

# Biology – (Theory)

Dec. 2022 – 2 hours



## Instructions to candidates

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of **two** sections; **A** and **B**.
- (d) Answer **all** the questions in section **A** in the spaces provided.
- (e) In section **B** answer question **6 (compulsory)** and either question **7** or **8** in the space provided after question **8**.
- (f) **This paper consists of 12 printed pages.**
- (g) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (h) **Candidates should answer the questions in English.**

### For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1	8	
	2	8	
	3	8	
	4	8	
	5	8	
B	6	20	
		20	
Total Score		80	

889

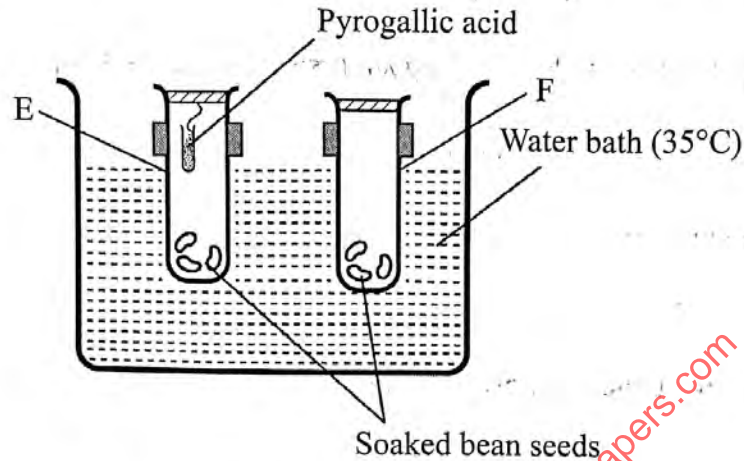
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## SECTION A (40 marks)

Answer **all** the questions in this section in the spaces provided.

1. The set-up below was used to investigate a certain factor necessary for seed germination.



- (a) (i) Identify the factor under investigation. (1 mark)

Oxygen; Acc-~~2~~

- (ii) Give a reason for your answer in 1(a)(i) (1 mark)

Presence / Inclusion of pyrogallic acid; (in set up E it absorbs Oxygen in experimental set up)

- (b) Explain why it was necessary to:

- (i) maintain the water bath at 35°C (1 mark)

It is the optimum temperature required for functioning of enzymes;

- (ii) use soaked bean seeds (1 mark)

To soften seed coat / testa / Water activates germination enzymes / Hydrolyses stored food / Solvent / medium of transport;



- (c) (i) Explain the expected observations at the end of the experiment in test tubes E and F. (2 marks)

E - Germination will not occur due to lack of energy / Oxygen;

F - Germination will take place due to presence of oxygen / softened seed coat / testa / temperature is optimum;

- (ii) Explain what is likely to happen if set-up F was maintained for 7 days. (2 marks)

- Germination / growth process stagnates / slows down / stops; the seeds will wither / die; the oxygen / moisture in the test tube will be depleted; (2 marks)

2. A fresh water lake surrounded by agricultural farms has the following organisms:

- Fish
- Hippopotamus
- Reeds
- Algae

- (a) State the roles of each of the following organisms in the lake ecosystem:

- (i) hippopotamus (2 marks)

- Exhale carbon dioxide which is used up by algae / seeds;

any 2 - Their dung released into the water enriches it, favouring growth of phytoplankton / seeds / algae; the dung is also fed on by fish; (Max 2) (2 marks)

- (ii) algae (2 marks)

- Are the producers; release oxygen; purifies

any 2 - the ecosystem by using up the CO<sub>2</sub>; regulates the pH of water by using up the CO<sub>2</sub>; provides breeding grounds for fish; Fed on by fish and hippopotamus; (max 2)

- (b) Explain the likely positive and negative effects of the surrounding agricultural farms on the lake ecosystem.

