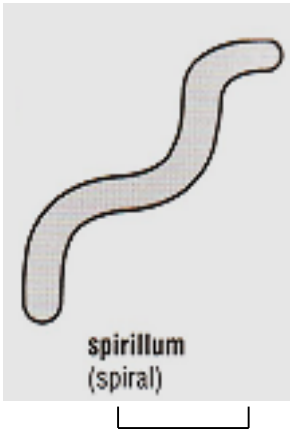
**Activity 2.1:**

The magnification of a drawing is x 6 and size of the drawing is 54cm. Find the actual size of the specimen.

## CALCULATING MAGNIFICATION GIVEN SCALE OF A DIAGRAM

When you are given the scale of the diagram you need to measure the actual scale and relate it to the length of the diagram by measuring it with a ruler.

Sometimes the size of a specimen is indicated by a scale like below:



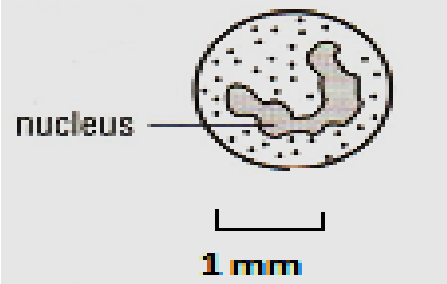

**15µm**

The scale of 15 µm (micrometer) on the drawing means that the length of the line on the drawing represents the number shown by the scale, in this case 15µm on actual specimen.

Therefore, to find the size of the actual specimen:

1. Measure the length of the line (the scale given using a ruler) and record the measurement.
2. Measure the required distance or length on the drawing (the longest axis).
3. Divide the length obtained in 2 by the length obtained in 1.
4. Multiply the quotient so obtained by the figure indicated above the line; in this case 15µm.

Example: Calculate the actual size of the cell below.




Actual size = length of drawing ÷ length of scale x Actual scale given

$$= \frac{22mm}{14mm} \; x \; 1mm$$

$$= 2 \; mm \text{ x } 1 mm$$

$$= 2 \; mm$$

**Note:** The standard conversion of micrometers to millimeters is

1µm = 0.001mm

## MICROSCOPE

This is an apparatus used to study tiny organisms which cannot be seen by naked eyes.

A microscope enlarges organisms and structures several times.

## HOW TO FIND MAGNIFICATION WHEN USING A MICROSCOPE

Magnification of specimen viewed under a microscope is found by **multiplying eyepiece magnification by objective magnification**

**E.g.** If eyepiece magnification is x 10 and objective magnification is x 40, the magnification of the specimen is found by multiplying x10 x x40 = x400.

**Activity 2.2**
A specimen viewed under a microscope had a magnification of x200. If the objective magnification was x 80, calculate the eyepiece magnification**.**

# III. CLASSFICATION AND THE DICHOTOMOUS KEY

### Classification

Classification means putting things into groups according to their similarities and differences. Thus organisms are sorted and then grouped. The grouping helps in identification and it uses devices called identification or biological key.

It is a key which helps to classify organisms and identify them by name or groups.

### Biological Classification

Organisms are first divided into very large groups called **Kingdoms** such as **kingdom plantae** and **kingdom animalia**. Kingdoms are further sub-divided into **phylum**. Each phylum is divided into **classes**, the classes are divided into **orders**, and orders are divided into **families**. Each family is divided into **genera** (singular **genus**) and genera are divided into **species**.

## Dichotomous key

It is a biological key used for identifying organisms. The key is arranged in steps and it is made up of a pair of statements which are numbered using Arabic numbers i.e. 1, 2, 3,….. Each pair of statements in a step describes one features or characteristics of the organisms.

A dichotomous key divide a set of organisms into two groups depending on whether they do or do not have certain features or characteristics in common. For example, a group of chickens, ducks, goats, sheep and cattle can be separated into two groups using a characteristic such as **feathers.** Thus animals with feathers would be put in one group and animals without feathers would be in another group. The process then continues up until each animal is identified individually using a specific characteristic. Chickens and ducks can be separated using a characteristic of **webbed feet.**

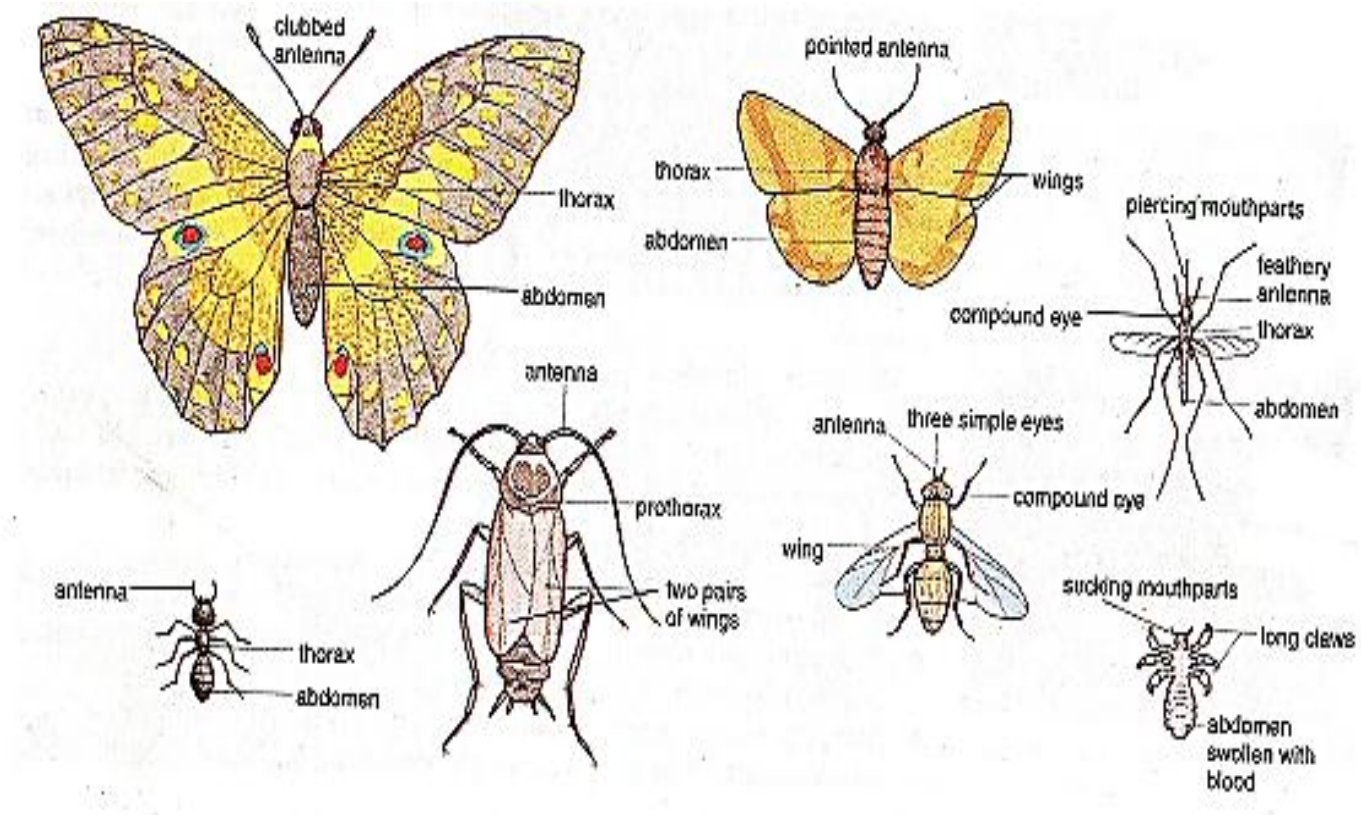
## Guide lines to Using or Constructing a Dichotomous Key:

i. Look carefully at the specimen, photograph or drawing
ii. Identify characteristics among organisms given in the diagrams or specimens.
iii. Describe one characteristic in a pair of statements.
iv. Read the first pair of descriptive sentence and choose the one that fits your specimen (this applies if the key has been constructed already).
v. This sentence will have a number which tells you which pair of descriptive sentence to read next. (This applies if the key has been constructed already).
vi. Each pair of statements describes one characteristic at a time.
vii. At each step one organism may be eliminated and divides the organisms into two groups.

**Characteristics of Different Animals that can be used when Constructing a Dichotomous Key**

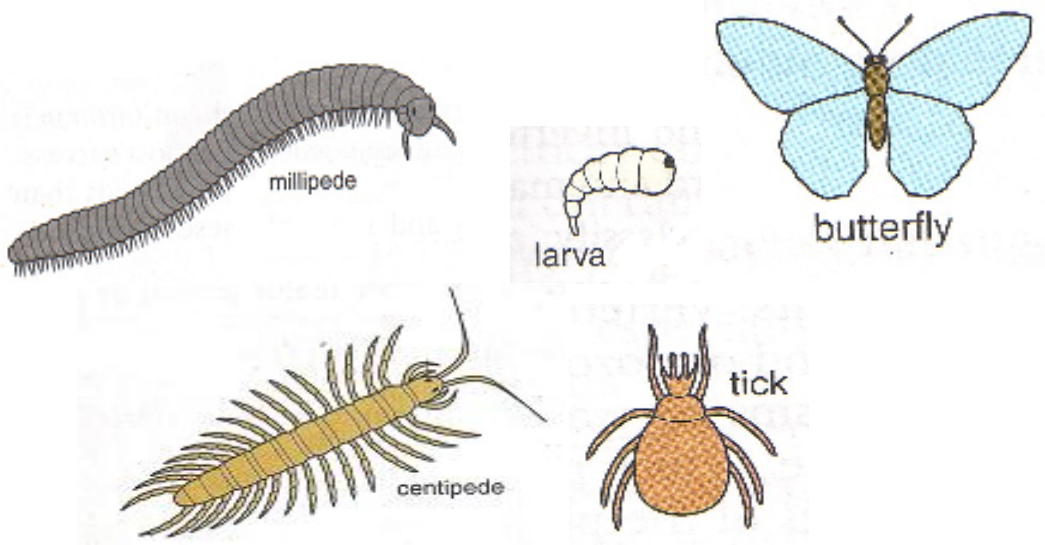
| | |
|---|---|
| Wings | Feathers |
| Legs | Scales |
| Antennae | Thorax |
| Body hairs | Tail |
| Mouthparts | Tail like structure(s) |
| Eyes | Body cylindrical (tubula) |

Other structures depend on how an insect or any animal looks like. Some characteristics can be observed in the diagrams of various insects below.




Diagrams above show different parts of insects that can help when constructing an identification key.

For example, construct a dichotomous key that can be used to identify the invertebrates below.




**Possible Answers:**

1. Animals with wings ……. butterfly
   Animals without wings ……. See 2

2. Animals with legs ……. see 3
   Animals without legs ……. larvae

3. Animals with 8 legs …….. tick
   Animals with more than eight legs …… see 4

4. Animal with long antennae …….. centipede
   Animals with short antennae …….. millipede

OR

1. Animal without legs …… larvae
   Animal with legs …… see 2

2. Animal without antennae …….. tick
   Animal with antennae …….. see 3

3. Animal with wings …… butterfly
   Animal without wings …….. see 4

4. Animal with a pair of legs per segment …….. centipede
   Animal with two pairs of legs per segment ……. Millipede

Activity 3.1

1. Figure below shows some organisms. Use it to answer the questions that follow.


Use the following biological key to identify the organisms on page 8.

1. Wings present…… See 2
   Wings absent…… See 3

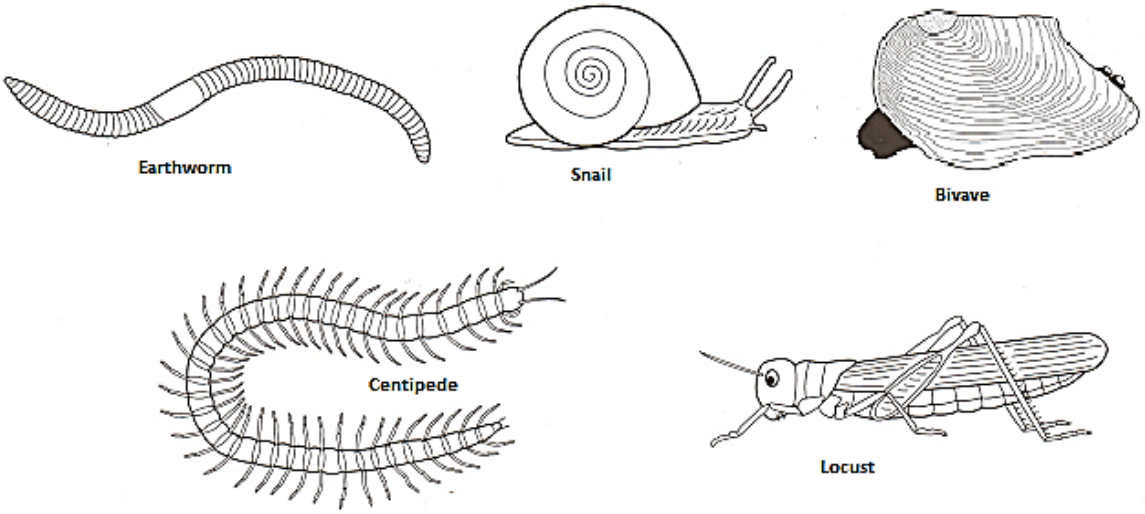
2. Organism with 4wings…… Papilio
   Organism with 2 wings…… See 4

