Inference:
It refers to the conclusion that is made following the observation. The conclusion tells whether the type of food tested is present or absent,

Food substances tested at this level are;

- ❖ Carbohydrates (reducing sugar, non-reducing sugar and starch)
- ❖ Proteins and
- ❖ Lipids.

Carbohydrates

Carbohydrates are among of the fundamental classes of macromolecules found in living organisms. They are primary products of photosynthesis, and energy providing substrates for various organisms including mammals. Carbohydrates contain three elements, namely carbon, hydrogen, and oxygen, in which hydrogen and oxygen are in the ratio of 2:1

There are three types of carbohydrates that we can test for.

(a) Reducing sugar.

All monosaccharides and some disaccharides including maltose and lactose are reducing sugars, meaning that they carry out a type of chemical reaction known as **reduction.**

Chemical reagent used to test reducing sugar is called Benedict's solution.

The function of Benedict's solution.

To indicate the presence of reducing sugars by changing colour in solution containing reducing sugar from blue, green, yellow and finally orange colour which is observed when the mixture is heated. Heating (boiling) is important since speed up the reduction of copper II (blue) to copper I (orange)

Benedict's solution contains copper sulphate. Reducing sugars reduce soluble blue copper sulphate; containing copper (II) ions ($Cu^{2+)}$ to insoluble red-brown copper oxide containing copper (I).

$Cu^{2+} + e^{-} \rightarrow Cu^{+}$ [Blue solution Brick red ppt]

Natural sources of reducing sugar are;

- ❖ Ripe bananas,
- ❖ Ripe oranges,
- ❖ Ripe pawpaw,
- ❖ Ripe mango and
- ❖ Onion bulb.
- ❖ Carrots
- ❖ Ginger

- ❖ Fat deposits surround and protect body Organs such as the heart and kidneys.
- ❖ Storage of fat in the adipose tissue under the skin help to regulate body temperature by insulating the body against loss of heat,
- ❖ Fat-soluble vitamins are also stored in fatly tissues.
- ❖ Essential fatty acids are important for the formation of substances that help to control blood pressure and activate the body's immune response.

Note:
There are two forms of lipid which are fats and oils.

- ✓ Fats are solid at room temperature and are usually extracted from animals.
- ✓ Oils are liquid at room temperature and usually extracted from plant seeds**.** fats are stored under skin

Note: Excess lipid in the human body leads to obesity

Obesity increases the likelihood of conditions such as;

- ✓ High blood pressure
- ✓ Heart diseases
- ✓ Diabetes
- ✓ Stroke
- ✓ Respiratory problems

Parts of alimentary canal

1 Digestion in the mouth

a. Mechanical and chemical digestion of food starts in the mouth. *Mechanical digestion* is achieved by teeth through mastication (chewing). During mastication, the food is mixed with saliva, a watery mixture of mucus and amylase secreted by the salivary glands in response to thought, smell, taste or sight of food. Saliva is a neutral or very weak alkali with the pH ranging between 6.5 and 7.5.

Saliva has the following functions with regard to digestion:

- ❖ It lubricates food so that it can move through the oesophagus easily;
- ❖ It catalyses the hydrolysis of starch into maltose using the enzyme called salivary α-amylase;

- ❖ It maintains pH of the mouth between 6.5 and 7.5. This level is optimum for the action of salivary amylase to function which is accomplished by its constituent mineral salts (example $NaHCO_3$).

b. *Chemically,* the digestion of food in the mouth involves converting starch into maltose by salivary α-amylase. The tongue which is located at the back of the buccal cavity rolls the food into a ball-like structure called bolus and forces it against the soft palate during swallowing, thereby closing the nasal cavity. The opening in the larynx (voice box) called glottis, is also closed by a flap like structure called epiglottis. Then, the bolus enters the oesophagus.

2 The stomach

The stomach is a highly elastic muscular organ. It has two valve-like rings of smooth muscles called sphincters that can open and close. One sphincter is called *cardiac sphincter*. It is located between the oesophagus and the stomach. The second sphincter is called *pyloric sphincter*. It is positioned between the small intestine and the stomach. The stomach wall consists of a layer of mucous membrane called *gastric mucosa*, it is highly folded and is equipped with small pits (gastric pits) leading to gastric glands in which gastric juice is secreted.

Gastric juice has the following components:

- ❖ Water. This is a solvent involved in hydrolysis by which food substances are broken down.
- ❖ Hydrochloric acid (HCl).

This is an acid produced by parietal cells of the gastric mucosa. Hydrochloric acid activates prorennin and pepsinogen into rennin and pepsin respectively, also kills any bacteria that might have entered the stomach through food.

