

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

231/1

Paper I

BIOLOGY – (Theory)

Dec. 2022 – 2 hours

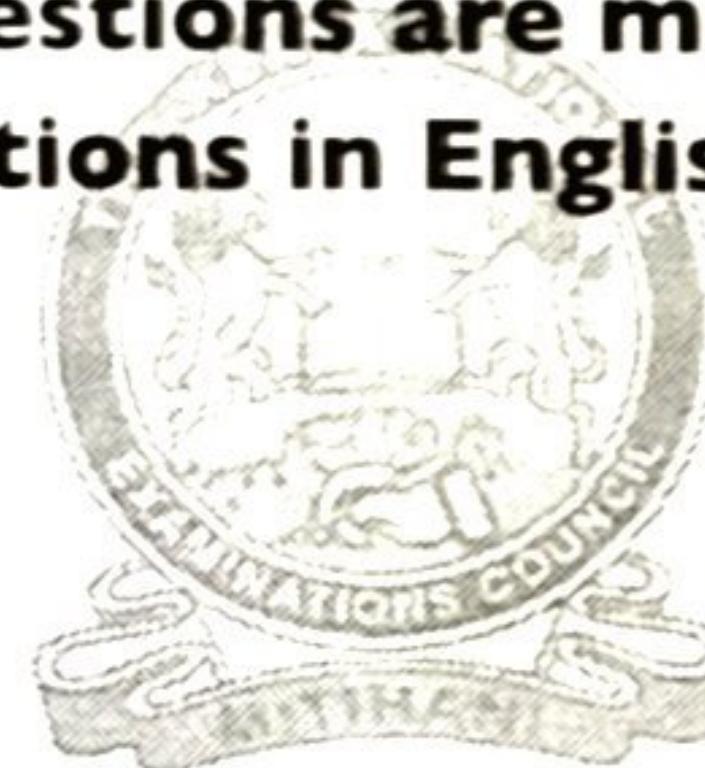


Name **Index Number**

Candidate's Signature **Date**

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) Answer **all** the questions in this question paper.
- (d) **This paper consists of 12 printed pages.**
- (e) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (f) **Candidates should answer the questions in English.**



For Examiner's Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

17	18	19	20	21	22	23	24	25	Grand Total	

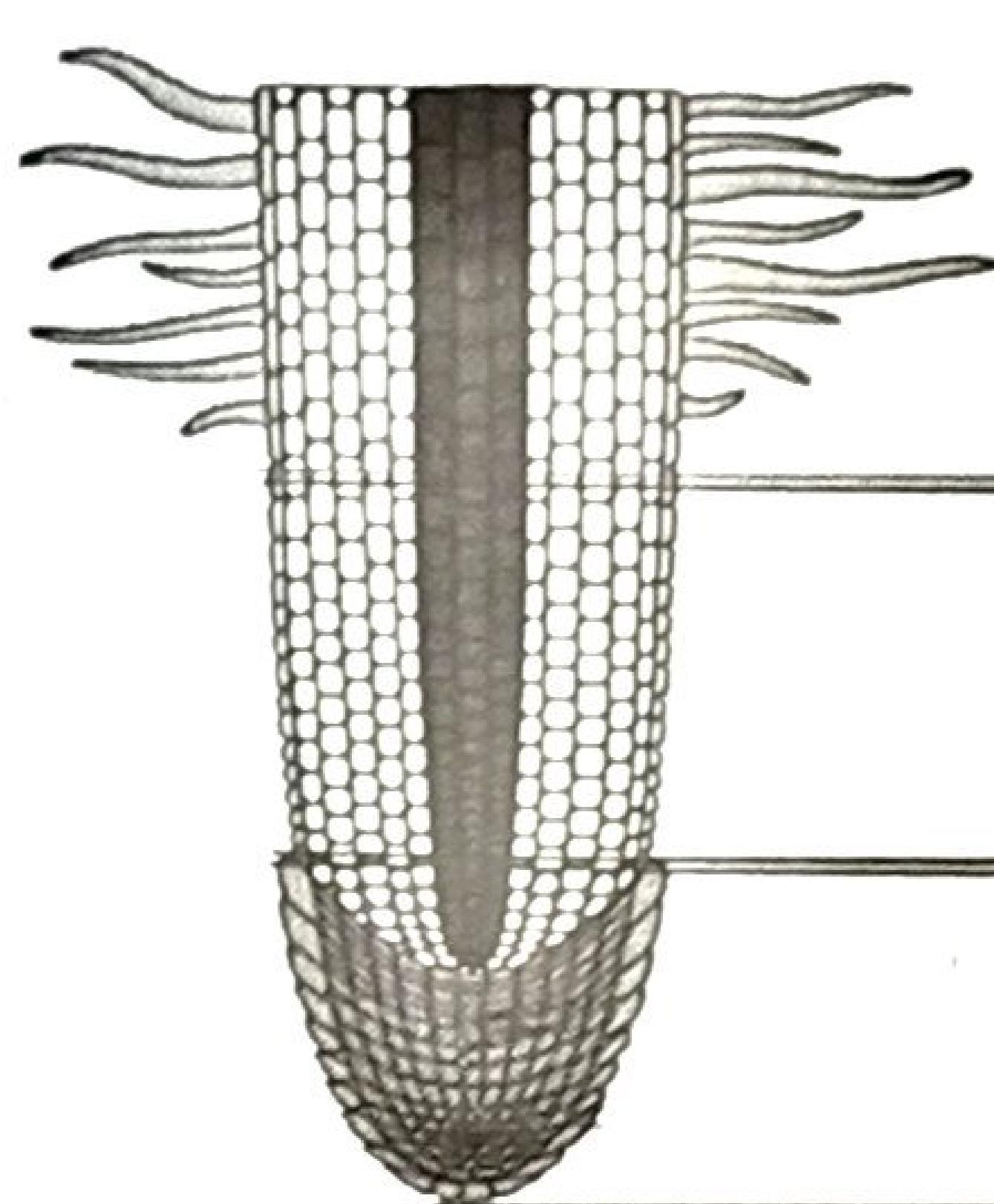


Answer all the questions in the spaces provided.

