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553/1

BIOLOGY

(Theory)

Paper 1

Oct/Nov. 2020

2 ½ HOURS

UGANDA CERTIFICATE OF EDUCATION

BIOLOGY

(THEORY)

Paper 1

TIME: 2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES:

This paper consists of sections **A, B** and **C.**

Answer **all** questions in sections **A** and **B**, plus **two** questions in section **C**.

Write the answers to section **A** in the boxes provided, answers to section **B** in the spaces provided and answers to section **C** in the answer booklets provided.

For examiners' use Only		
Section	**Marks**	**Examiner's Signature**
A:	*30*	*SCZ Salongo 2020*
B: No. 31 **No.32** **No. 33**	*20* *10* *10*	
C: No. **No.**	*15* *15*	
Total	*100*	

SECTION A (30 MARKS)

*Answer **all** questions in this section. Write the letter representing the most correct answer to each question in the box provided.*

1. Which of the following formulae is correct for calculating magnification of a specimen when using a hand lens?

A. Size of image x Size of the real specimen
B. Size of the image + Size of real object
C. Size of the real specimen ÷ Size of the real specimen
D. Size of the image ÷ Size of the real specimen

2. Which of the following is an example of a modified root?

A. Irish potato tuber
B. Rhizome
C. Cassava tuber
D. Corm

3. Which one of the following activities takes place during the larval stage in the lifecycle of a housefly?

A. Hibernation
B. Organ formation
C. Feeding
D. Resting

4. **Figure 1** below is a leaf type.

Which type of leaf is represented in the figure above?

A. Compound digitate
B. Compound trifoliate
C. Compound pinnate
D. Compound Bipinnate

5. A medium of low pH stops the action of

A. Pepsin
B. Lipase
C. Ptyalin
D. Maltase

6. In an experiment to find the proportion of air in soil, the following results were obtained.

Volume of soil = Wcm^3

Volume of water added to soil =$300cm^3$

Volume of soil + water after stirring = Zcm^3

Which one of the following expressions gives the volume of air in the soil sample?

A. Z - W cm^3

B. (W + 300) – Z cm^3

C. Z – 300 cm^3

D. Z – (W + 200) cm^3

7. A soil sample was heated strongly to red hot. Which component of soil was being investigated?

A. Humus

B. Microorganisms

C. Air

D. Water

8. ***Mimosa pudica*** exhibits which type of nastic response?

A. Photonasty

B. Hydronasty

C. ***Haptonasty***

D. Thermonasty

9. Which of the following is the intermediate host for pig-tape worm?

A. Man

B. Pig

C. Cow

D. Undercooked pork

10. Which of the following is the function of choroid of the mammalian eye

A. Absorbs light and prevents total internal reflection

B. Protects the delicate inner layers of the eye

C. Transmits sensory impulses from the retina to the brain for interpretations

D. Provides nutrients and oxygen to the cornea and eye lens

11. An endosperm is formed in plants when the second male nucleus fuses with the

A. Egg nucleus

B. Antipodal nuclei

C. Embryo

D. Polar nuclei

12. When a plant cell is put in a hypotonic solution it becomes

A. Flaccid

B. Turgid

C. Crenated

D. Haemolysed

13. Secondary growth in a flowering plant is caused by;

A. Cortex cells

B. Phloem cells

C. Xylem Vessels

D. Cambium cells

14. When the tip of a maize coleoptile is covered with an aluminum foil and then illuminated on one side, it grows straight because,

A. The foil kills the hormones in the coleoptile

B. The tip does not receive the light stimulus

C. Hormones in the coleoptile move to the zone of elongation

D. The foil activates the hormones in the coleoptile

15. The following are features found in birds.

(i) Light bones

(ii) Webbed feet.

(iii) Presence of features.

(iv) Streamlined body.

Which of the features are adaptations for flight?