- ❖ **Mucus.**

This protects the stomach from its own digestive enzymes and lubricates the wall for easy passage of food to the small intestine.

- ❖ **Pepsinogen.**
- ❖ It is produced by the chief cells of the stomach wall. It is a precursor or inactive form of pepsin. Pepsinogen is activated by hydrochloric acid in the stomach to form pepsin; an enzyme responsible for the breaking down of polypeptides into peptides.

duodenum. Bile is a greenish-yellow juice containing a large amount of water and small amounts Of greenish yellow pigment, salts, mucin, and other substances.

4 Ileum.

Digestion in the ileum the ileum is the final part of the small intestine. The process of digestion ends in the ileum. When chyme enters the ileum, it stimulates the intestinal wall of the ileum to secrete an intestinal juice known as sucus entericus. This contains digestive enzymes for finalisation of the digestion of proteins, carbohydrates and lipids (fats and oils). The digestive enzymes found in the ileum include the following:

- **Lipase**
  This enzyme catalyses the conversion of the remaining fats and Oils into fatty acid and glycerol
- **Maltase**
  It catalyses the conversion of maltose into glucose.
- **Sucrase**
- It catalyses the conversion of sucrose into glucose and fructose.
- **Lactase**
  It catalyses the conversion of lactose into glucose and galactose
- **Peptidase**
- It catalyses the conversion of the remaining peptides into amino acids

Part of alimentary canal	Medium	Secretion	Enzymes secreted	Substance digested	Product of digestion
Mouth	Alkaline	saliva	Salivary amylase	Carbohydrate (starch)	Maltose
Stomach	Acidic	Gastric juice	Pepsin	Protein	Peptides
			Renin	Soluble milk protein	Casein
Duodenum	Alkaline	Pancreatic juice	Trypsin	Protein	Peptides
			Pancreatic amylase	Starch	Maltose
			Pancreatic lipase	Lipid	Fatty acids and glycerol
Ileum	Alkaline	Intestinal	Maltase	Maltose	Glucose

		juice	Sucrase	Sucrose	Glucose and fructose
			Lactase	Lactose	Glucose and galactose
			Peptidase (erepsin)	Peptides	Amino acids
			Lipase	lipid	Fatty acids and glycerol

FOOD TEST REPORT

Food tested	**PROCEDURE**	**OBSERVATION**	**INFERENCE**
STARCH	To $2cm^3$of solution **X** in a test tube, 3drops of Iodine solution were added and then shaken well.	Blue-black colour was observed in the mixture solution	Starch was present
REDUCING SUGAR	To $2cm^3$of solution **X** in a test tube,2ml of Benedict's solution was added then heated.	Series of colour changes were observed from blue to green to yellow to orange to brick red precipitates	Reducing sugar was present
NON-REDUCING SUGAR	To $2cm^3$ of solution **X** in a test tube,1ml of dilute hydrochloric acid was added followed by heating and then left to cool, 1ml of sodium hydroxide solution followed by addition of 2ml of Benedict's solution and then heated again.	Series of colour changes were observed from blue to green to yellow to orange to brick red precipitate	Non-reducing sugar was present
PROTEIN	To $2cm^3$of solution **X** in a test tube, $1cm^3$ of sodium hydroxide solution was added followed 2drops of 1% copper II sulphate solution and the mixture was shaken well then allowed to settle.	Purple or violate colour observed.	Protein was present
FATS/OILS	To $2cm^3$of solution **X** in a test tube, 3drops of Sudan III solution were added and the mixture was shaken well then allowed to settle for 1miute.	A red- stained oil layer separates on the surface of solution.	Fats/oils was present

(v) Record what you see.

Questions

a) What is the aim of experiment?

b) Based on observations made on a piece of white paper what is the type of food substances contained in the specimen P? Give reasons to justify your answers.

c) What will be the end product of digestion of digestion of food substances contained in specimen P to the human body?

d) What is the importance of the food substances identified in specimen P to the human body?

e) What other seeds can you use to perform the grease spot test

ANSWERS

a) The aim of experiment was to test for the presence of, lipids in specimen P by the grease spot.

b) The food nutrients contained in specimen p was lipids on a piece of white paper since the paper becomes translucent

c) the end product of digestion of digestion is fatty acids and glycerol

d) Functions of lipids are;

- Used as energy source in the body
- Fat deposits protect organs such as heart and kidney
- Insulate the body against heat loss
- Activate the body's immune response

e) Other seeds can you use to perform the grease spot test

- Avocado
- Sunflower Seeds
- Coconuts.
- Castor seeds

NECTA 2018
BIOLOGY 2A

1. You are provided with specimen **X**

(a) write the procedures you will follow to prepare a solution **X** for investigation

(b) Using chemical reagents provided, carry out experiments to identify food substance(s) present in specimen **x**. Record your experimental work as shown in table 1 below.