3. Fins present…… Tilapia
   Fins absent…… Formica

4. Has six legs…… Musca
   Has two legs…… Avis

| ORGANISM | NAME OF ORGANISM |
|---|---|
| A | |
| B | |
| C | |
| D | |
| E | |

2. Figure below shows five different animals. Use it to construct a dichotomous key.




## CHARACTERISTICS OF DIFFERENT PLANTS THAT CAN BE USED WHEN CONSTRUCTING A DICHOTOMOUS KEY

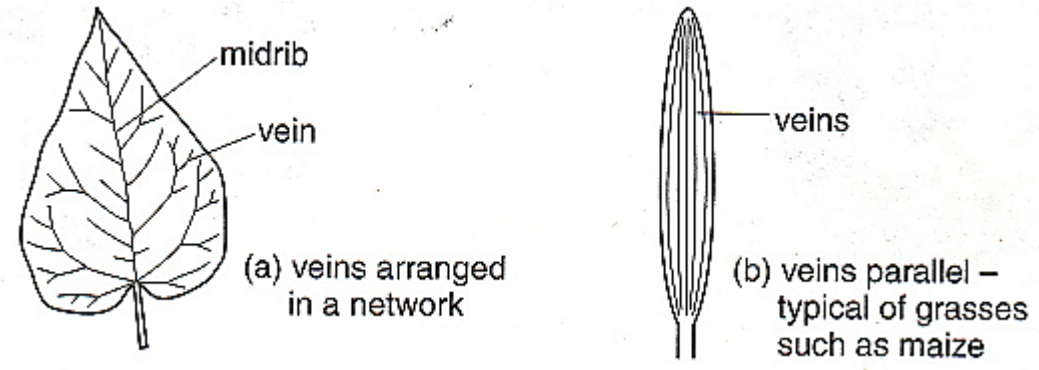
Venation
Leaf shape
Leaf type
Hairs

### Constructing Keys for Identifying Plants

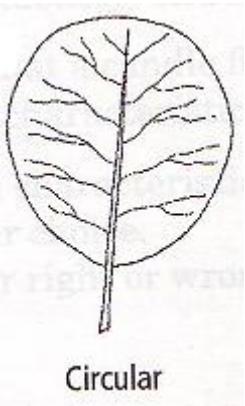
Plants can be identified using their leaves i.e. leaf shape, arrangement of veins, or type of leaf.

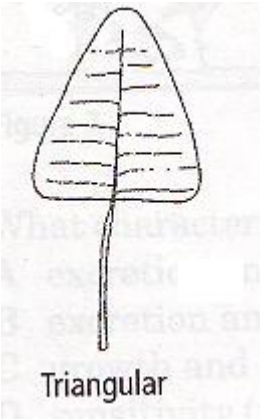
(a) Leaf Type
A leaf can be simple or compound.

A simple leaf has flat, undivided blade supported by a stalk also called a petiole.

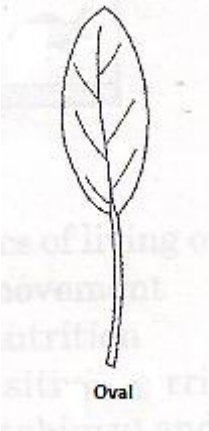


Simple dicot leaf



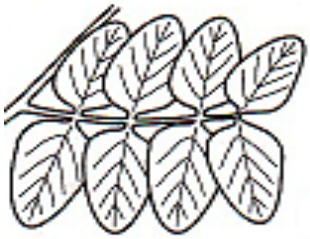




Simple monocot leaf

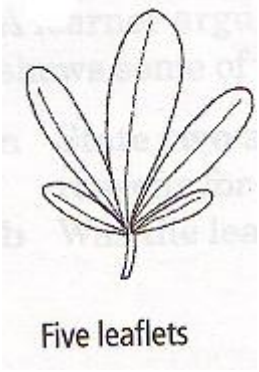


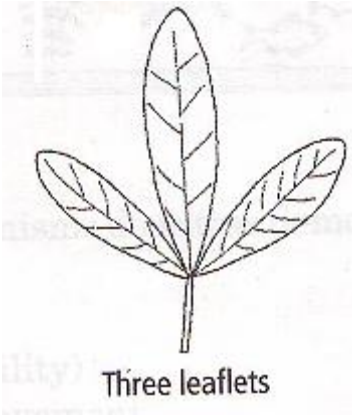

A compound leaf is divided into leaflets. The leaflets can be arranged in pairs along a central stalk. This has been shown in the diagrams below.

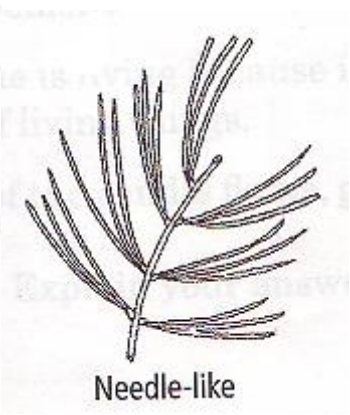

Palmate or digitate



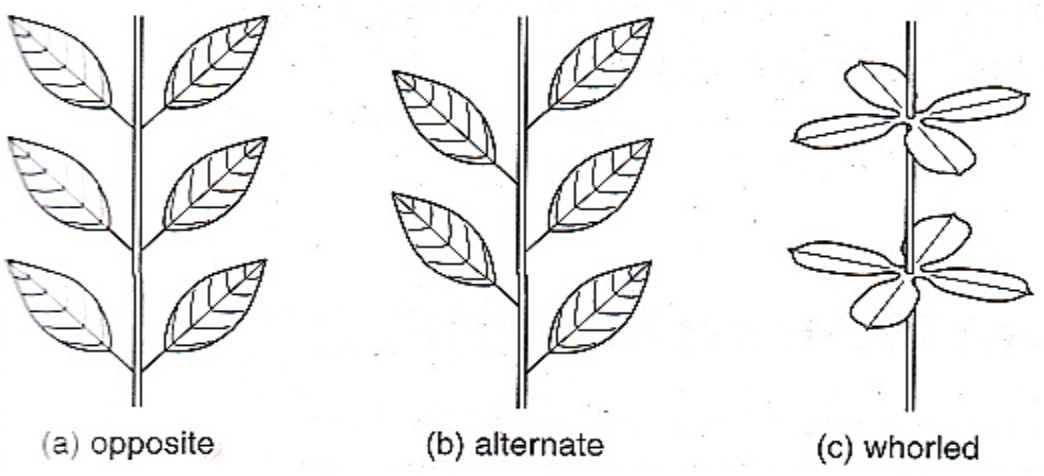
pinnately compound leaf



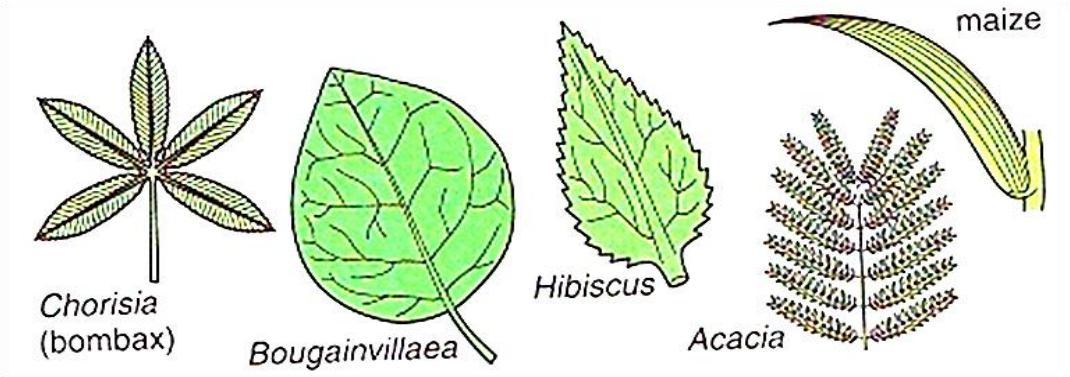

Leaf arrangement around a stem can be another useful characteristic when identifying plants using an identification key as in the diagrams below.