1. State **two** reasons why humans are **not** commonly used as specimens for genetic studies. (2 marks)

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2. On the diagram of the root tip below, label the regions where:



- (a) cells become specialised as **E** (1 mark)
- (b) cells increase in size as **F** (1 mark)
3. (a) State **two** environmental conditions that can lead to the formation of carboxyhaemoglobin in the human body. (2 marks)

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- (b) Explain the effect of carboxyhaemoglobin in the human body. (2 marks)

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4. State the significance of each of the following characteristics of the mammalian lungs:

- (a) being elastic (1 mark)

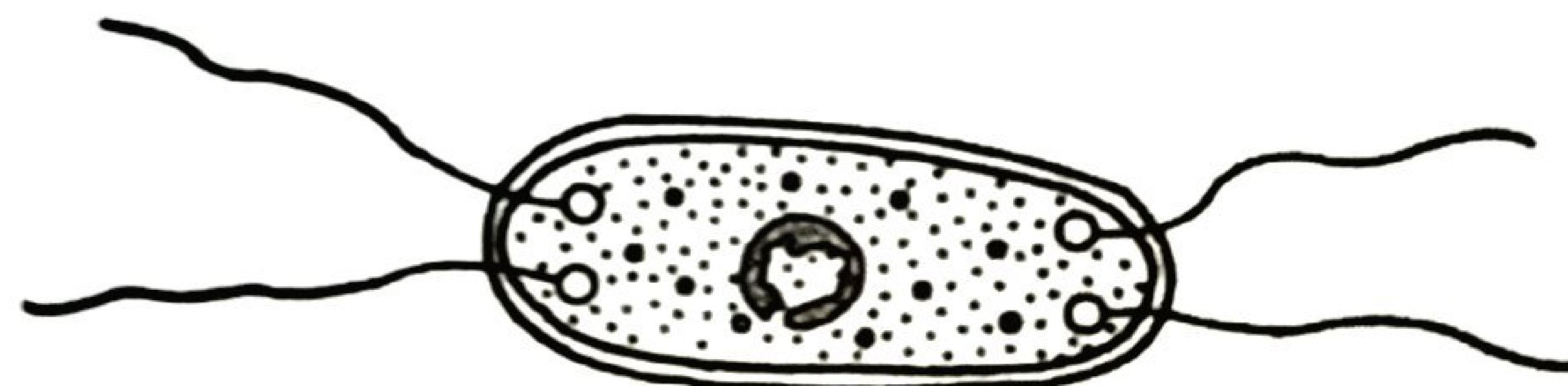
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- (b) having pleural fluid. (1 mark)

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5. Below is a diagram of a bacterium.



- (a) Identify the Kingdom to which the organism belongs. (1 mark)

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- (b) State **two** features shown on the diagram that are characteristics of this Kingdom. (2 marks)

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6. (a) Name the part of the ovule that forms each of the following structures after fertilisation:

- (i) zygote (1 mark)

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- (ii) testa. (1 mark)

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- (b) Name the hormone responsible for the development of a deep voice in humans. (1 mark)

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7. (a) Differentiate between a population and a community as used in ecology. (1 mark)

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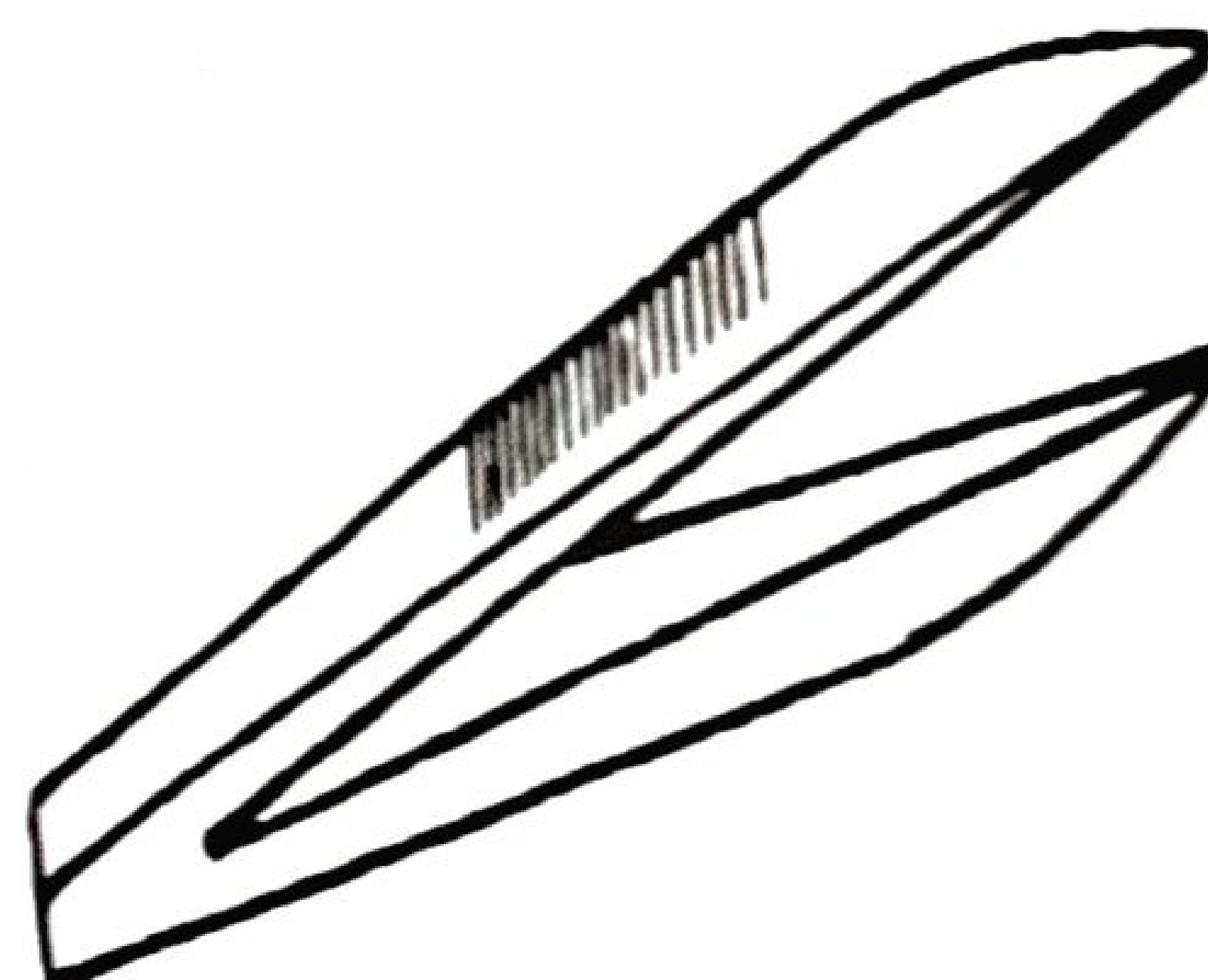
- (b) Explain **one** negative effect of the use of herbicides on human health. (1 mark)

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- (c) State **two** ways through which energy is lost from one trophic level to the next in a food chain. (2 marks)

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8. The following apparatus is used in biological studies.