Table 1

Food tested	Procedure	Observations	inference

(c) State two properties of the food substance(s) identified in specimen **X**

(d) Name four other sources which contain the same food substance as that identified in specimen **X**

(e) mention the parts of the human alimentally canal in which the digestion of the food substance in specimen **X** takes place

(f) Explain how the body stores excess food substance(s) identified in solution **x**

(g) Why the food substance(s) identified in solution **X** important in human body?

ANSWERS

(a)Preparation of sample solution from orange fruit

(i) Orange fruit was peeled and then sliced into small pieces.

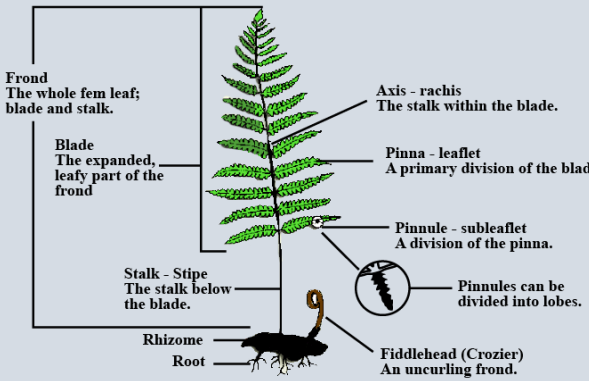
(ii) Small pieces of orange fruit were put into mortar and then grinded or crushed.

(iii)Little amount of water was added and then filtered to get orange fruit solution (juice).

(iv) The solution was filtered in a beaker and labeled **X**.

(b) Table 1

FOOD TESTED	PROCEDURE	OBSERVATION	INFERENCE
STARCH	To 2$cm^3$of solution X in a test tube,2drops of iodine solution were added and then shaken well.	The mixture solution retained reddish-brown colour of iodine solution	Starch was not present
REDUCING SUGAR	To 2$cm^3$of solution X in a test tube,2ml of Benedict's solution was added then heated.	Series of colour changes were observed from blue to green to yellow to orange to brick red precipitates	Reducing sugar was present
Protein	To 2cm^3ofsolution X in a test tube, 1cm^3 of sodium hydroxide solution was added	The mixture solution retained the blue colour of 1% of copper II sulphate solution	Protein was not present



Figure;2. 5**:** Fern Plant

Advantages of fern plants

- ❖ They constitute ground-cover in moist areas; they are primary producers, thus produce food for themselves and for heterotrophic organisms in an ecosystem;
- ❖ They are used for decoration in homes and offices;
- ❖ They are the major components of coal, a fossil fuel which is made up of the remains of primitive plants;

Adaptations of fern plants to its mode of life

Fern plant possess the following features which enable them to adapt to their environment:

- ❖ They have chloroplasts containing chlorophyll for capturing light energy needed for photosynthesis.
- ❖ They have roots for anchorage and absorption of water and mineral salts.
- ❖ They have stomata which facilitate gaseous exchange.
- ❖ They have xylem responsible for transportation of water and dissolved minerals and also, they have phloem for translocation of manufactured food.
- ❖ Rhizomes play part in storing food and propagating new plants, and can remain viable in the soil for a long time to ensure survival.
- ❖ They have a well-developed and independent sporophyte generation, since the gametophyte withers and dies as the young leaves of sporophyte grow.
- ❖ They have cuticle in their leaves to prevent excessive water loss.

- Archegonia secrete chemical which attracts antherozoids to swim towards the egg during fertilization.

Division coniferophyta

Coniferophyta is a division of kingdom Plantae which belongs to a broad group of non-flowering seed-bearing plants, referred to as gymnosperms. The word *gymnosperms* originated from a combination of two Greek words *Gymno* meaning 'naked' and *sperma* meaning 'seed.' Theophrastus was the first person to use this term in his book "Enquiry into plants" referring to plants producing naked seeds.