Opposite: The leaves are directly opposite each other on a stem
Alternate: here there is one leaf per node and the leaves are attached alternately on each side of the stem.
Whorled: There are three or more leaves per node.

Leaves can also be classified using leaf margins. There are different types of leaf margins such as smooth margin, serrated margin, dentate or toothed margin.


Example: Using figure below showing different leaves of plants construct a dichotomous key that can be used to identify the leaves.



| | |
|---|---|
| 1. Simple leaves …… | See 3 |
| Compound leaves …….. | See 2 |
| 2. Leaves digitate …….. | Chorisia |
| Leaves not digitate …… | Acacia |
| 3. Leaves with parallel veins ……. | Maize |
| Leaves without parallel veins …… | See 4 |
| 4. Leaves with serrated margin …….. | Hibiscus |
| Leaves without serrated margin ……. | Bougainvillaea |

## IV. STORAGE ORGANS, THEIR STRUCTURES AND FUNCTIONS

Storage organs are structures which store food produced by photosynthesis in different forms. These organs could be in form fresh stems, fresh leaves, root tubers and fruits of various plants. These organs store food in form of starch, sugar, proteins and lipids. Examples of storage organs include bulbs e.g. onion, seed e.g. maize grain, bean etc, fruits e.g. tomato, mango etc and tubers e.g. cassava, Irish potato etc.

### BULB

It is a shortened, compressed underground stem surrounded by fleshy leaves that develop a central bud located at the tip of the stem. It includes onions, tulips, lilies etc. The fleshy leaves are the storage organs that store food in form of starch.

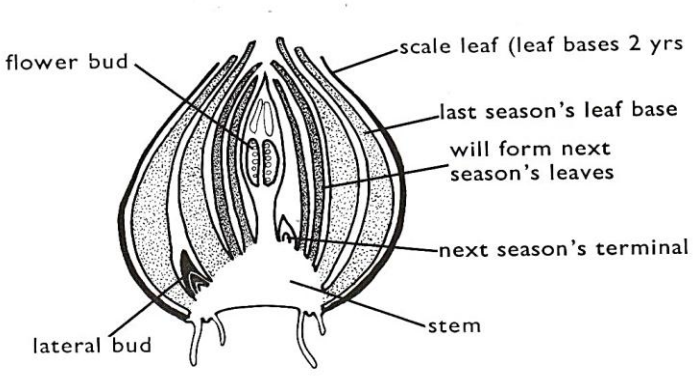



Fig. 4.1 Longitudinal section

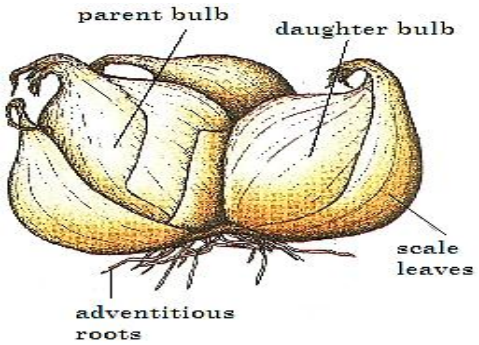



Fig. 4.2 Diagram of Onion bulbs

## FRUITS AND SEEDS

A fruit is a fertilized ovary of a flower. It is generally formed from the ovary and the ovules, e.g. mango, tomato, maize seed. The ovary forms the fruit wall called the pericarp. The pericarp is made up of three parts namely the epicarp, fleshy mesocarp and the endocarp. Inside the endocarp is the seed

A seed develops from an ovule after fertilization. It consists of a tough coat or testa enclosing the embryo which is made up of a plumule, a radical and one or two cotyledons. In favourable conditions the seed germinate and grows into an independent plant bearing flowers and seeds.