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- (a) Identify the apparatus. (1 mark)

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- (b) State its function. (1 mark)

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9. (a) Give **two** reasons why anaerobic respiration yields less energy than aerobic respiration. (2 marks)

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- (b) Explain why fats are **not** efficient respiratory substrates. (2 marks)

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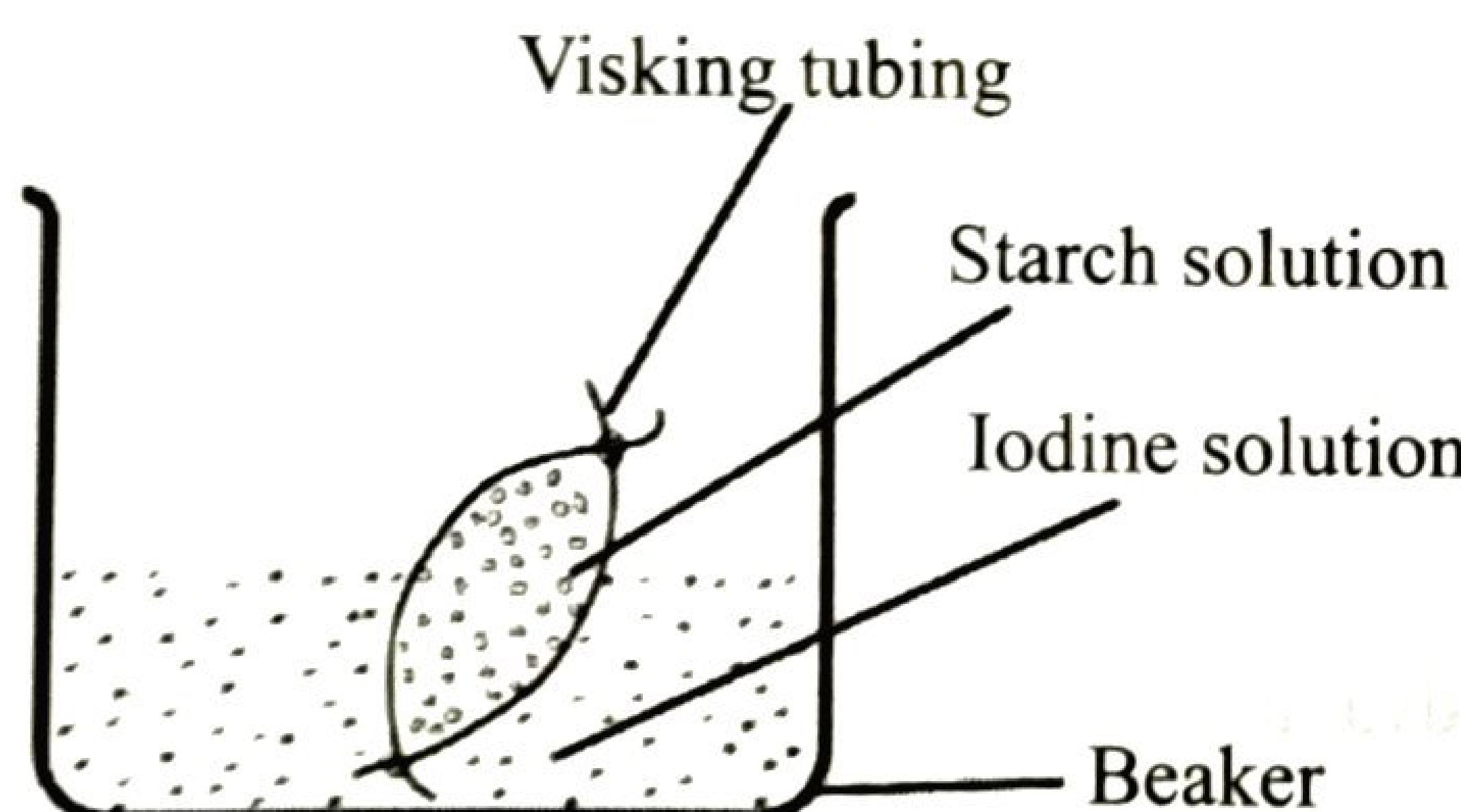
10. The table below shows the concentration in parts per million of sodium and iodide ions in sea water and cell sap of a plant.

	Sodium ions concentration	Iodide ions concentration
Sea water	326	39
Cell sap	162	574

- (a) (i) Which of the two ions intake will be affected if the plant was sprayed with a chemical that inhibits respiration. (1 mark)