A. (i) and (ii)

B. (ii) and (iii)

C. (iii) and (iv)

D. (i) and (iv)

16. In estimating the population of Tilapia in a fish pond, 80 fish were captured, marked and released. After 2 days, 50 were captured and out of which 20 were marked. The population of Tilapia in the fish pond was;

A. 300

B. 400

C. 200

D. 100

17. Which one of the following is common respiration and photosynthesis?

A. Energy is released.

B. Both occur in all living cells.

C. Food oxidations is common to both.

D. Oxygen, carbondioxide and water are involved.

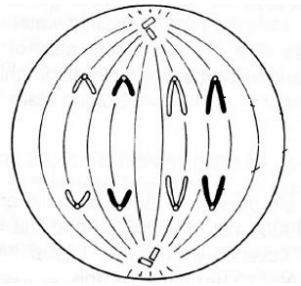
18. In mammals, the anti-diuretic hormone (ADH)

A. ***stimulate the reabsorption of water in the urinary tubules.***
B. Inhibits the reabsorption of water in urineferous tubules.
C. inhibits the action of osmoreceptors regulate the osmotic pressure of blood.
D. Stimulates the nephron so that there is an increase in the formation of the glomerular filtrate.

19. When a white flowred plant was crossed with a red flowered plant, all the F1 Offspring had pink flowers. If a pink flowered plant was crossed with a pinke flowered plant, the offspring flowers would be expected to be

A. all pink
B. all red
C. all white
D. ***a mixture of red, white and pink***.

20. What stage of cell division is represented in the figure 2 below?



A. ***Anaphase***
B. Prophase
C. Metaphase
D. Telophase

21. Lactic acid is likely not to accumulate

A. When engaged in a vigorous exercise
B. After breathing in excess carbon dioxide
C. Deep sleep
D. After consuming alcohol

22. Which one of the following is an adaptation to ensure effective gaseous exchange in organisms?

A. Decreased surface area of organs involved
B. Increased thickness of gas exchange surface
C. Increased body size of organism
D. Increase in concentration gradient of gas

23. The rate of glomerular filtration is lowest in;

A. Marine vertebrates
B. Amphibians
C. Mammals
D. Fresh water animals

24. Which one of the following organisms does not use blood to carry oxygen within its body?

A. Fish
B. Bee
C. Snake
D. An earthworm

25. Natural immunity is developed by

A. Taking preventive drugs.
B. Inoculation with mild strain of pathogen.
C. Injection with antibiotics to the disease organism.
D. ***Casting the disease and recovering from it***.

26. Which one of the following processes is not linked with transpiration?

A. Absorption of water by roots.
B. Transportation of sugars.
C. Cooling of leaves.
D. Provision of mechanical support.

27. Which one of the following is not an example of excretion?

A. A man sweating
B. A tree dropping its leaves.
C. A dog salivating
D. A goat exhaling.

28. Some of the following events occur when seeds show epigeal germination.

(i) testa slits.
(ii) hypocotyl grow fast
(iii) epicotyl grows fast
(iv) cotyledons appear above the ground
(v) cotyledons remain below the ground.

Which of the following are the events that occur?

A. (i), (ii), (iv)
B. (i), (iii), (v)
C. (iii), (iv), (v)
D. (i), (ii), (iii)

29. In man the oestrus cycle is also known as

A. heat period
B. gestation period
C. Menstrual cycle
D. lactation cycle.

30. Which one of the following pairs of bones form a ball and socket joint?

A. Humerus and Ulna
B. Femur and pelvis
C. Humerus and radius
D. Femur and tibia

SECTION B (40 MARKS)

*Answer **all** questions in this section. Answers **must** be written in the spaces provided.*

31. The table below shows different concentrations of substances in blood plasma in a part labelled **A**, in glomerular filtrate in a part labelled **B** and in urine in a part labelled **C**. Study it carefully and answer the questions that follow.