Parts Of A Seed or Fruit and its Functions
Bean Seed

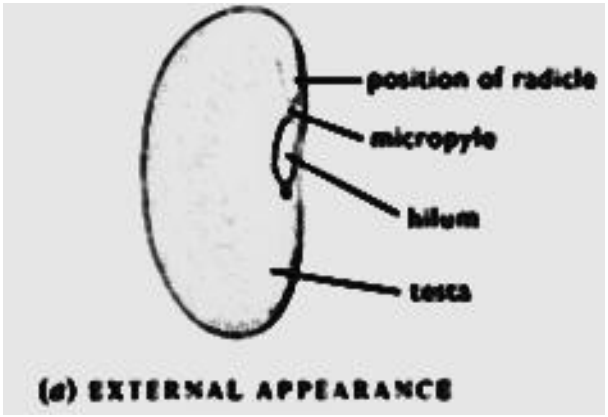



Fig. 4.3

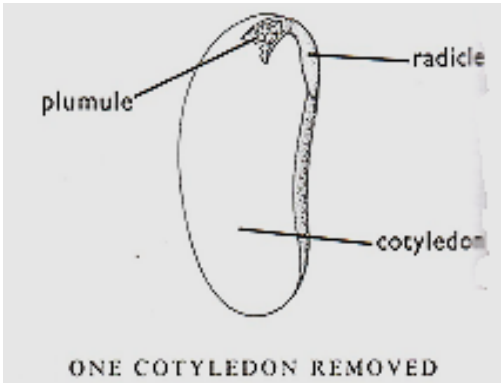



Fig. 4.4

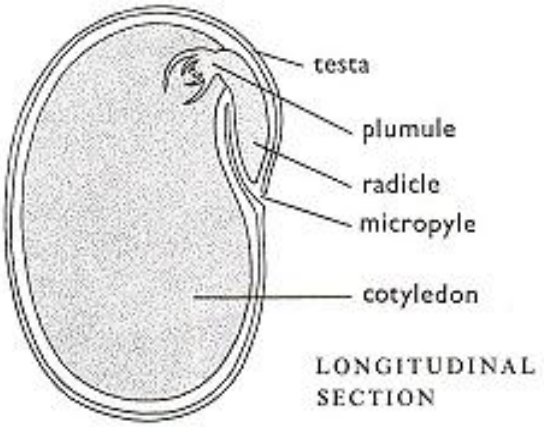



Fig. 4.5

# MAIZE FRUIT

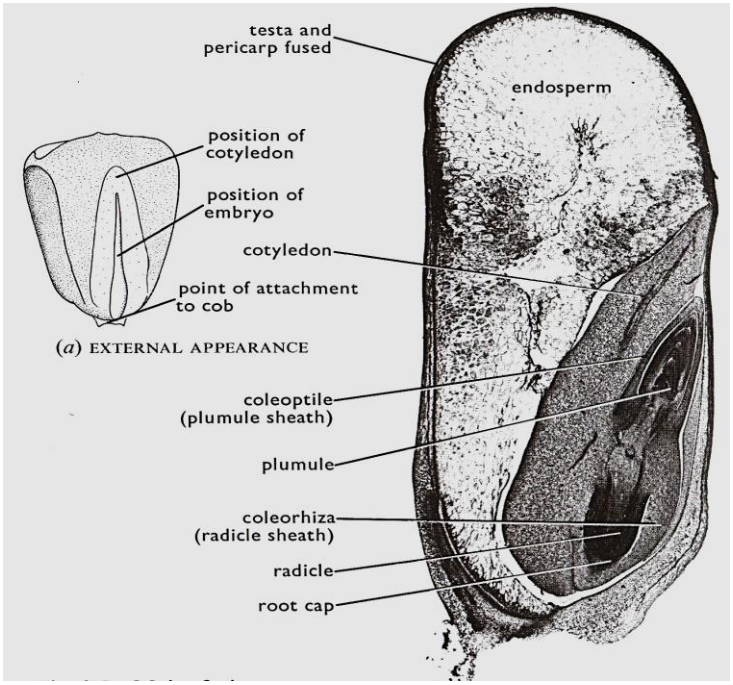



Fig. 4.6

i. Testa: the integument round the ovule forms the testa. It is a tough, hard coat which protects the seed from fungi, bacteria and insects.
ii. Hilum: is a scar left by the stalk which attach the ovule to the ovary wall
iii. Radicle: the embryonic root which grows and develops into the root system of the plant.
iv. Plumule: Part of the embryonic shoot that grows into the shoot system of a plant.
v. Micropyle: is the opening in the integument through which the pollen tube entered at fertilization. As a tiny hole it allows water to the embryo before germination.
vi. Cotyledons: monocots like maize have one cotyledon while dicots like beans have two cotyledons
vii. The cotyledons contain food reserves which are used by the developing embryo for the seed during germination.

## TUBERS

A tuber is an enlarged portion of an underground stem like in potato tuber or an enlarged portion of an underground root like cassava.

It stores food in form of starch because this is in the insoluble state where it cannot easily dissolve in water.

The tuber like any other stem has nodes that produce buds. The eyes of a potato are actually the nodes on the stem.

Each eye contains a cluster of buds.

Diagram of a potato tuber showing some external parts

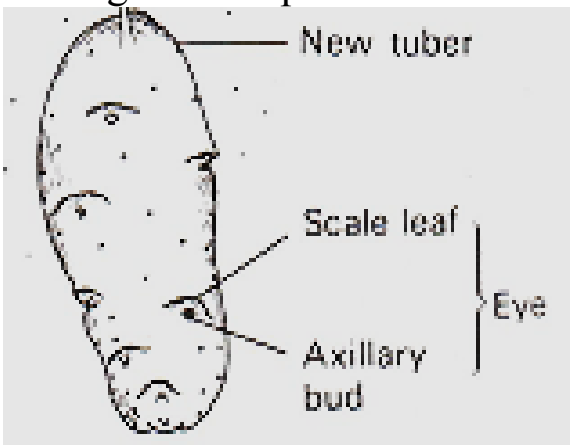



Fig. 4.7

## LEAVES

Leaves that are thick acts as storage organs and can store food in form of starch. For example, sisal leaves are thick and may act as storage organ.

# V. GRAPHS

The word 'graph' includes all diagrams representing the relationships between numerical data, such as bar charts, curves, line graphs, pie-charts etc.

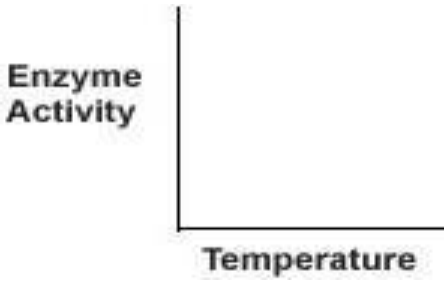
## Rules for Graph Drawing

(a) Determine the independent and dependent variables

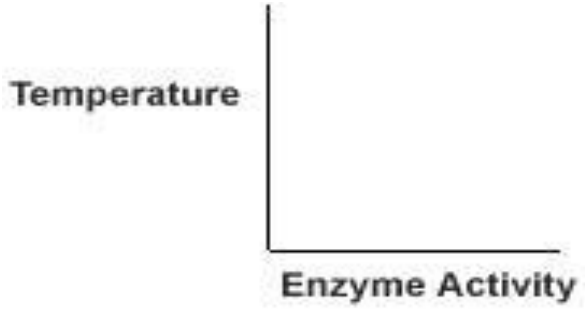
The values for the variables are entered on the horizontal and vertical lines called axes. The horizontal or x-axis is called the independent variable and it is under the control of the experiment. Here we put the factors that we can decide ahead of time, for example, how often we will take the readings.

On the vertical or y-axis we record the other variable which depends upon the first, and is called the dependent variable. These are the readings we take during the experiment, e.g. volume, masses, heights etc.

For example, in an experiment to determine the effect of temperature upon the activity of a particular enzyme the axis should be set up as shown below.



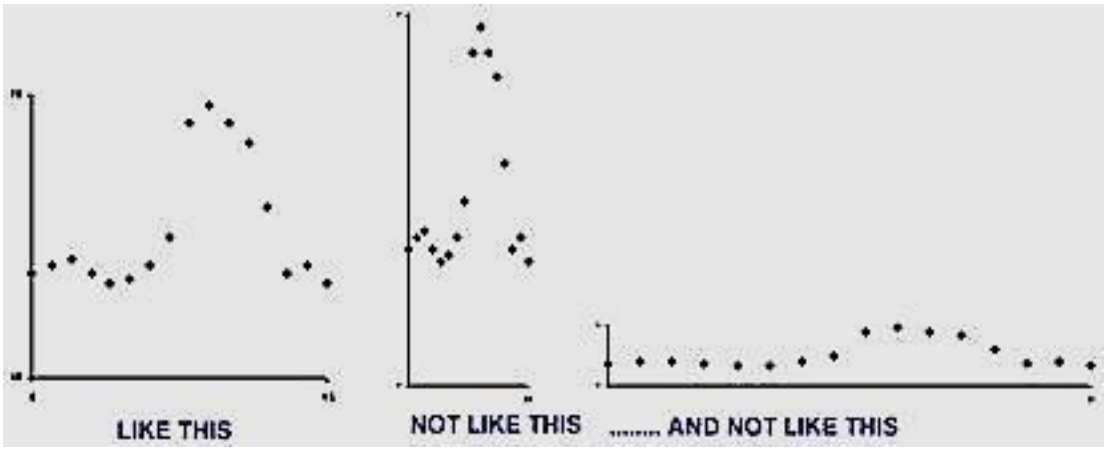

Like this




Not like this

(b) Label the axes and note the units of measurements for each of the variables and are presented behind the label of the axis after an oblique line not in brackets, e.g. Temperature /$^{o}$C