Characteristics of division Coniferophyta

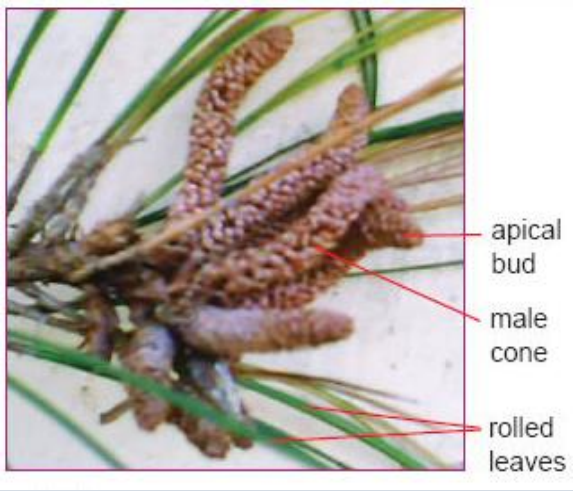
- They are non-flowering, seed bearing plants, producing naked seeds which are not enclosed in ovaries or fruit tissues.
- Sexual reproduction involves microspores (male gametophyte) and megaspores (female gametophyte) which are found in male and female cones or strobili respectively.
- Fertilisation does not require water; instead, they develop pollen tubes which carry sperms to the ovule for fertilisation.
- They have poor xylem with only tracheids as conducting elements but no vessel elements. This is the reason why most coniferophytes produce soft wood.
- Leaves are reduced into spiny or needle-like leaves to minimize water loss through transpiration.

Distinctive features of division Coniferophyta

Presence of the following features in members of division Coniferophyta differentiate them from members of other divisions:

- The pollen grains are winged to provide buoyance; hence they are wind pollinated.
- They have seeds which are not enclosed within the ovary; thus, no ovaries, and no formation of fruits.
- Their phloem tissues are associated with albuminous cells instead of companion cells.
- The majority produce resin in special ducts called resin canals. Such resin is useful in wound healing and deterring browsers.
- Most are evergreen plants with needle-like shaped leaves.

- They are ornamental plants



Figure; 2.6: Conifers

Adaptation of conifers(pine) to its habitats

- ❖ They have extensive roots for absorption of water
- ❖ They have needle-like to reduce transpiration

Disadvantages of the division Coniferophyta

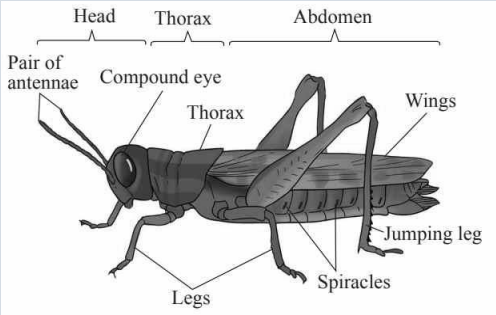
- ❖ Coniferous forest completely shades the ground and prevents the growth of other plants.
- ❖ Wood products from conifers are soft and can be easily attacked by termites if not treated.
- ❖ They have needle like thorny leaves that can prick and cause injury.
- ❖ Resins which are produced by pines catch fire easily. Thus, in case of fire outbreak in a Pinus forest, fire is likely to spread rapidly because of the resins.

Division Angiospermophyta

Angiospermophyta is the division in Kingdom Plantae which comprises plants commonly known as flowering plants or angiosperms. Angiosperms are the most diverse and a successful group of all the plants.

Distinctive features of Angiospermophyta.

- ❖ They show alternation of generation
- ❖ Fertilization does not depend on water



Figure;2.9: Grasshopper

Adaptation of grasshopper to its habitat.

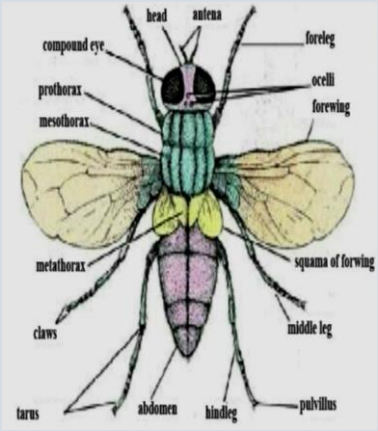
- ❖ They have jointed legs for locomotion
- ❖ They have antenna for sensitivity
- ❖ They tracheal system for gaseous exchange
- ❖ They compound eyes for vision.

Housefly

Habitat: Decaying matter e.g. toilet

Economic importance of housefly.