- (i) Positive effects (2 marks)

- Fertilizer / Organic manure applied on the farms find themselves deposited in the lake; enriching the lake ecosystem, favouring growth of phytoplankton / algae / producers / plants;



- Excessive run-off/soil erosion and deposition into the lake blocks clog gaseous exchange surfaces of aquatic life;

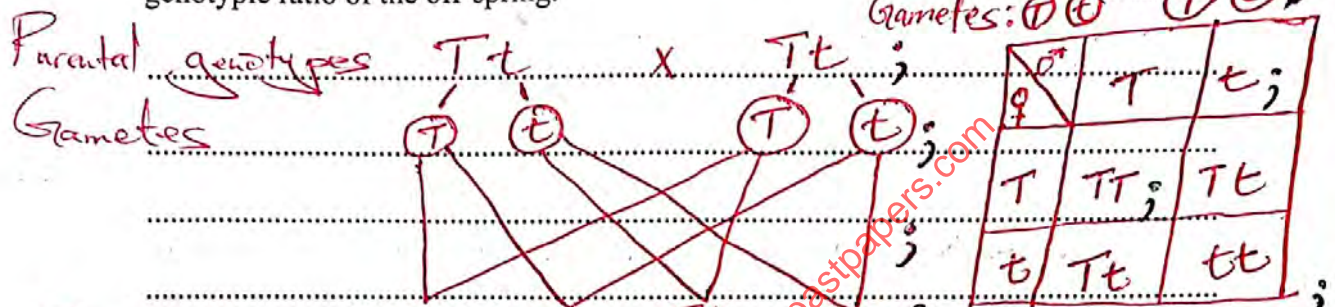
(ii) Negative effects

(2 marks)

- Excessive use of fertilizers/organic manures results in overgrowth of phytoplankton/algae/eutrophication;

- Some agrochemicals used in the farms may be toxic/poisonous/kills aquatic organisms; It increases turbidity/reduces visibility/light penetration in the water;

3. (a) Two tall garden pea plants were crossed and of the resulting offspring, 750 were tall and 250 were short. Using letter T to represent the dominant gene, determine the genotypic ratio of the off-spring. (5 marks)



F<sub>1</sub> generation: TT Tt Tt tt

Genotypic ratio: 1TT : 2Tt : 1tt

(b) Besides height in the garden pea plants, state two other contrasting seed traits that Mendel focused on in his genetic studies. (2 marks)

- Texture; (Wrinkled or smooth) - mentioned in the question for the student to score

- colour;

- Form/Shape;

(c) State how the genetic knowledge has been used to improve pea plant farming. (Max 2)

(1 mark)

- Artificial selection/Cross breeding/Polyploidy/genetic engineering;



4. (a) Explain how each of the following factors affect uptake of mineral ions in plants:  
 Active transport is responsible for uptake of mineral ions;  
 (i) temperature - At temperature below optimum, the rate (3 marks)

of mineral ion uptake is low due to the inactive respiratory enzymes; At optimum temperature, the rate of mineral ion uptake is highest because respiratory enzymes are most active; Beyond optimum temperature, rate of mineral ion uptake slows down because respiratory enzymes are denatured; (Max 3.) (3 marks)

- (ii) glucose concentration in root hair cell sap

Glucose is a respiratory substrate; needed for active uptake of mineral salts; High glucose concentration produces more energy leading to more mineral ion uptake; Low glucose concentration produces less energy leading to low mineral ion uptake;

- (b) State two characteristics of the root hairs that increase their surface area for absorption of mineral ions. (2 marks)

- Elongated/Long to reach more mineral ions;
- Numerous/Many;

5. (a) State two main functions of the ear ossicles. (2 marks)

- Transmission of vibrations;
- Amplification of vibrations;

- (b) Explain how each of the following parts of the ear are structurally adapted to their functions:

- (i) tympanic membrane (1 mark)

- Thin/Pliable/tight membrane that vibrates/converts sound waves into vibrations;

- (ii) cochlea (1 mark)

- Highly coiled to accommodate a large/many/more number of sensory cells;
- Has numerous sensory cells to perceive sound vibrations;
- Filled with a fluid to enhance transmission of vibrations;

N/B: If endolymph is mentioned, perilymph must also be mentioned  
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 for the student to score 231/2





(c) State the function of the eustachian tube in the mammalian ear. (1 mark)

- To balance pressure between the atmosphere and middle ear / on either side of the tympanum / b/w outer & middle ear;

