

FOR OFFICIAL USE

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**X007/201**

NATIONAL  
QUALIFICATIONS  
2000

MONDAY, 29 MAY  
9.00 AM – 11.00 AM

BIOLOGY  
INTERMEDIATE 2

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

**SECTION A (25 marks)**

Instructions for completion of Section A are given on page two.

**SECTIONS B AND C (75 marks)**

- (a) All questions should be attempted.  
(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.
- The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- Additional space for answers and rough work will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this book.
- The numbers of questions must be clearly inserted with any answers written in the additional space.
- Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

### Read carefully

- 1 Check that the answer sheet provided is for Biology Intermediate 2 (Section A).
- 2 Fill in the details required on the answer sheet.
- 3 In this section a question is answered by indicating the choice A, B, C or D by a stroke made in **ink** in the appropriate place in the answer sheet—see the sample question below.
- 4 For each question there is only **one** correct answer.
- 5 Rough working, if required, should be done only on this question paper, or on the rough working sheet provided—**not** on the answer sheet.
- 6 At the end of the examination the answer sheet for Section A **must** be placed inside the front cover of this answer book.

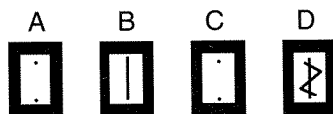
### Sample Question

Which of the following are the raw materials for photosynthesis?

- A Carbon dioxide and glucose
- B Carbon dioxide and water
- C Oxygen and water
- D Oxygen and glucose

**The correct answer is B**—carbon dioxide and water. A **heavy** vertical line should be drawn joining the two dots in the appropriate box in the column headed **B** as shown **in the example on the answer sheet**.

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and put a vertical stroke in the box you now consider to be correct. Thus, if you want to change an answer **D** to an answer **B**, your answer sheet would look like this:



If you want to change back to an answer which has already been scored out, you should **enter a tick (✓)** to the **RIGHT** of the box of your choice, thus:



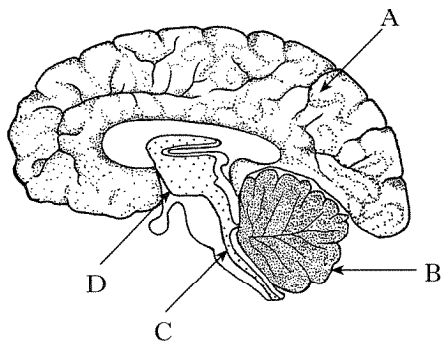
SECTION A

All questions in this Section should be attempted.

1. Which of the following lists all the elements that are present in every protein molecule?
- A Carbon, hydrogen, oxygen, nitrogen
  - B Carbon, oxygen, nitrogen
  - C Carbon, hydrogen, oxygen, sulphur
  - D Carbon, hydrogen, oxygen
2. The table below shows some of the features of blood vessels.
- Which line describes features of arteries?