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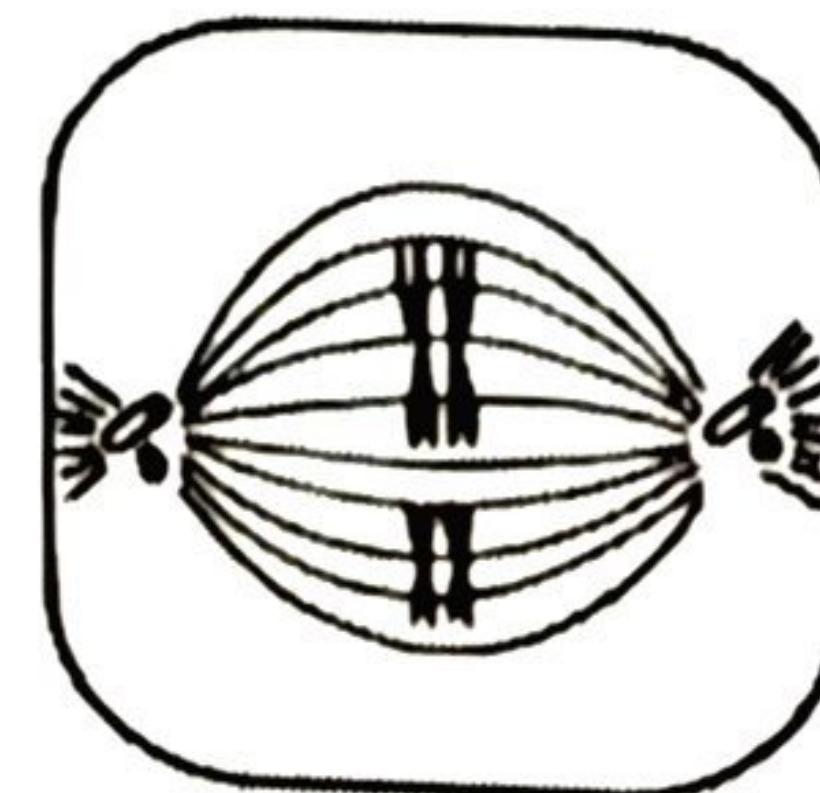
- (b) An experiment was set up as shown in the diagram below.



At the end of the experiment it was observed that the starch turned blue black while the colour of iodine solution in the beaker did **not** change. Account for this observation. (2 marks)

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11. The diagram below represents a stage in cell division.



- (a) (i) Name the stage of cell division illustrated. (1 mark)
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- (ii) Give a reason for your answer in 11(a)(i). (1 mark)
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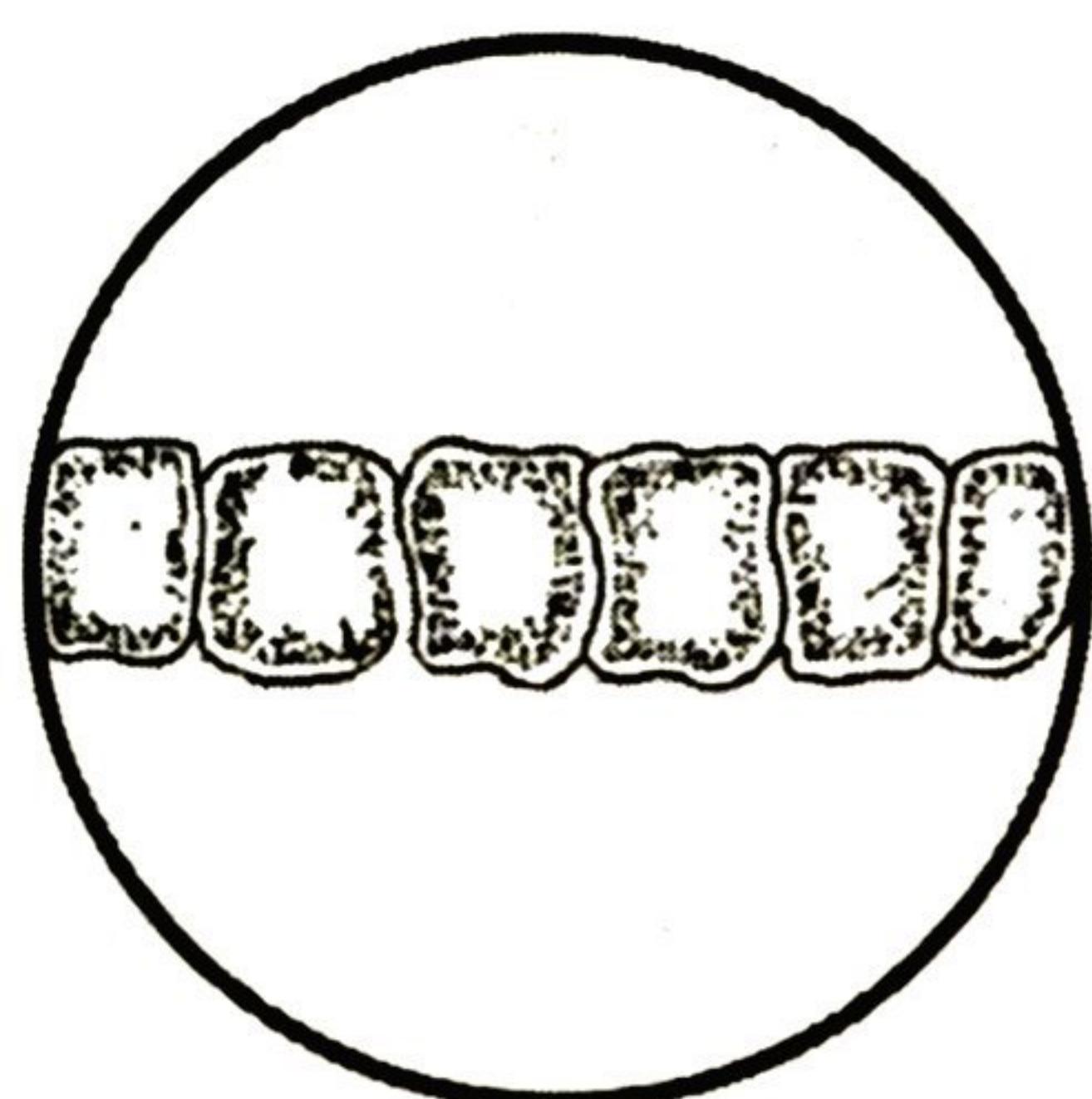
- (b) In the space below, illustrate the next stage of cell division after the one illustrated above. (1 mark)

- (c) Explain the disadvantage of in-breeding among living organisms. (2 marks)
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12. Explain why protozoans do **not** require an elaborate system of gaseous exchange. (2 marks)

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13. The diameter of the field of view of a light microscope was found to be 1.5 mm. Cells observed under the field of view appeared as shown below.