(d) State the importance of each of the following in the mammalian ear:

(i) wax (1 mark)

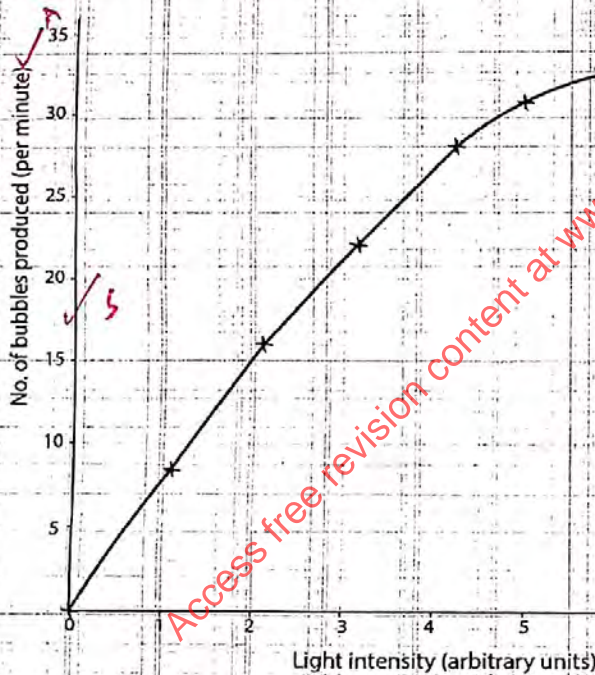
- Trap dust particles / prevent entry of solid / foreign particles / bacteria / (micro)-organisms;  
- Maintain the flexibility / pliability of tympanic membrane;

(ii) endolymph and perilymph (2 marks)

- Absorbs shock;  
- Transmission of vibrations in the inner ear;

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6. (a)



- Plotting (P) - 2 marks
- Labelling axes (L) - 2 marks
- Smooth curve (SC) - 1 mark
- Scale (S) - 2 mark

06

\* If upper limits are missing  
deny for one scale

\* Invested graph.  
max of 3 points awarded.  
- scale 2  
- Plotting 1

- If one origin is missing  
mark the one present.

- Scale must be workable.

- Extrapolations beyond small squares, curve is denied.

- If plotting is incorrect, the plot & curve are denied.

(b) (Using a glowing splint) it relights a glowing splint;

rej. burning

(1 mark)



- (c) Name the apparatus used for measuring light intensity. (1 mark)

Photometer / Light meter / Exposure meter / Photographic light meter;

- (d) Why was it necessary to get the shoot from an aquatic plant? (1 mark)

Aquatic plants are adapted to photosynthesizing under water / Can photosynthesize where intensity of light is low; Can utilize  $\text{CO}_2$  in solution form; It is easier to collect the gas produced by aquatic plants under water;

- (e) Account for the number of bubbles produced between the following units of light intensities.

- (i) 0-6 (3 marks)

Rapid increase in number of bubbles produced; due to increased light intensity; Which increased the rate of photosynthesis;

- (ii) 6-8 (3 marks)

Number of bubbles produced remains constant; Since the rate of photosynthesis had reached maximum; due to optimum light intensity; Other factors become limiting;

- (f) State two modifications one would make on the experimental set up to increase the rate of gas bubble production. (2 marks)

- Supply of sodium hydrogen carbonate in the set up;  
- Increase in number of shoots in the set up; - First 2  
- Increase in temperature; (Max 2)

- (g) Explain the limitations of using gas bubbles to determine the rate of photosynthesis. (2 marks)

- Photosynthesis and respiration occurs simultaneously in plants / Gases produced in one process are used in the other; Not all the bubbles may be accounted for / Some gas dissolves in water;

- (h) With a reason, predict the number of bubbles that would have been produced at 15 units of light intensity. (1 mark)

32 or any other value less than 32; photosynthesis had reached the peak;

Explanation for values less than 32 - Chlorophyll had bleached;