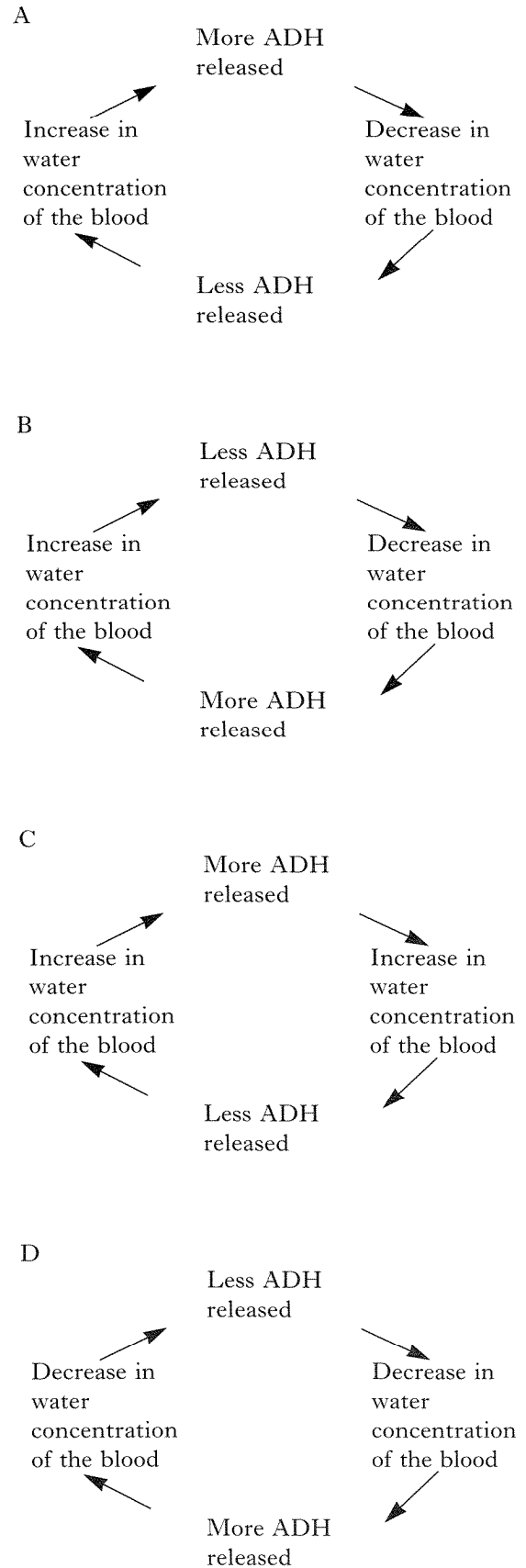
	<i>Direction of blood flow</i>	<i>Detection of pulse</i>	<i>Presence of valves</i>
A	Towards the heart	Yes	No
B	Away from the heart	No	Yes
C	Towards the heart	No	Yes
D	Away from the heart	Yes	No

Questions 3 and 4 refer to the diagram below which shows the human brain.

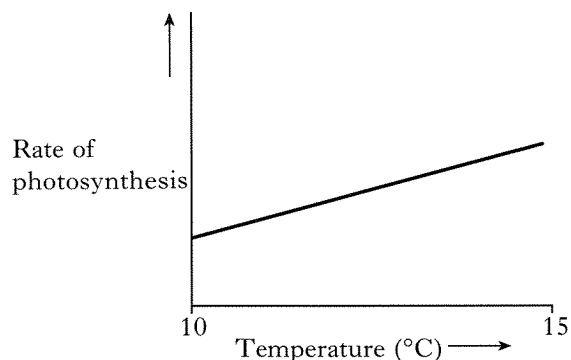


3. Which labelled arrow is pointing to the cerebellum?
4. Which labelled part is the site of temperature regulation?

5. Which of the diagrams below describes negative feedback control by anti-diuretic hormone (ADH)?

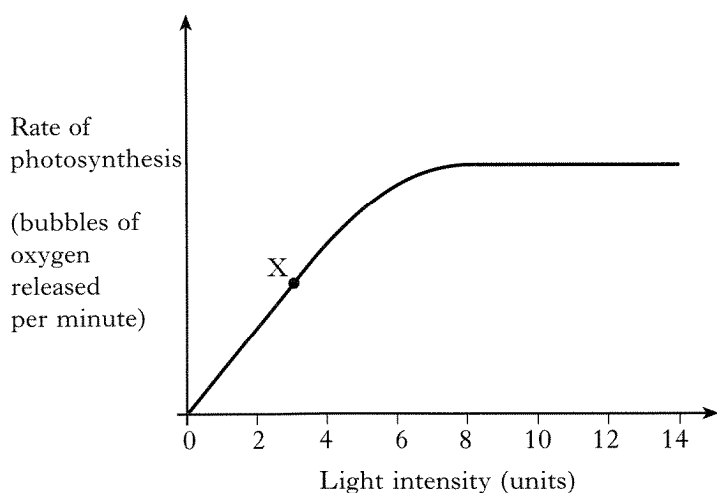


6. The graph below shows the effect of temperature on the rate of photosynthesis in a plant.



A correct conclusion would be that

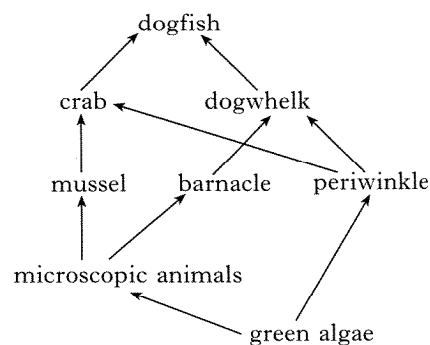
- A as the temperature increases, the rate of photosynthesis increases
  - B as the temperature increases, the rate of photosynthesis decreases
  - C as the temperature increases, the rate of photosynthesis remains constant
  - D as the temperature decreases, the rate of photosynthesis increases.
7. The graph below shows the effect of increasing light intensity on the rate of photosynthesis.