- ❖ vector of disease e.g. cholera and sleeping sickness
- ❖ Used for biological studies
- ❖ Source of food to some organisms e.g. toad, chameleon

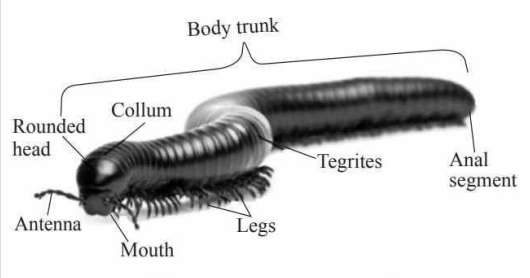


Figure;2.10: Housefly

Adaptations of the millipede to its mode of life

Millipedes have the following features that make them adapt to their environment:

- ❖ They have many, short and strong legs that enable them to burrow into the soil.
- ❖ They produce special secretions, which help them to moisturize dead organic matter on which they feed upon.
- ❖ A millipede tends to curl up into a tight flat coil for self-defense, and protect their delicate legs inside an armoured exoskeleton.
- ❖ Millipedes produce an offensively odorous fluid (repugnatorial fluid) when provoked, this acts as a defense against predators.



Figure;2.18: Millipede

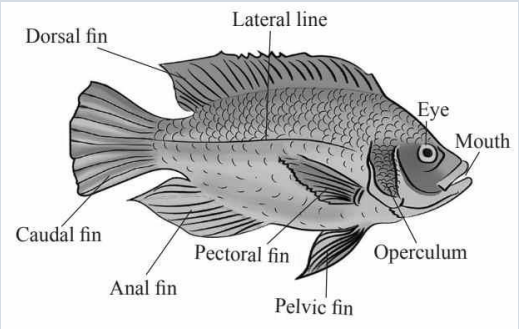
Adaptation of millipede to its habitat

- ❖ They have many, short and strong legs that enable them to burrow into the soil.
- ❖ They produce special secretions, which help them to moisturize dead organic matter on which they feed upon.
- ❖ A millipede tends to curl up into a tight flat coil for self-defence, and protect their delicate legs inside an armoured exoskeleton.
- ❖ Millipedes produce an offensively odorous fluid (repugnatorial fluid) when provoked, this acts as a defence against predators.

5. Class Chilopoda

This class consists of organisms found in terrestrial environment. They are terrestrial animals abundant in moist areas, such as leaf litters, under logs or rocks. An example of chilopoda is centipedes.

The distinguishing characteristics of class chilopoda



Figure;2.24: Tilapia Fish

Adaptation of tilapia fish to its mode of life

- ❖ They have swim bladder for buoyancy maintenance
- ❖ They have gill for respiration and are protected by operculum from mechanical damage
- ❖ They have fin for locomotion
- ❖ Has a streamlined shape to overcome water resistance during swimming
- ❖ Its body surface is covered by cycloid scales, which point backwards in order to reduce resistance during swimming.
- ❖ The fish has a lateral line that runs along the side of its body. The lateral line is a series of sensory organs called neuromasts that helps the fish to sense vibrations and water pressure for navigating and locating prey

Economic importance of Tilapia fish

- ❖ Used in biological studies.
- ❖ Used as the source of food to human being.
- ❖ Source of income.

Class Reptilia

The word reptilian is a Latin word which means 'crawl'

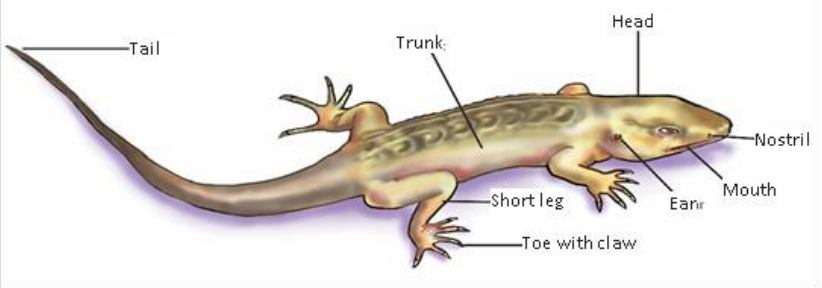
Some reptiles have limbs (e.g. lizards) while others are limbless (e.g. snakes)

The reptiles occupy different habitats. Some are aquatic (e.g. Turtles) while others are terrestrial (e.g. Lizards). Example of reptiles are Tortoise, Turtles, Lizards, Snakes, Chameleons, crocodiles.

Characteristics of Reptiles

- ❖ Have dry skin covered with horny scales
- ❖ They are poikilothermic animals (cold blooded animals)
- ❖ They use lungs for gaseous exchange

- Their eggs are fertilized internally and laid on land. A membrane known as amnion covers their eggs.
- With exception of crocodiles, they have heart which is divided into two atria (singular atrium) and two partially divided ventricles. In crocodiles the heart has four chambers.
- Some reptiles have shells e.g. Tortoise and turtles
- The limbs of reptiles arise from the lateral side of the body



Figure;2.25: Lizard

Adaptation of lizard to its mode of life

- Their dry skin is covered with horny scales to prevent dessication
- Produce uric acid as waste which require less amount of water
- Have nostrils for smell
- They protruding eyes for wider field of view.