Components of Blood	***% in plasma in A***	***% in Glomerular filtrate in B***	***% in urine in C***
Proteins	7.0	0	0
Glucose	0.2	0.02	0.05
Urea	0.03	0.03	2.0
Sodium ions	0.32	0.32	0.35
Chloride ions	0.37	0.37	0.60
Water	92	98	96

(a) Identify the parts labelled ***A, B*** and ***C*** where the fluids in the table above are found. ***(03 marks)***

A: Blood vessel ✓ *B: Glomerulus* ✓ *C: Urinary bladder* ✓ *(03 marks)*

(b) ***(i).*** Which component of urine shows the greatest percentage increase in concentration compared to the glomerular filtrate in B? ***(01 mark)***

Urea ✓

(ii). Fully explain why the component you have named in ***b (i)*** above has the greatest increase in concentration in Urine. ***(04 marks)***

Urea is not reabsorbed back into the blood stream ✓ *because it is toxic* ✓ *once it accumulates in the body* ✓*. Also more urea is added into the tubules by tubular secretion* ✓.

(c) Suggest with a reason the health condition of the person from whom the results in the tables above were obtained?

Health condition ***(01 mark)***

The person has Diabetes mellitus ✓

Reason ***(01 mark)***

Because glucose is present in this person's urine ✓.

(d) With a reason, state the effect of the following conditions on the amount of water excreted by the kidney.

(i) Eating salty food ***(02 marks)***

Little amount of water is excreted ✓ because taking in salt food increases the osmotic pressure above the Norm, ✓ this causes secretion of ADH ✓ that increases the reabsorption of water back into blood stream. ✓

(ii) A long loop of Henle ***(02 marks)***

Less water is excreted ✓ because of its high selective reabsorption of water back into the blood stream ✓ due to a long surface area provided ✓ by this long loop of Henle maximum reabsorption takes place. ✓

(iii) A reduction in blood pressure in the renal artery ***(02 marks)***

Less water is excreted ✓ because of its high selective reabsorption of water back into the blood stream ✓ due to a long surface area provided ✓ by this long loop of Henle maximum reabsorption takes place. ✓

(e) How is the nephron adapted to perform its functions? ***(04 marks)***

First function of the nephron is Ultra-filtration (formation of the glomerular filtrate).

- *The Bowman's capsule of the nephron has a cup-shaped structure to enable the collection of the filtrate. ✓*
- *The capsule has small pores in its membranes that allow the substances with small sized molecules to filter through into the glomerulus to form the filtrate. ✓*
- *Also these small pores on the capsule membranes act as filtration barriers for large molecules like proteins and cells from being filtered into the filtrate ✓*
- *The capsule is of large volume to accommodate more filtrate during the process of ultra-filtration. ✓*

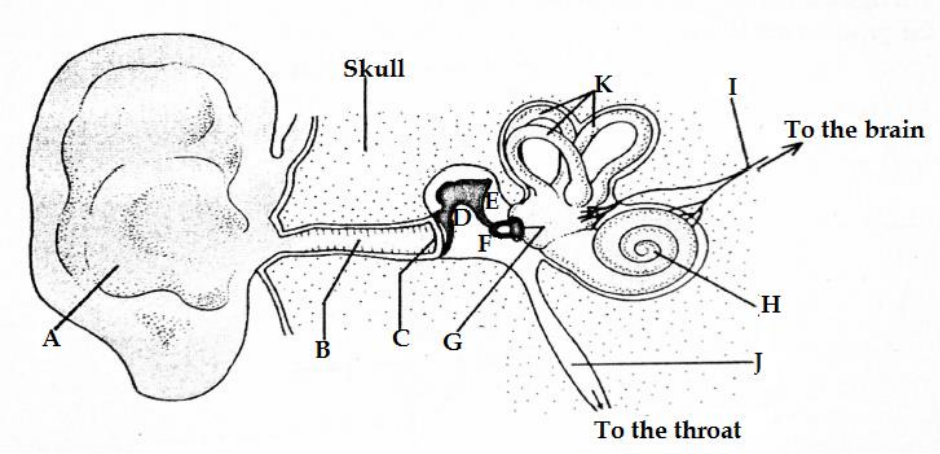
Second function of the nephron is selective reabsorption

- *The nephron has a long loop of Henle which provides a large surface area for maximum reabsorption of essential materials like glucose back into the blood stream.* ✓
- *The descending limb of the loop of Henle is impermeable to ions but permeable of water,* ✓ *thus it allows selective reabsorption of water back into blood stream by osmosis.* ✓
- *The ascending limb of the loop of Henle is impermeable to water but permeable to ion,* ✓ *thus allowing selective reabsorption of ions back into blood stream by active transport.* ✓

The third function of the nephron is tubular secretion.