Which factor is limiting the rate of photosynthesis at point X on the graph?

- A Carbon dioxide concentration
- B Temperature
- C Light intensity
- D Oxygen concentration

8. The diagram below shows a food web from the seashore.



The mussel can be described as a

- A producer
  - B primary consumer
  - C secondary consumer
  - D decomposer.
9. Plants convert 1% of the light energy they receive into new plant material. In the food chain below, primroses receive 100 000 units of light energy.

Primrose → vole → weasel → owl

How much of this energy is converted into new plant material?

- A 10 000 units
  - B 1000 units
  - C 100 units
  - D 10 units
10. Which of the following describes a population in an ecosystem?
- A The total number of one species present
  - B All the living organisms and the non-living parts of the ecosystem
  - C All the living organisms
  - D All the plants
11. Which term refers to the process by which organisms that are better adapted to their environment survive and breed?
- A Meiosis
  - B Natural selection
  - C Selective breeding
  - D Genetic engineering

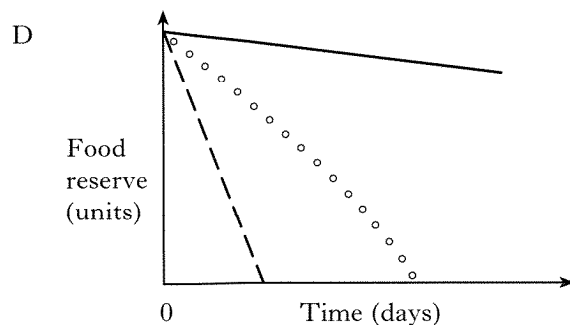
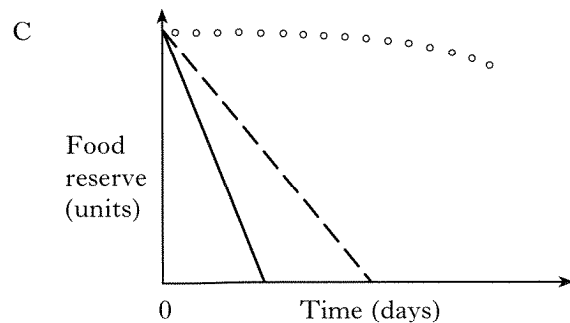
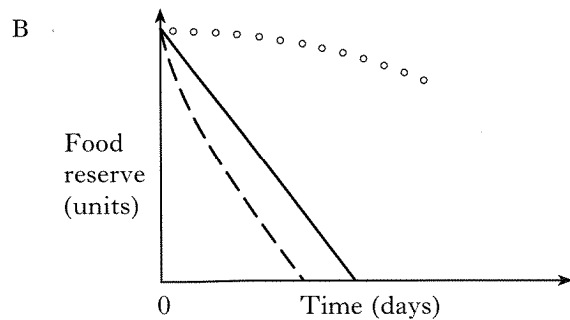
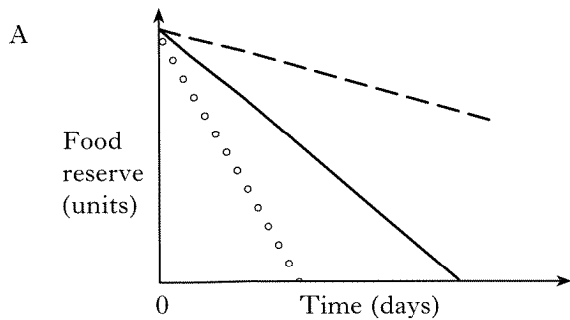
12. When the body is starved of food it has to rely on its food reserves to provide energy.