Determine the length of each cell in micrometers. ($1\text{ mm} = 1000\text{ }\mu\text{m}$) (2 marks)

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14. Name the cell organelle responsible for each of the following activities:

(a) protein synthesis (1 mark)

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(b) transport of lipids (1 mark)

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15. Name two organisms that belong to the Kingdom Protocista. (2 marks)

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16. (a) Explain why only the fine adjustment knob should be used when focusing a specimen using the high power objective lens of the light microscope. (2 marks)

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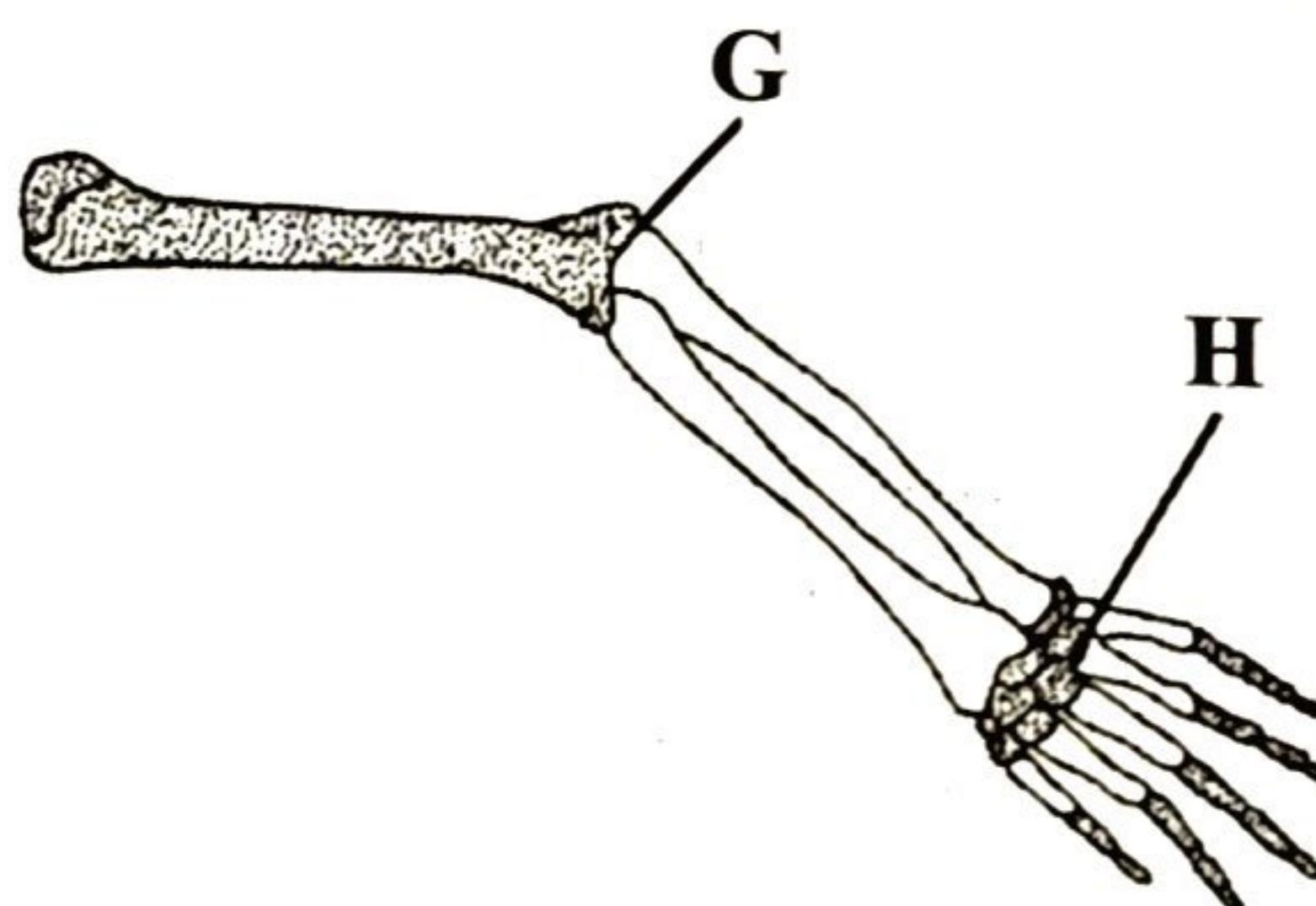
- (b) An animal cell was viewed under a light microscope using objective lens of $\times 75$ and eye piece lens of $\times 10$. Determine the total magnification of the image. (2 marks)

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17. A goat and a sheep are both herbivores. Explain why the two can comfortably exist in the same ecosystem. (2 marks)

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18. The diagram below shows the bones of the human arm.



- (a) Name the type of joint formed in the region labelled:

(i) G (1 mark)

(ii) H (1 mark)

19. (b) Explain why the bones of the cranium are fused. (1 mark)

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19. 60 white and 60 black mice were released in an area inhabited by jackals. After six weeks, it was established that 24 black and 8 white mice had remained.

- (a) Account for the above observation. (3 marks)

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- (b) Name the evolution theory that supports this observation. (1 mark)

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20. A small amount of a substance K was applied on one side of bean coleoptiles. After 36 hours, the coleoptiles curved away from the side where the substance was applied.

- (a) Suggest the likely identity of substance K. (1 mark)

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- (b) Explain how the substance may have caused coleoptiles to curve. (3 marks)

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21. Explain the role of antidiuretic hormone when the human blood water level is below normal. (3 marks)

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22. Equal amounts of crushed Irish potato were placed in equal volumes of hydrogen peroxide solution at various pH values. A gas, L, was produced, its volume measured and recorded as shown in the table below.

pH	4.2	7.0	9.2
Volume of gas L (cm ³)	2.9	5.9	7.9

- (a) Identify gas L. (1 mark)

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- (b) Account for the difference in the volume of gas L produced at pH values 4.2 and 9.2. (3 marks)

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23. (a) Name the causative agent of Trichomoniasis. (1 mark)

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- (b) State the role of hair-like structures in each of the following: (2 marks)