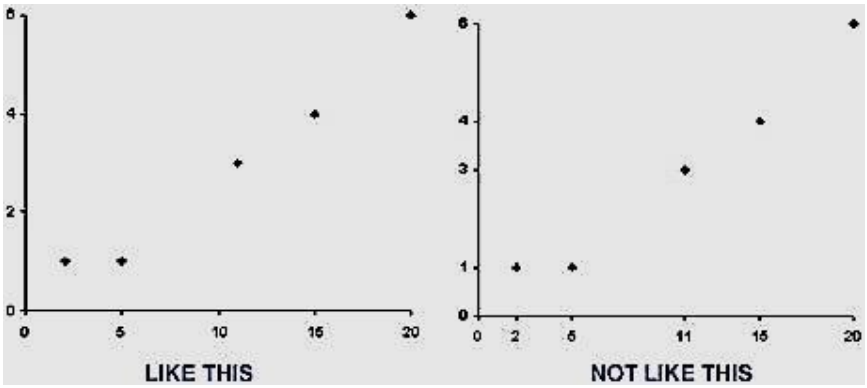
(c) Use the collect scale when plotting values and note the proportions of the axes. The area enclosed by the axes should be roughly square and not disproportionately exaggerated. For the axes to be in good proportion it requires careful analysis of your data by determining the highest and lowest values for each of the two variables so too is the scale. The best origin should be 0. Axes must be proportionate.




Scale gives uniform distribution of the quantities given on the data. Scale is chosen basing on the range of values that one has been given so that it should not go beyond the ends of the axes on the graph paper given. The scale for the two axes can be, 2 cm to represent 5 units on the x-axis and 1 cm to represent 2 units on the y-axis.

(d) Mark the Quantities on both axes and number them at regular intervals. When marking the quantities do not follow the presentation on the raw data given instead, follow your scale. For example, study data in table below:

| TIME IN DAYS | WEIGHT IN mg |
|---|---|
| 2 | 1 |
| 5 | 3 |
| 11 | 4 |
| 15 | 5 |
| 20 | 6 |

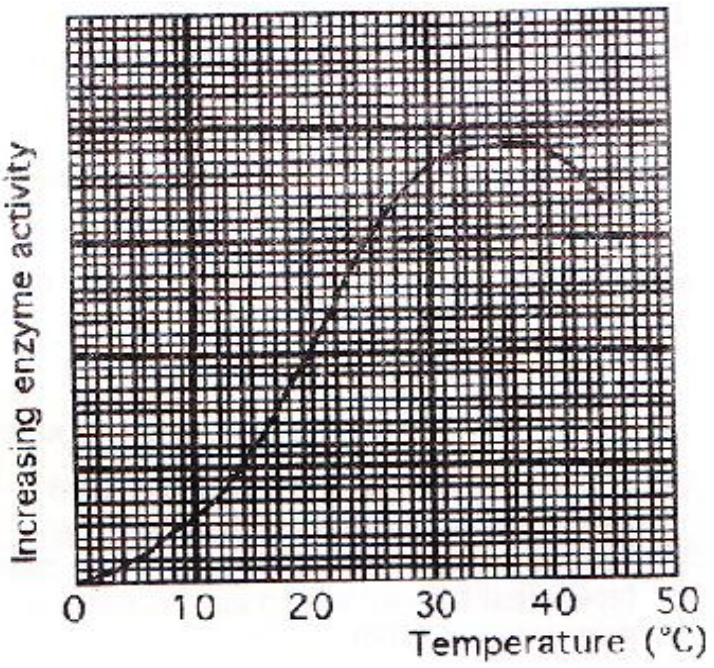



(e) Plotting and drawing the Graph.

Mark data points as crosses (×) or dots (·) with a sharp pencil. Using a free hand connect the points to come up with a smooth curve joining the points.

| ENZYME ACTIVITY | TEMPERATURE IN $^{O}C$ |
|---|---|
| 0.4 | 5 |
| 2 | 14 |
| 4 | 20 |
| 7 | 29 |
| 7.4 | 31 |
| 7.4 | 41 |

Table 5.1




Activity 5:

The table below shows water temperature and it ability to dissolve oxygen in a river.

| WATER TEMPERATURE $^{8}C$ | AMOUNT OF OXYGEN DISSOLVED mg/litre |
|---|---|
| 0 | 14.5 |
| 5 | 12.5 |
| 10 | 11.0 |
| 15 | 10.0 |
| 20 | 9.0 |
| 25 | 8.0 |
| 30 | 7.5 |

a. Plot a graph of amount of dissolved oxygen against temperature. (6 marks)

b. Find the amount of dissolved oxygen when temperature is $18^{o}C$. (1 mark)

# VI. ANSWERING ESSAYS QUESTIONS IN BIOLOGY

## TYPES OF ESSAYS IN BIOLOGY

- Descriptive essay
- Problem solving
- Experimental design

## GENERAL GUIDELINES WHEN ANSWERING ESSAYS

- The essay must have paragraphs
- Paragraphs or sentences should not be numbered
- Do not use bullets, dashes, or stars at the beginning of a sentence.
- Do not use diagrams to illustrate a point because they do not attract marks, only explanations are awarded marks
- Essays on experimental designs should not have sub-topics used when writing laboratory reports such as materials, procedures, results, and conclusion.
- Do not waste time with introduction and summary because they are not awarded marks

## A. DESCRIPTIVE ESSAYS

Candidates are expected to come up with **five** points and each point has to be backed with an explanation. The point has a single mark and the explanation another single mark. Each point and its explanation form the paragraph and carries two marks.

Example: Describe any **five** ways of preventing diseases caused by vectors.

**Answer:**

Removing bush around the house. This destroy breeding areas for the vector.

Draining stagnant water. This kills the vector at larvae stage.

Spraying oils on stagnant water. It helps to suffocate larvae of the vector and dies.

Wearing long sleeved shirts and long trousers. This prevents being bitten by the vector.

Spraying insecticides such as doom to kill the vector.

## B. PROBLEM SOLVING ESSAYS

The examiner creates a situation or a problem and asks the candidate to solve the problem by applying what was learnt in class.

Candidates are expected to come up with **five** points and each point has to be backed with an explanation. The point has a single mark and the explanation another single mark. Each point and its explanation form the paragraph and carries two marks.

Example:

a. Imagine there is an outbreak of a diarrhoea disease in your community. Explain how you would establish the cause of the disease. Give **five** points in an essay form.

(10 marks)

b. Suppose you are a Health Surveillance Assistant in a certain area and there have been several cases of malaria in your community. How would you establish the cause of the disease? In essay form give any **five** ways.

(10 marks)

Answer:

You would check if grass in the surroundings is not cut short as they become breeding places for mosquitoes which due to bites may increase prevalence of the disease.

You would check if there are basins keeping stagnant water. They provide breeding places for mosquitoes which due to bites may increase prevalence of the disease.