The first food reserves to be used are carbohydrates, then fats; after several weeks of starvation, proteins are used.

Which of the graphs below shows what would happen to the food reserves if an individual was starved for several weeks?

**Key**

carbohydrate	—————
fat	- - - - -
protein	o o o o o



13. A garden pond has snails, goldfish, water lilies and some pondweed living in it.

Students monitored the oxygen concentration of the water and found that it was too low.

Which of the following changes should they make to increase the oxygen concentration of the water?

- A Remove some snails and add more goldfish  
 B Remove some snails and add more pondweed  
 C Remove some pondweed and add more snails  
 D Remove some water lilies and add more goldfish

14. Which of the following shows the use of energy released from the breakdown of glucose?

- A  $ATP + Pi \rightarrow ADP$   
 B  $ADP + Pi \rightarrow ATP$   
 C  $ATP \rightarrow ADP + Pi$   
 D  $ADP \rightarrow ATP + Pi$

15. The movement of water through a selectively permeable membrane from an area of high water concentration to an area of low water concentration is called

- A absorption  
 B osmosis  
 C plasmolysis  
 D filtration.

[Turn over

Questions 16 and 17 refer to the information below.

In mice, the dominant form (B) of one gene determines black coat colour; brown coat colour results from the recessive form (b) of the gene.

A cross between two mice is shown below.

P BB × bb

F<sub>1</sub> Bb

16. Which of the following shows all the possible genotypes of the F<sub>2</sub> generation?

- A BB and Bb
- B bb and Bb
- C BB and bb
- D BB, Bb and bb

17. What proportion of the F<sub>2</sub> generation would be expected to have black coats?

- A  $\frac{1}{4}$
- B  $\frac{1}{2}$
- C  $\frac{2}{3}$
- D  $\frac{3}{4}$

18. In humans, which of the following gametes would determine a male offspring at fertilisation?

- A An egg cell with an X chromosome
- B An egg cell with a Y chromosome
- C A sperm cell with an X chromosome
- D A sperm cell with a Y chromosome

19. Which line in the table below names gametes and their sites of production in a flowering plant?

	Male gamete	Site of production	Female gamete	Site of production
A	Sperm	testes	egg	ovule
B	Pollen nucleus	anther	egg cell	ovary
C	Sperm	anther	egg	ovary
D	Pollen nucleus	testes	egg cell	ovule

20. Which term refers to a description of a characteristic of an organism?

- A Genotype
- B Phenotype
- C Allele
- D Natural selection

21. Which term refers to forms of a gene controlling the same characteristic?

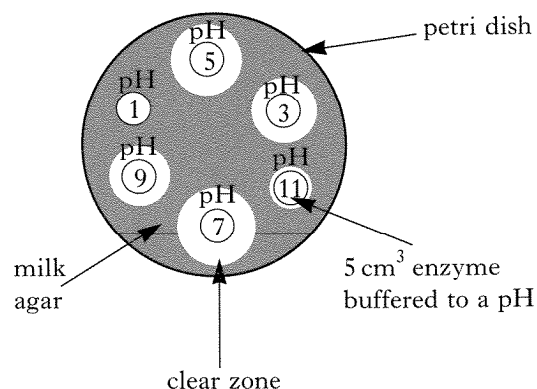
- A Genotypes
- B Phenotypes
- C Alleles
- D Dominant

Questions 22, 23 and 24 refer to the information below.

An investigation into the effect of pH on the digestion of milk by an enzyme was carried out.

Five identical dishes were set up with wells cut out of the agar.

To each well was added 5 cm<sup>3</sup> of the enzyme kept at a different pH as shown in the diagram below.