(i) fallopian tube

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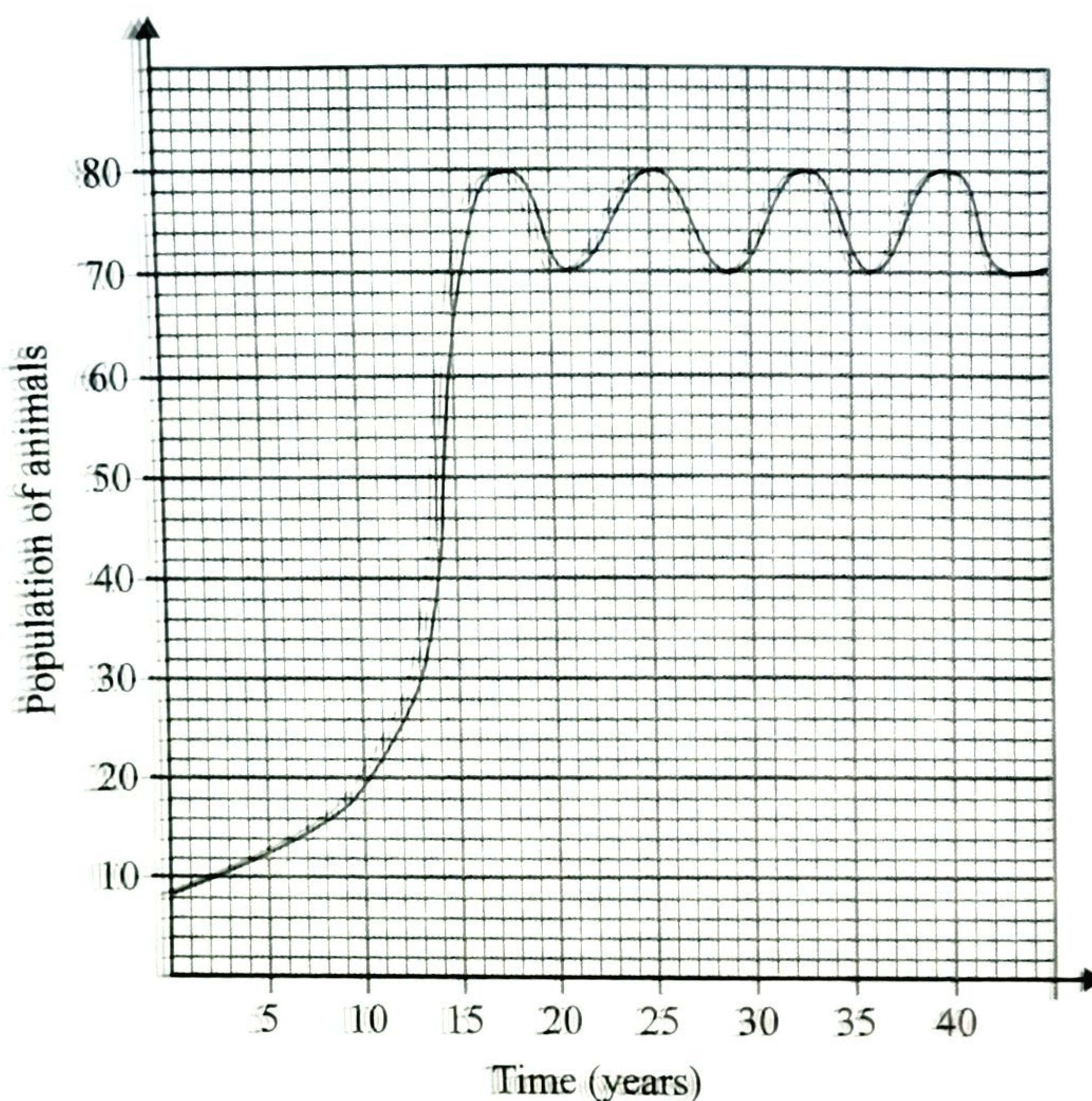
(ii) nasal lining.

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- (c) Name the agent of pollination in a maize plant. (1 mark)

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24. Below is a graphical representation of the population of animals in a certain ecosystem over a period of time.



- (a) Determine the carrying capacity of the ecosystem. (1 mark)
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- (b) Account for the change in population for the first 15 years. (3 marks)
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25. The photograph below shows a plant obtained from a certain habitat.



- (a) Suggest the likely habitat for the plant. (1 mark)

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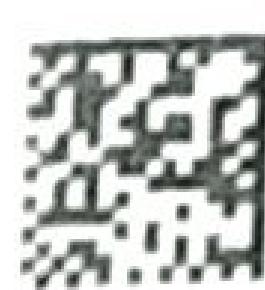
- (b) Explain your answer in 25(a). (3 marks)

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BIOLOGY – (Practical)

Dec. 2022 – 1½ hours



Name **Index Number**

Candidate's Signature **Date**

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) Answer **all** the questions in the spaces provided.
(d) You are required to spend the first 15 minutes of the 1½ hours allowed for this paper reading the whole paper carefully before commencing your work.
(e) Additional pages must **not** be inserted.
(f) **This paper consists of 7 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.**

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Question	Maximum Score	Candidate's Score
1	13	
2	14	
3	13	
Total Score	40	