You would check if villagers in the community use and sleep under mosquito nets. If not it means that people are being bitten by mosquitoes which cause malaria.

You would check if villagers in the community use insecticides such as doom to kill mosquitoes.

You would check if villagers put on long sleeved shirts and trousers to get protected from mosquito bites.

## C. ANSWERING EXPERIMENTAL ESSAYS

An experimental question has main areas to consider when answering such as aim, materials, procedure or steps, results and conclusion.

Any experiment has the aim which it tries to achieve at the end after carrying out the experiment.

For an experiment to be conducted it requires materials which may be regarded as variables for the experiment and it has three variables namely input (independent) variable, outcome (dependent) variable and control variable.

Materials are explained in the procedures or steps that are followed when carrying out the experiment to achieve the aim or prove the hypothesis right or wrong for the experiment. An experiment also has the set-up which is described in the same procedures.

Results are arrived at by critically observing the outcome variable having changed or manipulated the input variable. Results can be described in just one paragraph with just one sentence if possible.

The conclusion answers the problem of the experiment that is, it approves or disapproves the hypothesis put forward. For this to be done there must be a critical analysis of the results of the experiment.

## NB: A CONTROL OF AN EXPERIMENT

In any experiment that involves finding out if a particular condition is necessary for something to occur we give everything that is required to one set-up, except for the condition being tested (input variable).

Another set-up is used at the same time and is called the control of the experiment. The control is given everything it needs including the condition being tested for. Therefore, an experimental design must have two set ups. One for the main experiment and the other for the control.

**Examples,**

Q 1. Describe an experiment that can be conducted to show the effect of temperature on enzyme activity. In your answer include procedures, results and conclusion in essay form.

Answer:

Take four test tubes and put $2cm^3$ of starch solution into each of the test tubes and label them A, B, C and D.

Collect amylase and at the same time add $2cm^3$ solution of the enzyme into each of the four test tubes, stir each tube with its own glass rod and leave the experiment to stand for 25 minutes.

Put test tube A into a refrigerator and record the temperature of the refrigerator. Then put test tube B into a test tube rack on your bench and record the room temperature. Put test tube C into a water bath at about $35^oC$ and record the temperature and also put the test tube D into a water bath at about $80^oC$ and record the temperature.

After 30 minutes add 2 to 3 drops of iodine solution into each test tube and observe.

Test tube A and D showed blue black colour while test tubes B and C turned brown.

Enzyme salivary amylase worked on starch in test tube B and C while in test tube A the enzyme was made inactive and in test tube D the enzyme was denatured, therefore enzymes work best at different temperatures.

**Q 2**. Describe an experiment that can be carried out to estimate population of toads in a school environment.

The population of toads would be estimated by using the capture recapture method because they are mobile animals.

Mark a region and capture a sample of toads from around the school environment without harming them, count them, mark them with a small spot of waterproof paint that cannot be easily removed and make them very conspicuous then release them back into their environment.

Recapture the toads, count the total number of toads and the number of marked ones and record them.

Multiply the number of toads caught the first time by the number of toads caught the second time divided by the number of marked toads caught the second time.

**Q3**. Describe an experiment that can be carried out to show that in plant leaves there are three pigments. In your essay include procedures, results and conclusion.

Answer;
Crush the fresh leaves of a plant using a mortar and a pestle and squeeze out an extract (fluid) into a container.

Using a dropper suck the extract (fluid) from the crushed leaves and put a drop midway on a filter paper.

Dip the filter into a beaker containing ethanol with the drop spot slightly above the level of ethanol and clamp the other end of the filter paper.

Leave the setup to stand for 15 minutes and observe.

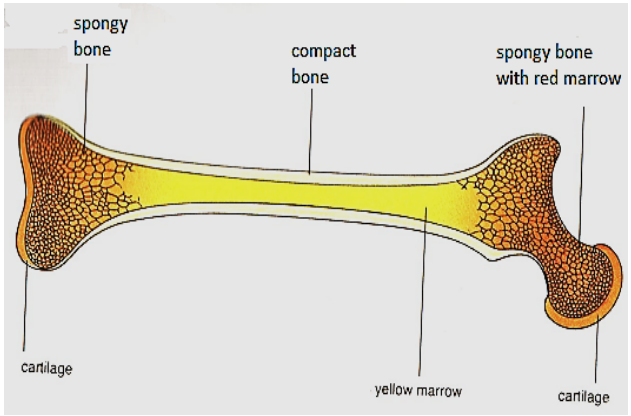
There will be three different layers of pigments being shown on the filter paper i.e. green, orange and yellow. This shows that there are three pigments on plant leaves.

# VII. GENERAL PROBLEMS

## STRUCTURE AND COMPOSITION OF A BONE

Formation of bones in the body requires the following;

- Calcium
- Amino acids
- Phosphate
- Hormones
- Vitamin D




CARTILAGE
This is a hard but flexible supporting tissue found at the ends of bones. Its function is to prevent the bones from rubbing agaisnt each other. It also enables the body to withstand shocks and jarrings that accompany movements.

COMPACT BONE
This is the hardest part of a bone that provides strength and stores calcium.

BONE MARROW
It is a soft tissue with a good supply of blood. Its functions includes manufacturing red blood cells, white blood cells and platelets.

SPONGY BONE
It has spaces in it which stops the bone from being too heavy.

NB: Periosteum is a structure where tendons are attached.

A bone is made up of the compact bone which is the hardest, the spongy bone with spaces and the bone marrow which is very soft and has a good supply of blood.

A bone is composed of organic and inorganic substances. The organic component is made of a protein collagen which makes it flexible and rubbery.

The inorganic component is made up of calcium phosphate and calcium carbonate.

Strong bones have a hole and are curved. This enables them to support the weight of the body.

## LOCOMOTION AND GAS EXCHANGE IN FISH

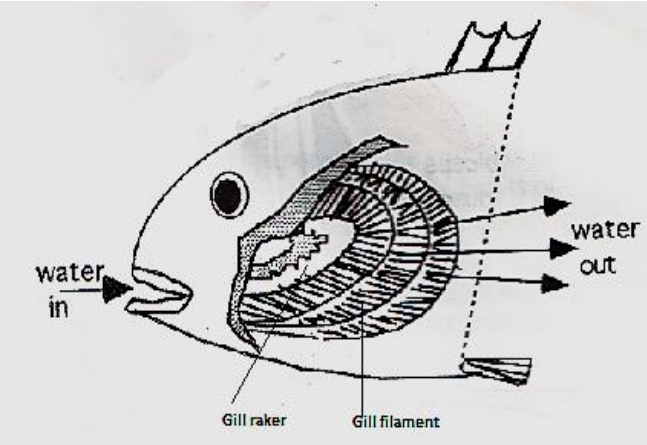


Fig. 7.1

Water that goes into the mouth of fish contains low carbon dioxide concentration than the water that leaves the fish through the gills. The concentration of carbon dioxide increases due to carbon dioxide which is produced by respiration and is carried by the water that leaves the fish through the gills.