Economic importance of lizard

- Used in biological studies.
- Source of food to some organisms

Class Mammalia

The class Mammalia consists of all animals with mammary glands. It is an extremely diverse and very advanced group in the kingdom Animalia. Members of the class Mammalia include: human, mouse, rabbit, cow, lion, bat, whale, and donkey.

Characteristics of Mammals

- Are homoeothermic (warm blooded)
- Viviparous, give birth to young, not eggs (except platypus and echdina)
- Have mammary glands
- Have external ear pinnae, (singular pinna) for collecting sound waves.

flower. Examples include orange, Hibiscus sp and bean flowers.

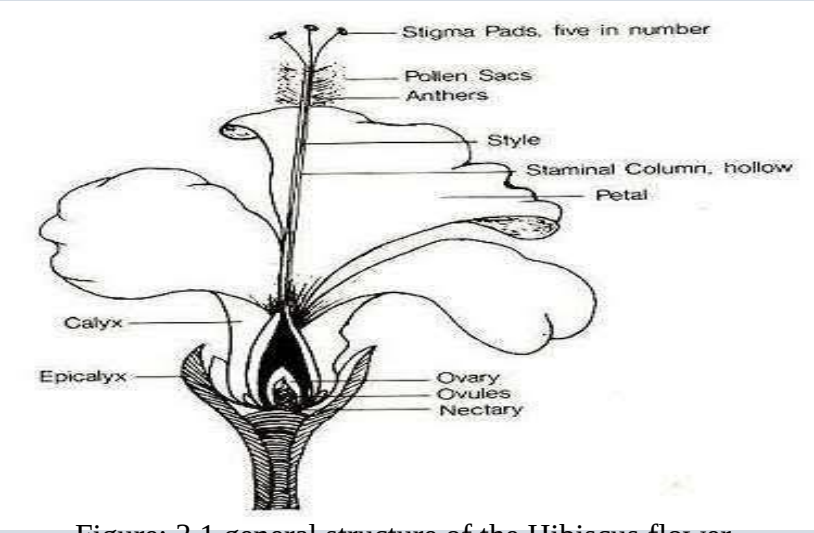
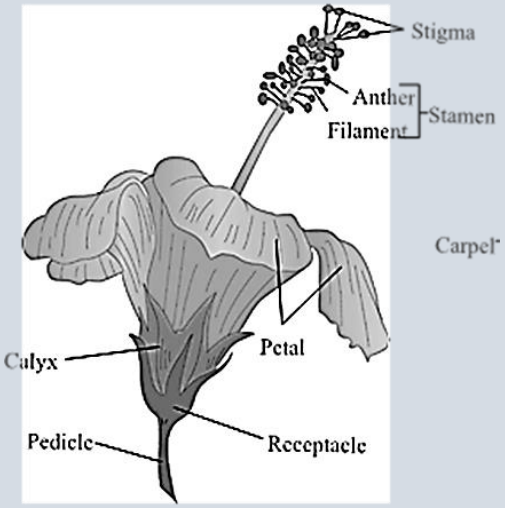


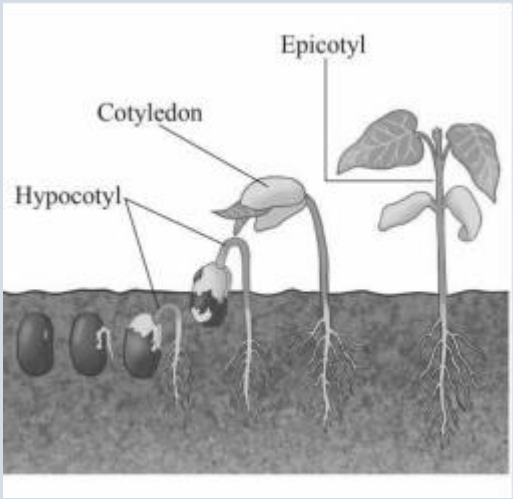
Figure: 3.1 general structure of the Hibiscus flower



Figure;3.2:exteral structure of the Hibiscus flower

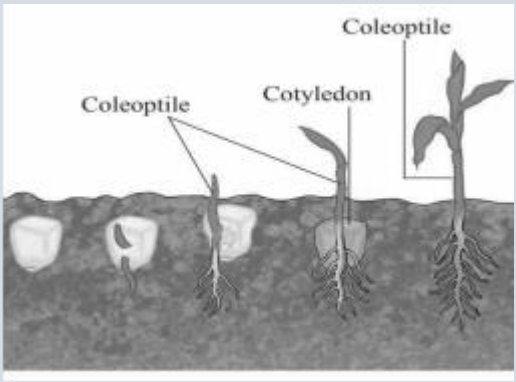
Types of Reproduction in plants

Sexual Reproduction; this is the type of reproduction which involves two individuals. One parent is a male and the other is a female. Sexual



Figure;4.2: stages of epigeal germination

Hypogeal germination is the type of germination in which the seed cotyledons remain underground. It occurs in plants such as maize and pigeon peas.