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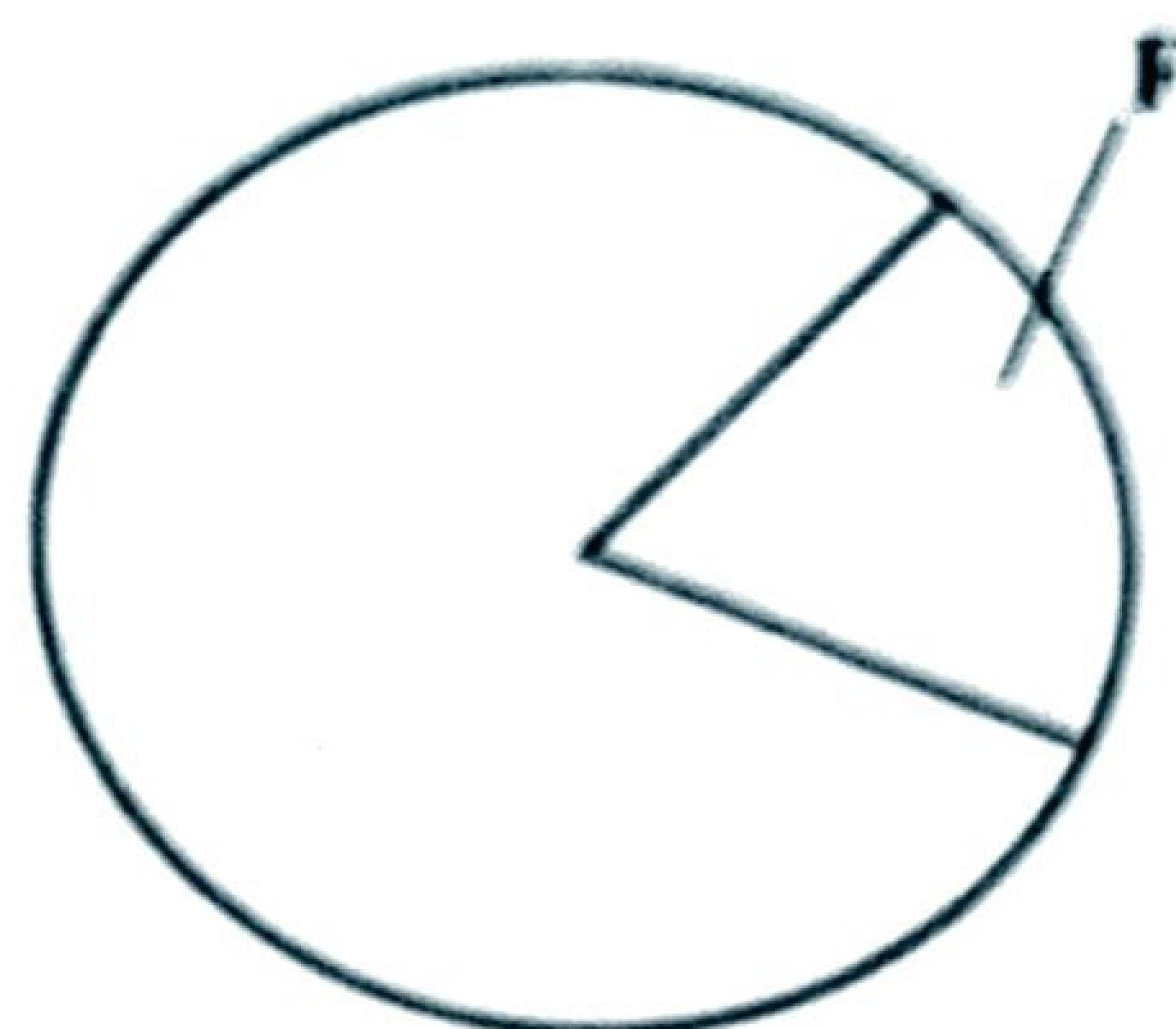


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I. You are provided with the following material and apparatus:

- A prepared slide, labelled E containing the transverse section through a plant organ.
 - Access to a light microscope with at least the low and medium power objective lens.
- (a) Observe the section under the low power and medium power objective lens of the light microscope.
- (i) Fill the portion, labelled F in the plan diagram below to show (a portion of) the structures seen under the medium power objective of the light microscope.
Label the structures. (3 marks)



- (ii) Calculate the magnification of the image observed under low power objective lens. (2 marks)
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- (b) With reference to one observable feature, state the Class of plants from which the organ was obtained. (2 marks)
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- (c) Name the plant part from which the section was obtained. (1 mark)
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- (d) State two precautions one should take to ensure the safety of the slide during observation under the microscope. (2 marks)
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- (e) State how each of the following parts of the light microscope contributed to clarity of the image of the section observed. (3 marks)

(i) Mirror

(ii) Diaphragm

(iii) Condenser

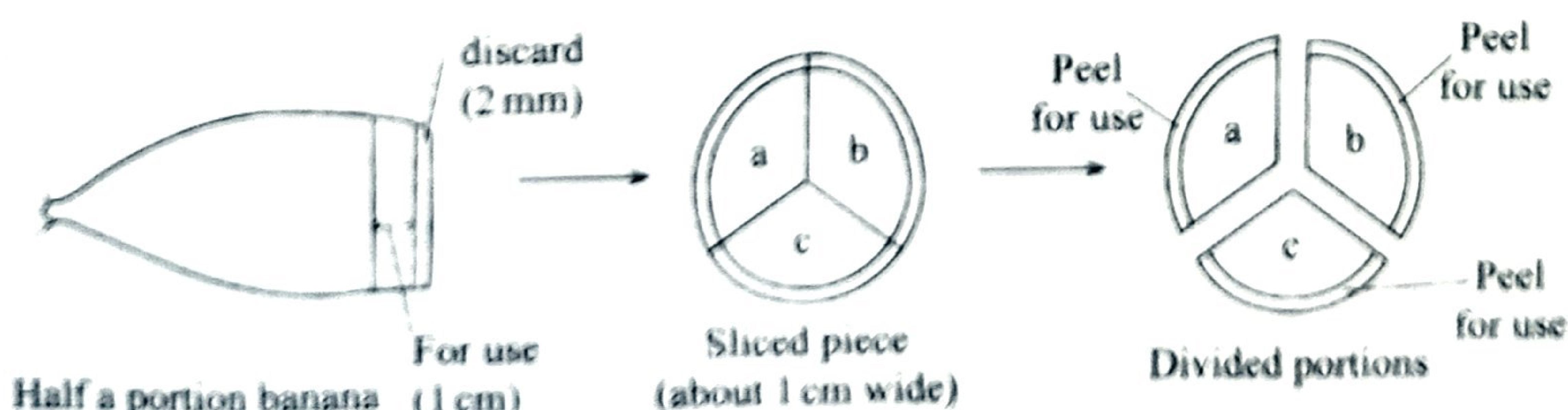
● 2.

You are provided with the following materials and reagents.

- Half a portion of raw banana
- 3 beakers labelled **G**, **H** and **J** treated as follows:
 - Beaker **G** contains 50 ml of dilute hydrochloric acid
 - Beaker **H** contains 50 ml of distilled water
 - Beaker **J** is empty
- Scalpel
- Spatula/pair of forceps
- A white plain paper or white tile
- Stopwatch/means of timing

When some plant tissues are exposed, enzymes on the exposed surfaces react with oxygen. Using the provided materials, investigate the enzyme-oxygen reaction using the procedure below.