- *The distal convoluted tubule has cells which actively secrete and transport more of the excess metabolic wastes like urea and ions into the filtrate.* ✓ *(✓@ 1mk 04 marks max.)*

32. The figure below shows the section through the human ear. Study it carefully and answer the questions that follow.



(a) (i) Name the parts labelled ***(02 marks)***

A. Pinna ✓ *C. Eardrum/ Tympanic membrane* ✓

B. Auditory canal ✓ *G. Oval window* ✓ *(✓@ ½ mk 2 marks)*

(ii) State the general name for structures D, E and F ***(01 mark)***

Ossicles ✓

(iii). State the function of the following structures: ***(02 marks)***

J – It equalizes air pressure on both sides of the eardrum so that it vibrate freely. ✓

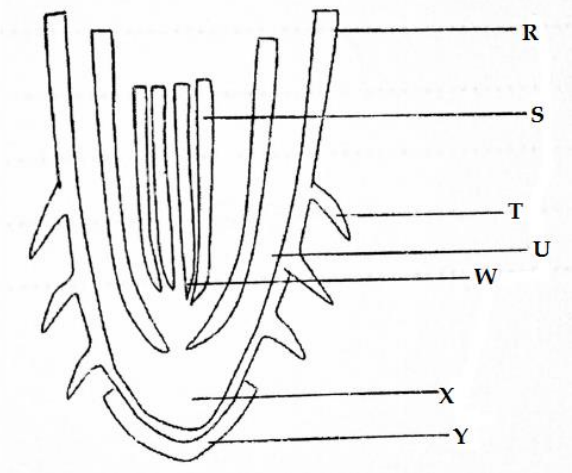
K – It detects changes in direction, acceleration and deceleration thus maintaining body balance and posture. ✓ *(✓@1mk 2 marks)*

d) Describe how the structures labelled A to I are involved in the hearing process.

The pinna (part A) collects sound waves from its source ✓ *and it also detects the source of sound* ✓*. The auditory canal (part B) contains hairs and wax* ✓ *with trap and prevent entry of dust, dirt and foreign bodies into the middle ear.* ✓ *It also conducts the sound waves from the pinna to the eardrum (part C)* ✓*.The eardrum (part C) vibrates the sound waves to the ossicles (parts D, E and F).* ✓*The ossicles (D, E and F) transmit the vibration to the inner ear through the oval window (part G)* ✓*. They also amplify sound of low tones.* ✓ *The oval window (part G) receives impulses from the ossicles (specifically the stapes) and transmits it to the cochlea (part H).* ✓ *The cochlea (part H) contains sensory cells which detect sound.* ✓ *The auditory nerves (part I) transmits impulses to the brain for interpretation.* ✓ *(✓@ ½ mk 5 marks)*

(05 marks)

33. The figure below shows a longitudinal section through part of a plant showing its internal structures. Study it carefully and answer the questions that follow.



(a) (i) Name the parts labelled R - X ***(03 marks)***

R – Epidermis ✓ *S – Phloem* ✓ *T – Root hair* ✓ *U – Cortex* ✓

W – Xylem ✓ *X – Apical meristem* ✓ *(✓@ ½ mk 3 marks)*

(ii) With a reason, name the part from which the figure was obtained.