Gill rakers are used to filter food from the water as the fish swim through water. It also filters out dirty from water that may damage the tender gill filament.

Gill filament is used for absorption of oxygen and it has special features or adaptations which includes;
- well supplied with blood vessels to transport respiratory gases
- are numerous or many which provide large surface area for diffusion of gases
- are very thin (one cell thick) which provide the shortest distance for oxygen to diffusion rapidly into the blood.

Fish swim in water and water provides a better support for locomotion. For fish to move in water it has several adaptations.

**Problems that fish face when swimming in water.**
- resistance or friction
- drag
- turbulence
- gravitational force

**How fish overcome these problems**

- ✓ Friction is overcome by the scales overlapping backwards
- ✓ Drag is overcome by the streamlined shape and the powerful tail muscles
- ✓ Turbulence and gravitational force is controlled by the presence of the swim bladder which reduces the average density of the fish.

**Fish adaptation to locomotion in water**

- the body is streamlined to reduce friction
- powerful tail muscles
- presence of the swim bladder
- action of the fins
- They have a swim bladder which when filled with air makes the fish less dense hence it floats on water.

# FOOD TEST

**TESTING FOR STARCH**

**Materials**

Water, food stuffs (maize flour, ufa woyera, starch pouder, bean flour), test tubes, droppers, tes- tube rack, iodine solution.

**Methods**

Take small amount of each of the food stuffs and put them into individual test tubes and record the test tubes.

Add $5cm^3$ of water into each test tube to make a solution and stir the contents.

Using a dropper or dropping pipette add few drops of iodine solution and observe colour change.

**Results**

| Food solution | After adding iodine solution | Conclusion |
|---|---|---|
| Maize flour solution | Blue black | Starch was present |
| Ufa woyera solution | Blue black | Starch was present |
| Starch solution | Blue black | Starch was present |
| Bean flour solution | Straw-coloured of iodine | Starch was absent |

Presence of starch is indicated by the changing of the food solution into blue black.

**PROTEIN TEST**

**Materials**

Egg albumen/milk

1% copper ii sulphate and 5% sodium hydroxide solution (Biuret solution)

Test tubes

Dropping pipette

**Procedure**

i. Put 2$cm^3$ of food solution (i.e. egg albumen or milk) into the test tube and using a dropping pipette add 1$cm^3$ of sodium hydroxide solution.
ii. Thereafter add another 1$cm^3$ of copper sulphate solution using the dropping pipette (remember to rinse the pipette with deionised water) and shake the test tube by holding a thumb on top of the test to avoid spilling of the contents.
iii. Purple colour or violet colour is observed as an indication of the presence of proteins in the food stuff.

**Note: The** use of sodium hydroxide and copper sulphate can also be replaced by reagent called

Biuret. This is the reason why sometimes protein test is also called Biuret test.

**TEST FOR LIPIDS**

The test uses a white plain paper and the food is either rubbed against the paper where a translucent spot is observed or put a spot on the paper and heat it gently on fire and observe a translucent sport.

or

Oils can also be tested by putting few drops of oil into a test tube and add ethanol into the same test tube. Shake the contents to mix by holding your thumb on the mouth of the test tube.

Milky colour of the mixture indicates presence of lipids.

# VIII. QUESTIONS APPROACH

When answering question during examinations often starts with such words as:

**STATE**
This means give a brief answer but don't add a supporting point or reason.

Eg. State any two growth hormones in plants. (2 marks)

Answer:
- *Auxin*
- *Gibberellins*

Eg. State two things that happen during the first stage of birth. (2 marks)

Answer:
- *Muscles of the uterine wall contract*
- *Cervix dilate*
- *Amniotic sac burst and amniotic fluid flows out*

**DEFINE**
This means give a formal statement of the meaning of the term.

Eg. Define mutation. (1 mark)

Answer:
- *It is the sudden change in either the amount or arrangement of the genetic materials (in the chromosome or a gene) in a cell.*

Eg. Define photolysis. (1 mark)

Answer:
- *The splitting of water molecules into oxygen and hydrogen atoms by sunlight energy.*

**GIVE**
This means list what has been asked in point form.

Eg. Give any three causes of mutations. (3 marks)
Answer:

- *Ultraviolet light*
- *High power radiation often used in ex-rays*
- *Crossing over during meiosis I*

Eg. Give any two function of a clot at a site of a wound. (2 marks)

Answer:

- *It stops further bleeding*
- *It minimizes entry of germs into the body*

**DESCRIBE**

This means state in words, with diagrams where appropriate the main points of the subject of a topic in the right order.

Eg. Describe five adaptations of a leaf for photosynthesis. (10 marks)

Answer*:*

*It is thin, this allow sunlight to penetrate to all cells and carbon dioxide and oxygen to enter into and out of the leaf as quickly as possible.*

*It is supported by stem and petiole, this help to expose the leaf to as much sunlight and air.*

*It has air spaces in the spongy mesophyll which allows carbon dioxide to diffuse to and from the cells.*

*The leaf is broad which creates a large surface area for absorption of sunlight energy and carbon dioxide.*

*They have an extensive network of veins for efficient supply of water to mesophyll cells and carry away manufactured glucose.*

**EXPLAIN**

This means 'give a reason for' and not describing. It tries to answer why some thing happens.

Eg. Explain any **two** factors that affect the rate of diffusion. (4 marks)

Answer*:*

*The size of the particles. Small particles move faster than large particles hence small particles diffuse faster than large ones.*

*Differences in concentration affect rate of diffusion in the sense that the bigger the difference in concentration between two points the steeper the concentration gradient the faster the rate of diffusion.*

Eg. Explain why a liver cell may require as many as one thousand mitochondria. (3 marks)

Answer:

*The large number of mitochondria are needed to produce sufficient energy for the many chemical reactions that take place in the lever cells, for example deamination.*

**OUTLINE**

This means give a brief overview of the topic or subject. The number of marks and space will decide how much will be required.

Eg. Outline the process of urine formation. (5 marks)

Answer:

*Blood is filtered in the Bowmans capsule and the filtrate trickles through the rest of the renal tubule where selective reabsorption takes place. All the glucose excess water and mineral ions are reabsorbed and what remains goes to the collecting tube as urine.*

**'EXPLAIN HOW'**

Here you describe a process of something (how something happens).

E.g. Explain how starch is formed in leaves. (2 marks)

Answer*:*
*Starch is formed when several glucose molecules are combined together through condensation reaction.*

E.g. Explain how red blood cells are adapted to carry out its function.
(2 marks)

Answer*:*

*It is biconcave shaped which increases surface area for attracting more oxygen.*

*Or*

*Has haemoglobin which has high affinity for oxygen which help to attract oxygen atoms.*

**'DESCRIBE HOW'**

This means state and give a reason for something.

Eg. Describe how you would test a bean seed for lipids. (6 marks)

Answer:

*Grind the bean seed and put some into a very clean and dry test tube. Add ethanol (pure alcohol) and shake thoroughly to mix the contents. Pour some of the liquid part of the mixture into clean water and a clear appearance shows that there are no fats in beans.*

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