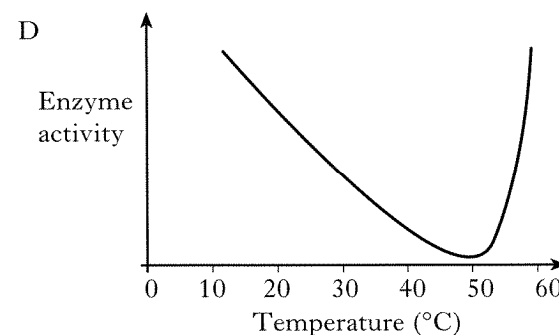
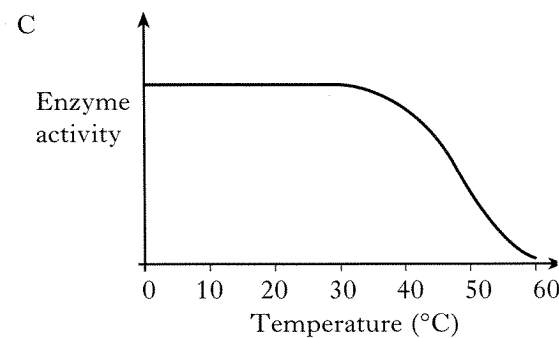
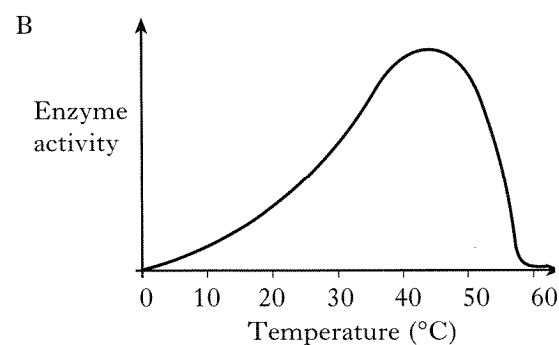
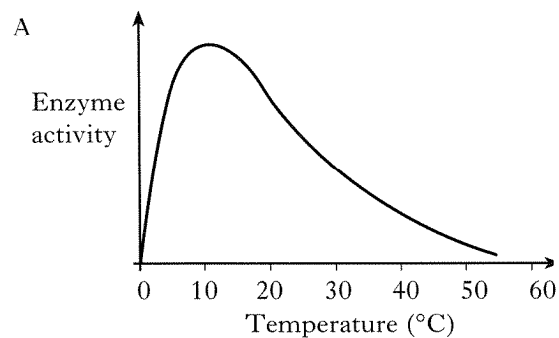
The dishes were kept at 35 °C.

The diameter of the area cleared by the action of the enzyme was measured.

pH	Diameter of clear zone (mm)				
	Dish 1	Dish 2	Dish 3	Dish 4	Dish 5
1	0	0	0	0	0
3	2	1	1	2	1
5	3	4	2	3	3
7	6	5	5	5	4
9	2	2	3	1	2
11	1	0	0	1	0

22. The average diameter cleared at pH 5 was
- A 3 mm
  - B 4 mm
  - C 5 mm
  - D 6 mm.
23. The variable altered in this investigation was
- A temperature
  - B diameter of the well
  - C pH
  - D milk concentration.
24. The pH at which the enzyme was most active was
- A 3
  - B 5
  - C 7
  - D 9.

25. Which of the graphs below shows the effect of increasing temperature on enzyme activity?



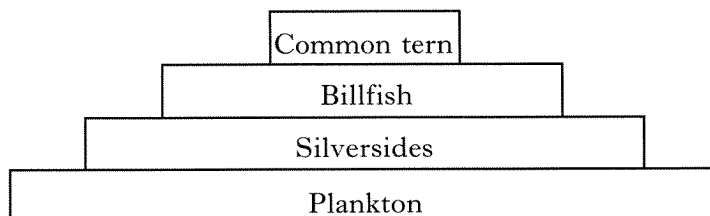
Candidates are reminded that the answer sheet for Section A **MUST** be placed inside the front cover of this answer book.

**SECTION B**

**All questions in this section should be attempted.**

Marks

1. The diagram below shows the pyramid of numbers for a food chain of a coastal bay.



- (a) (i) Present the information in the diagram as a food chain.

\_\_\_\_\_

1

- (ii) Use the diagram above to explain what is meant by the term *pyramid of numbers*.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

- (b) What other feature of a food chain can be represented as a pyramid?