Figure; 4.3: stages of hypogeal germination of maize grain

Coleoptile is the sheath which protects plumule in maize (plumule sheath).

Coleorhiza is the sheath which protects radicle as it emerges through the maize grain.

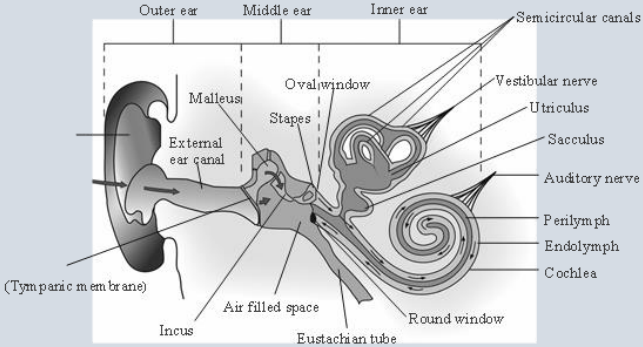
Function of the ear

- Hearing
- Body balance

Adaptation of the ear to its functions

The following are the adaptations of the ear to its functions:

- The presence of pinna which helps to collect the sound waves from the external environment and directs them into the ear canal.
- The presence of the tube-like canal which directs the sound waves to the ear drum.
- The existence of the ear ossicles which increase the force of the vibration and amplify the sound.
- Presence of fluid filled semicircular canals and utriculus which help the body to maintain its balance.



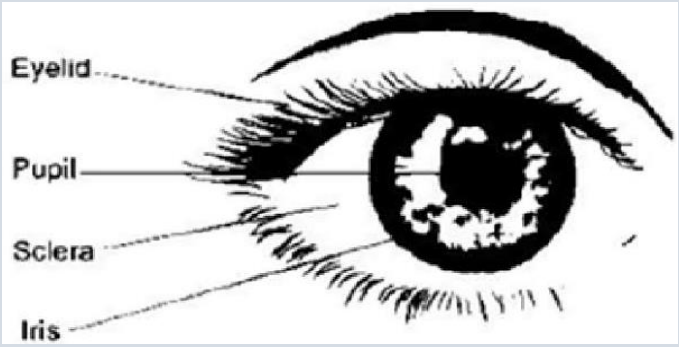
Figure; 6.1: An Ear

The eye

The eye is an organ for vision which receives light from the environment and converts it into electrical impulses. It is roughly spherical in shape and located in a bony socket called orbit in the skull. The orbit protects the eye against physical damage.