7. Method of excretion	Explanation:
(a) 1. Transpiration;	(Excess) water is lost in form of water vapour through Stomata/Lenticels;
2. Diffusion/Recycle/ Re-use;	- $\text{CO}_2$ (from respiration) / $\text{O}_2$ (from photosynthesis) / gases / waste products are eliminated through lenticels / Cuticle / Stomata / $\text{O}_2$ / $\text{CO}_2$ are reused in respiration / photosynthesis;
3. Deposition/Storage in non-toxic forms / organ fall;	- Some wastes e.g. Calcium Oxalate / Caffein / Nicotine / Quinin / are stored in non-toxic forms in tissues like leaves / flowers / buds / seeds / fruits / are eliminated when these tissues fall off;
4. Exudation;	- Some wastes are excreted in semi-solid forms / Salts / latex / gum / Calcium pectate / Resins;
5. Guttation;	(Excess) water is excreted in form of droplets through hydathodes;

Max = 5 mks.



7. (a) Describe how plants eliminate waste products. (8 marks)
- (b) Describe the structure and function of the mammalian nephron. (12 marks)
8. (a) Describe five tropic responses in plants and their survival values. (15 marks)

(b) Describe how the mammalian heart beat is controlled. (Max 12 marks)

7(b) It has renal tubule; and glomerulus/a network of blood capillaries; Bowman's capsule; for passage of the glomerular filtrate into the proximal convoluted tubule; and a glomerulus where ultrafiltration occurs; due to the difference in diameters of the blood vessels serving it; Afferent blood vessel/arterial; and efferent blood vessel/arterial; The proximal convoluted tubule; extends from the Bowman's capsule. The filtrate flows through the proximal convoluted tubule where useful substances/such as glucose, amino acids, some water and mineral salts are selectively reabsorbed into the blood stream; by active transport/Diffusion/Osmosis; (Acp Osmosis only when water is mentioned as one of the useful substances).

The loop of henle / Ascending and descending loop of henle; Descending loop of henle is for reabsorption of water; Ascending loop of henle is for reabsorption of mineral salts; The distal convoluted tubule; where (much) water is reabsorbed (into the blood stream) by Osmosis/Under influence of ADH; and (more) mineral salts are reabsorbed by diffusion/Active transport/Under influence of Aldosterone hormone; Collecting tubule; for reabsorption of more water;

N/B. ✓ If the student writes by naming the useful substance, they must be 2 for the student to score

✓ Ascending & descending limbs of loop of henle must be named together for the student to score.

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✓ If the student draws and labels the diagram of the nephron, it is awarded 231/2 (Afferent & efferent arterials must show difference in diameter)



8. a)

Name of tropism	Definition/Explanation.	Effects on shoots and roots	Survival values
1. Phototropism;	- Growth curvature in response to direction of light;	- Shoots are positively phototropic / Roots are -vely phototropic;	- To reach light for photosynthesis;
2. Chemotropism;	- Growth response to chemical substances / mineral ions;		- Growth of pollen tube towards the embryo sac / growth of roots towards mineral salts / Absorption / uptake;

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③ Geotropism/  
Gravitropism;

Growth response to gravity;

Shoots are -vely geotropic / Roots are +vely geotropic;

④ Hydrotropism;

- Growth response to water/moisture

- Roots are +vely hydrotropic;

⑤ Thigmotropism/  
Haptotropism;

- Growth response due to contact; (With solid objects) & conduct

- Enables roots to search water / Mineral salts for absorption / enables roots to grow into the soil for anchorage;

- Enables roots to search water for absorption;

= Observed in climbing stems / tendrils / plants with weak stems to enable them search light for photosynthesis / expose flowers for pollination / expose fruits for dispersal;



8(b) Mammalian heartbeats controlled in 2 ways, (During the non-nervous control), the cardiac muscles are myogenic/ initiate their own contractions/relaxations; Stimulation/electrical excitations/electrical charges originates from within/in the Sino atrial node/SAN; stimulation/electrical excitations/electrical charges spread through auricles leading to their contraction; Stimulation proceed to the atrioventricular node/AVN; into the Purkinje tissue; to all ventricles which contracts; (During the nervous control), Blood pressure and chemical composition of blood is monitored by Cardiovascular centre of the brain; the rate can be increased by Sympathetic nerve; heart beat rate lowered by Vagus nerve/Parasympathetic nerve; (max 5mks)

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