- I. Slice off about 2 mm from the exposed end of the raw banana and discard the slice.
- II. Slice another piece, about 1 cm wide from the remaining banana to use in the investigation.
- III. Divide the portion obtained in (II.) above into three parts (**a**, **b** and **c**) as illustrated in the diagram below.



- IV. Remove the peel from portion **a**, cut the peel into three pieces and immediately drop all the three pieces into beaker **G** (containing hydrochloric acid). Obtain peels **only**, without remnants of banana flesh.
- V. Repeat procedure IV with peels from portion **b** into beaker **H** (containing distilled water) and those from portion **c** into beaker **J**.
- VI. Leave the set-up for five minutes and observe the inner surfaces of the banana peels in each beaker.
- (a) (i) Record the observations made in each case. (3 marks)

G

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H

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J

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- (ii) Account for the observations made in beakers **H** and **J**.

Beaker **H**

(2 marks)

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Beaker **J**

(2 marks)

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- VII. Using the spatula/pair of forceps provided, remove the peels from each beaker and expose the sets of peels separately on the plain paper/white tile provided. Leave them for a further five minutes and observe.

- (b) (i) Record the observations made on the peels from beakers **H** and **J**.

H

(1 mark)

.....

J

(1 mark)

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- (ii) Account for the observations on the surfaces of peels from beakers **G** and **J** after a further 5 minutes.

G

(1 mark)

J

(1 mark)

- (c) Suggest the suitable pH for the enzymes found on the surface of the banana peels.

(1 mark)

- (d) Suppose the peels in set up **J** were initially boiled for 5 minutes.

- (i) Suggest the observations that would have been made.

(1 mark)

- (ii) Explain the observations made in (d)(i).

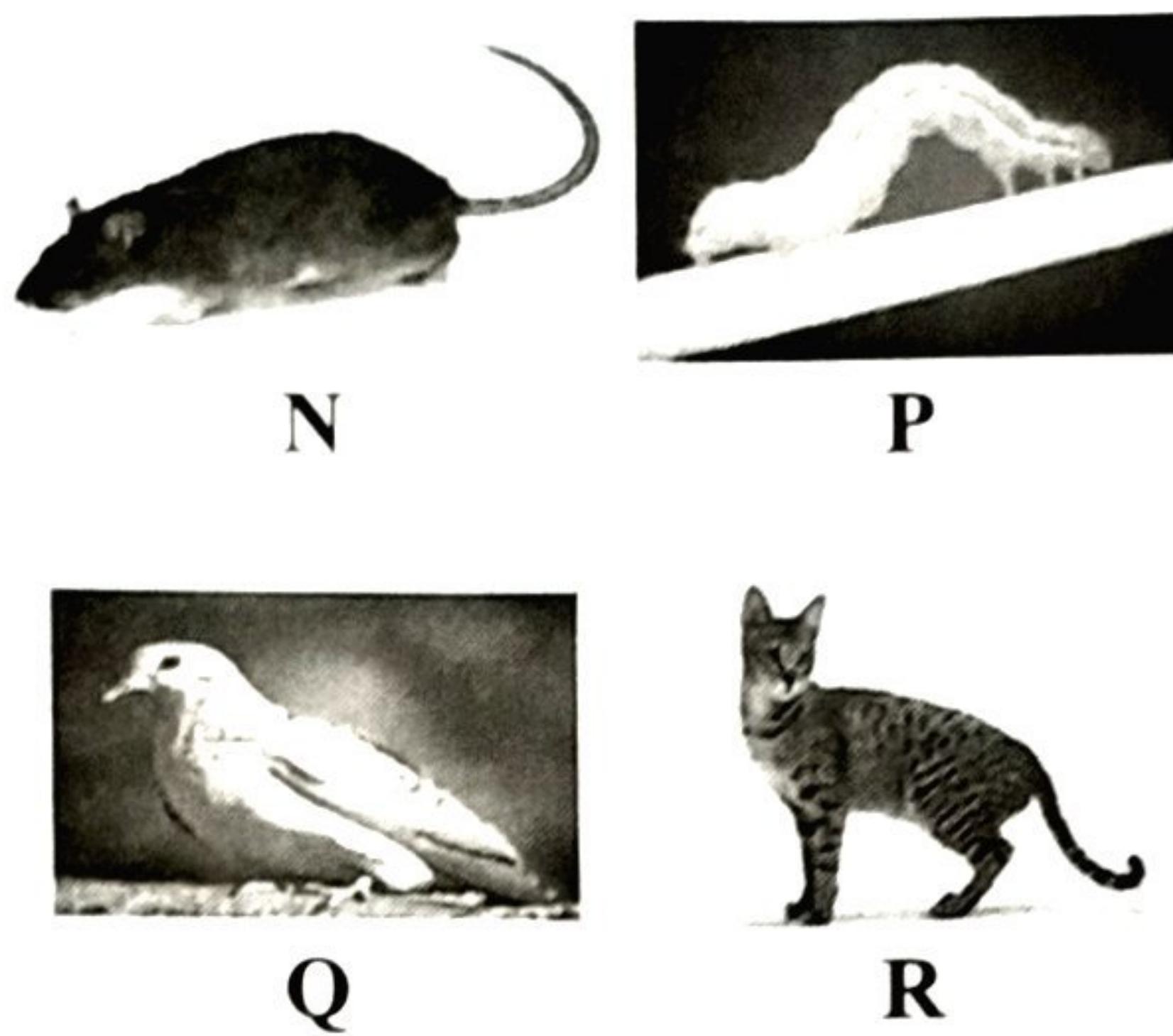
(1 mark)

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3. You are provided with specimens labelled **K** and **L** together with photographs of organisms labelled **N**, **P**, **Q** and **R**.



Assuming the organisms are found in the same ecosystem:

- (a) (i) Construct a complete food web that includes the specimens and photographs of organisms in this ecosystem. (8 marks)
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- (ii) From the food web, identify the longest food chain. (2 marks)
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- (b) (i) Identify the organisms with the highest biomass. (1 mark)
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- (ii) Give a reason for your answer in (b)(i) above. (1 mark)
-
- (c) Other than feeding, explain how the organism represented in photograph R benefits from specimen K. (1 mark)
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