Function of the eye

- To enhance a person to determine distance.
- To bring sense of sight/vision

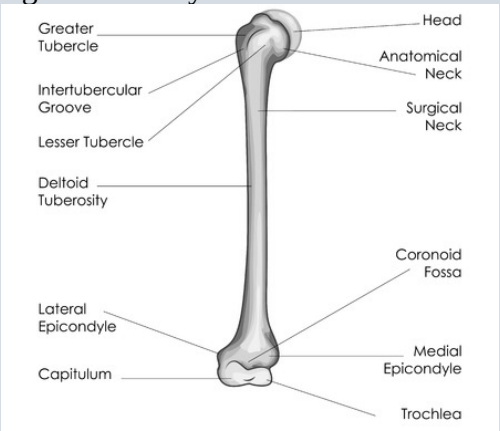


Figure;6.2: External Appearance of an Eye

Functions of the parts of external parts of an eye

- **Eyelid** protects the cornea from mechanical and chemical damage.
- **Iris**
  The contraction and relaxation of these muscles control the size of the pupil and amount of light entering the eye
- **Pupil** allow light to enter the eye.
- **Eye lashes**, protects the eye from entering of small particles and dusts
- **Ciliary body** When the eyes focus on an object they contract and relax, and they change the shape of the lens.
- **Eyelid** is a thin fold of skin that covers and protects the eye externally against entry of foreign particles. There are two eyelids namely *upper and lower eyelids*. They are able to move and as the result keep the surface of the eye moist. The movement of eyelids is called blinking. The upper eyelid of the eye secretes a saline fluid which contains enzymes that offer protection to the eye by killing microorganisms that can attack the eye.
- **Eye lashes** are fine hairs that grow at the edge of eyelid. They perform the function of protecting the eye from entry of small foreign particles such as sand and dust.
- **The eyebrow** is an area of thick, short hairs above the eye that follows the shape of the lower margin of the brow riges. Their main function is to prevent sweat, water, and other debris from falling down into the eye socket. They are also important in human communication and facial expression
- **Sclera** This layer protects, supports, and maintains the shape of the eyeball. The sclera is white in colour except the front part which is

The humerus is the skeleton in the upper arm. It's rounded which articulates with the glenoid cavity.



Figure; 7.4: the humerus

Function of humerus

- ❖ Attachments of biceps and triceps muscles

Adaptations of the humerus to its function include

- ❖ The presence of rounded head that fits into the glenoid cavity of the scapula. This allows for greater flexibility of movement of the arm. Humerus articulates with the fore arm at the elbow joint.
- ❖ It has trochlea at the lower ends which articulates with forearm(at the ulna bone) that allows movement in one plane.
- ❖ Also, it has capitulum which articulates with the head of the radius.
- ❖ The humerus is long to provide large surface area for attachment of biceps and triceps muscles.

Radius and ulna, these are bone found in the fore arm. Radius is on the side of the thumb while ulna is on the side of small finger

Function of Radius and ulna

- ❖ Supports the carpals, metacarpals and phalanges
- ❖ They provide site for attachment of forearm

Pectoral girdle (shoulder girdle) this is a set of bones in the appendicular skeleton that connect to the arm on each side. It consists of two dorsal shoulder blades, the scapulae (singular: scapula) and a pair of ventral collar bones called clavicles. They are not fussed to axial skeleton but are flexible and attached to the vertebral column by ligaments and muscles. This arrangement enables the girdle

Chapter 8

PHOTOSYNTHESIS

Photosynthesis is the process by which green plants, some bacteria and some Protoctists their own food using water, carbon dioxide and energy from the sun.

The process of photosynthesis mostly takes place in the green part of the plants, mostly in the leaf

Photolysis is the process whereby water is broken down into hydrogen and oxygen ions.

The Leaf's Adaptation for Photosynthesis.

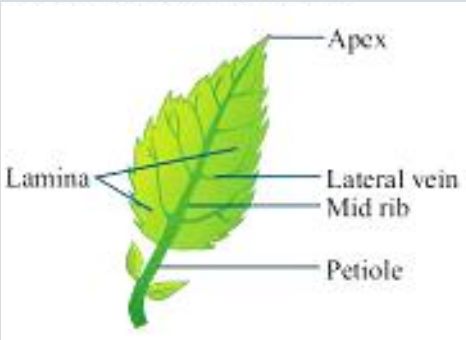
The external structure of a leaf can be viewed using either using hand lens or unaided eyes.

- **The petiole**

  The petiole or leaf stalk attaches the leaf to the branch or stem. It keeps the lamina in a position that will enable it to get maximum amount of sunlight.

- **The lamina** is the expanded portion or blade of a leaf. It has a large surface area. This maximizes the absorption of sunlight energy and carbon dioxide. The lamina is also thin so that carbon dioxide gas can diffuse and sunlight energy can penetrate over a short distance to reach cells.

- **The mid-rib which** gives rise to veins and **veins** contain xylem and phloem. Xylem transports water and mineral salts and Phloem transports manufactured food from the leaf to other parts of the plant.



Figure; 8.1: External structure of leaf

Common Asked Specimens in Biology Practical Examinations

1. Tilapia fish
2. Yeast
3. Frog/toad
4. Bread mould
5. Housefly
6. Spider
7. Bee
8. Sugarcane stem
9. Grasshopper
10. Irish potato
11. Liver fluke
12. Centipede
13. Fern plant
14. Ascaris
15. Millipede
16. Moss plant
17. Earthworm
18. Crab
19. Pine leaf
20. Tapeworm
21. Hibiscus leaf/flower
22. Butterfly
23. Cockroach
24. Cactus stem
25. Mites
26. Bean seed
27. Termites
28. Maize grain
29. Mushroom
30. Maize seedling
31. Bean seedling
32. Castor seeds
33. Ticks
34. Rat
35. Lizard
36. Onion bulb
37. Tea bag
38. Lime water
39. Potassium permanganates
40. Plane mirror
41. Variegated leaf