Part: Root ✓

Reason (s)

- **It has root hairs** ✓
- **It has a root cap.** ✓ **(2 marks max)**

(b) State the functions of parts labelled S, T and W ***(03 marks)***

S – transports manufactured food from the leaves to the different parts of the plant. ✓

T – absorbs water and mineral salts from the soil into the roots ✓

W – transport water and mineral salts from the roots up the plant to the stems and leaves. ✓ *(✓@ 1 mk 3 marks)*

(c) How is part T adapted to perform its function? ***(03 marks)***

- *They are numerous to increase surface area for maximum absorption of water and mineral salts.* ✓
- *They are slender and flexible to easily penetrate in between soil particles and rocks deep for maximum water absorption.* ✓
- *They lack cuticle to enhance passive absorption of water by osmosis with minimal or without resistance.* ✓
- *They have thin and permeable plasma membrane which allows maximum absorption of water by osmosis.* ✓
- *Their cell sap contains more salt concentration than that of the external soil solution, this facilitates osmotic flow of water from the soil into the root hairs.* ✓
- *(✓@ 1mk 2 marks max)*

SECTION C (30 MARKS)

*Answer any **two** questions from this section. Additional questions answered will **not** be **marked**. Answers to these questions must be written in the answer booklets provided.*

34. (a) With examples in each case, distinguish between;

(i) Open Blood circulation and closed blood circulation. ***(03 marks)***

Open blood circulation is a form of circulation where blood flows through open body cavities called Haemocoel but not in blood vessel ✓. E.g in insects like cockroaches, grass hoppers ✓ etc. (1 ½ marks)

While

Closed blood circulation is a form of circulation where blood flows through closed tubes called blood vessels. ✓ E.g in amphibians (frogs & toads), in mammals (Man, Goat, cow etc), birds ✓ etc. (1 ½ marks)

(ii) Single Blood circulation and Double blood circulation. ***(03 marks)***

Single blood circulation is a form of circulation where blood flows through the heart once for a complete circuit. ✓ E.g in fish ✓ While (1 ½ marks)

Double blood circulation is a form of circulation where blood flows through the heart twice for a complete circuit. ✓ E.g in Mammals like man, cow, goats etc. ✓ (1 ½ marks)

(b). Describe the function of blood as a transport medium in man. ***(09 marks)***

- ***Transports soluble and digested organic food substances from the gut to the liver and to all respiring tissues. ✓***
- ***Transports hormones from their endocrine glands to their target organs. ✓***
- ***Transports oxygen inform of oxyhaemoglobin with the red blood cells from the respiratory organs to the respiring tissues. ✓***
- ***Transports carbon dioxide mainly in form of bi carbonate ions in plasma from the respiring tissues to the respiratory organs to be exhaled out. ✓***
- ***It is important in maintaining the normal and optimum pH in the body. ✓***

- *It is important in temperature regulation via even distribution of heat throughout the body.* ✓
- *Defends the body against diseases via phagocytosis, normal blood clotting and immune response towards infections* ✓
- *It is important in maintaining osmotic pressure at the norm.* ✓
- *It transports metabolic wastes from the respiring tissues to excretory organs for their elimination from the body e.g urea, ammonia, uric acid etc.* ✓. *(✓@ 1mk 09 marks)*

35. (a) State four differences between internal fertilization and External fertilization.

Internal fertilization	*External fertilization*
Fusion of gametes to form a zygote occurs inside the organism	*Fusion of gametes to form a zygote occurs outside the organism particularly in water.* ✓
Water as external factor is not necessary	*Water as an external factor is necessary* ✓
Few gametes are produced in the process	*A lot of gametes are produced and necessary* ✓
Embryos develop well protected and normally offered help after birth	*Embryos develop not well protected and mostly helpless after birth* ✓
Less energy is involved since gametes are produced	*A lot of energy is involved since more gametes are produced* ✓
Chances of fertilization are higher	*Chances of fertilization occurring are fewer* ✓

(✓@1mk 04 marks)

(04 marks)

(b). Giving examples in each case, Describe the different forms of asexual reproduction.

A sexual reproduction is a form of reproduction which does not involve fusion of gametes and only one individual is involved. The different forms of asexual reproduction include;

A. ***Budding:*** ✓ ***this is a form of asexual reproduction in which an organism develops an outgrowth called a bud, which detaches itself from the parent organism and starts to grow as a self-resilient organism*** ✓***. It is common in hydra and yeast.*** ✓

B. ***Spore formation:*** ✓ ***this is a form of a sexual reproduction which involves production of spores are microscopic structures which can be dispersed and under favourable conditioned have the ability to germinate into new organisms.*** ✓ ***It is common in fungi and some bacteria.*** ✓

C. ***Fragmentation:*** ✓ ***this is a form of asexual reproduction where an organism breaks into many small parts called fragments and each fragment is able to grow into a new individual.*** ✓ ***It is common in tape worms and spirogyra*** ✓

D. ***Binary fission;*** ✓ ***is a form asexual reproduction where a single celled organism divides into two parts and each part starts to grow and develop into a separate individual.*** ✓ ***It is common in amoeba and other protozoans.*** ✓

E. ***Multiple fission:*** ✓ ***this is a form of asexual reproduction where a single celled organism divides into many parts which grow into separate individuals.*** ✓ ***It is common in plasmodium*** ✓

F. ***Vegetative propagation:*** ✓ ***This is a form of asexual reproduction in plants where part of the plant other than the seeds develops into a new individual.*** ✓ ***It is common in cassava, Irish potatoes, corms, Suckers, Sweet potatoes, Rhizomes, Bulbs etc*** ✓***. (11 marks… 2 ½ @each type)*** ***(11 marks)***

36. (a)Distinguish between;

(i) Mutualism and Commensalism ***(02 marks)***

Mutualism is an association between organisms of different species in which both partners benefit from each other ✓***. e.g lichens (fungi and algae). Mycorrchizae (Fungi and roots of spermatophytes), Nitrogen fixing bacteria (Rhizombium) and Root nodules of leguminous plants, Cellulase-digesting bacteria in the stomach of ruminants*** ✓ ***etc. (1 ½ marks)***

While

Commensalism is an association between two organisms of different species in which only one benefits and the other is not harmed ✓ E.g Cattle and Egret, Buffaloes and Egret. ✓ etc ..... (1 ½ marks)

(ii). Predation and Parasitism ***(02 marks)***

Predation is an interaction where one organism called a predator hunts and kills another organism called the prey and metabolically depends on it for food ✓. E.g a lion and an antelope. ✓ ..... (1 ½ marks)

While

Parasitism is an association between two organisms of different species in which one of them benefits and the other is harmed. ✓ E.g Tick on cattle, Tapeworm in human intestines. ✓ etc (1 ½ marks)

(b).With examples in each case, Describe how parasites are adapted to their mode of life.

- *Loss of some sense organs like eyes so as to live in low light areas. ✓*
- *Some parasites possess a thick, resistant cuticle to withstand host's immune reactions. ✓*
- *They possess attachment devices to enable them cling onto their hosts ✓ e.g claws in tick, suckers and hooks on tape worms ✓.*
- *Under harsh conditions, some are capable of suspending their development by forming cysts and spores till when conditions become favourable ✓ e.g Histolytica forms cysts which withstand adverse conditions ✓.*
- *Some parasites have the ability to live and survive in adverse conditions in the host's body ✓ such as low oxygen tension, pH fluctuations, low light intensity ✓ etc*
- *Some parasites possess dorso-ventrally flattened bodies ✓ which increase the surface area for maximum absorption of soluble digested food ✓.*
- *Some parasites possess sharp, piercing and sucking devices ✓ which enable then penetrate into the host's body to obtain food ✓ e.g Proboscis of mosquitoes etc.*
- *Some have the ability to suppress and compromise the immune responses of the host's immune system ✓. E.g HIV/AIDS*
- *Parasites normally have high reproductive rates with very short reproductive life cycles ✓. Thus increasing their chances of survival.*
- *Some have the ability to use more than one host so as to the increase their chances of survival ✓ e.g pork-tapeworm has two host i.e pig and man, Beef-tapeworm has two host i.e Cow and man. ✓*

- ***Some parasites are capable of using organisms as vectors ✓ to transmit their offspring to the other host. ✓ E.g a vector of plasmodium is a mosquito ✓***
- ***They inhabit suitable strategic areas of the host so that they obtain nutrients easily ✓ and also be able to find their way to a new host. ✓ E.g tapeworm in the intestines, HIV etc***

(✓@1mk 09 marks)

(11 marks)

37. (a) What is Photosynthesis? ***(02 marks)***

Photosynthesis is the process by which green plants manufacture their own organic food in form of starch (Glucose) ✓ from inorganic carbon dioxide and water ✓ using sunlight trapped by chlorophyll ✓ and oxygen is given off as a by- product ✓.

(✓@ ½ mk 02 marks)

(b) State the two raw material, two condition and two products of photosynthesis.

Raw materials: Carbon dioxide ✓ and Water ✓

Conditions: Sunlight ✓ and Chlorophyll ✓

Products: Starch ✓ and Oxygen ✓ ***(✓@ ½ mk 03 marks)***

(03 marks)

(c) Describe an experiment to show that oxygen is given off as a bi product during photosynthesis. ***(10 marks)***

AN EXPERIMENT TO SHOW THAT OXYGEN IS GIVEN OF AS A BY-PRODUCT DURING PHOTOSYNTHESIS ✓ **(1 mark)**

Apparatus/ materials required

Water plant (Elodea) ✓, Beaker ✓, Water ✓, Test tube ✓, Filter funnel ✓, Glowing splint ✓, 2 Wooden blocks ✓. **(✓@ ½ mk 2 marks)**

Procedure

(a) Place a water weed (elodea) in a beaker full of water containing dissolved sodium hydrogen carbonate ($NaHCO_3$) ✓.

(b) After cover the plant with an inverted funnel raised slightly from the bottom of the beaker using small wooden blocks ✓.

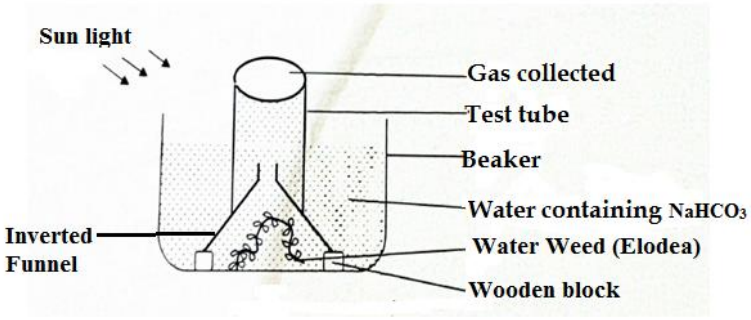
(c) Then an airtight test tube is placed on the funnel ✓.

(d) The setup A is kept in bright sunlight for 6 – 8 hours ✓.

(e) A similar setup B is placed in darkness to act as a control experiment ✓.

(f) After sometime, when sufficient gas is collected in each of the test tube, it is tested using a glowing splint✓. ***(✓@ ½ mk 03 marks)***

Set up✓



(1 mark)

Observation

In set up A, Bubbles of a colourless gas which relights a glowing splint were collected in the test tube.✓

In set up B, A colourless gas from the control experiment does not relight a glowing splint.✓

(✓@1mk 02 marks)

Explanation

In setup A, the plant was exposed to sunlight, so it carried out photosynthesis✓ producing more and more oxygen gas which was collected in the test tube,✓ hence relighting a glowing splint.

In set up B, the plant was exposed to darkness, so it didn't carry out photosynthesis✓ thus no oxygen was produced✓ instead more carbon dioxide was produced✓ by the plant as it respires✓ hence putting off a glowing splint.

Conclusion

Oxygen is given off as a by-product during photosynthesis.✓ **(1 mk)**

END

"You will experience a painful sharpening from time to time, but this is required if you are to become a better pencil".