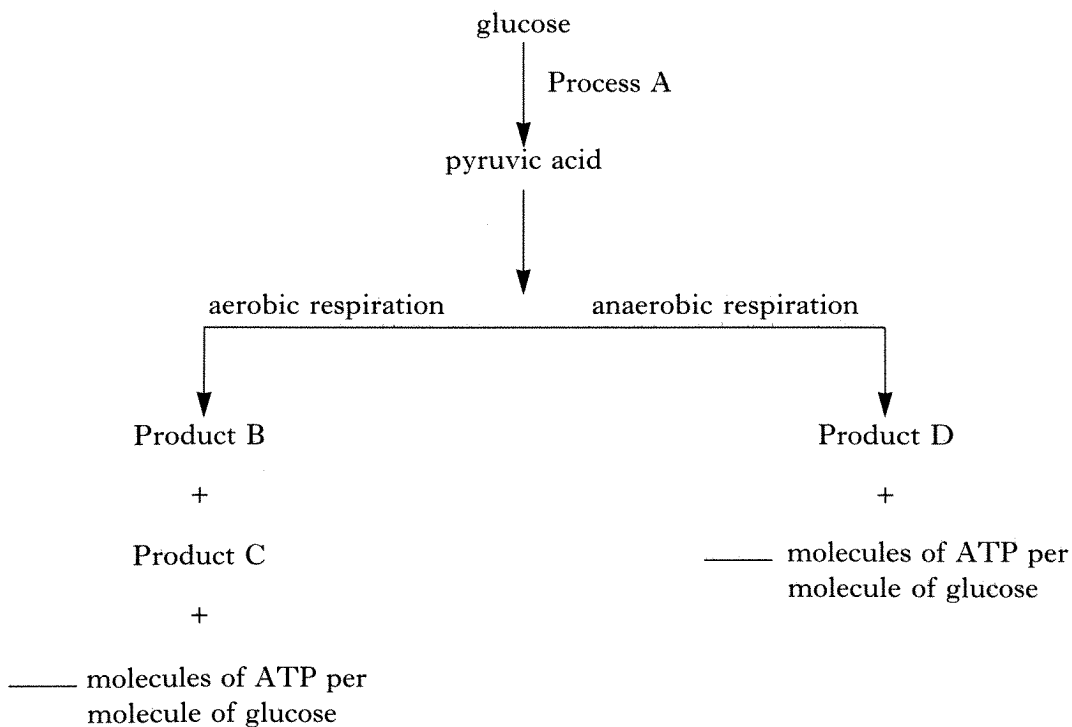
\_\_\_\_\_

1



Marks

2. The diagram below shows some steps in respiration in muscle cells.



(a) Name Process A.

\_\_\_\_\_

1

(b) Name the products B, C and D.

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

2

(c) State the number of molecules of ATP produced from each molecule of glucose by

(i) aerobic respiration \_\_\_\_\_

(ii) anaerobic respiration. \_\_\_\_\_

1

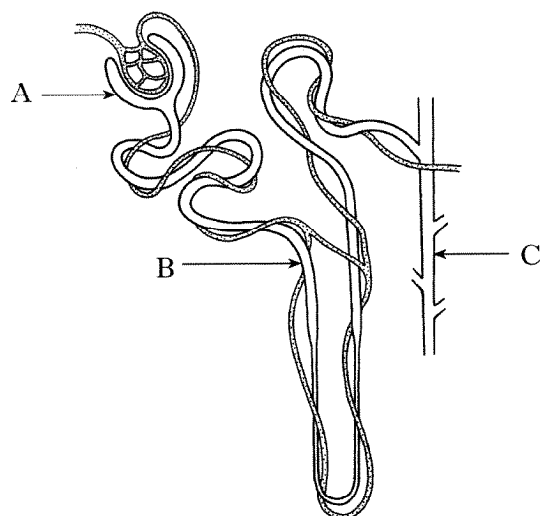
(d) Why might a muscle cell switch from aerobic to anaerobic respiration?

\_\_\_\_\_

1

Marks

3. The diagram below represents a kidney nephron.



(a) (i) Name the processes which take place in the areas labelled A and B.

A \_\_\_\_\_

B \_\_\_\_\_

2

(ii) Name the structure labelled C.

\_\_\_\_\_

1

(b) Excess protein in the body is broken down in the liver.  
Name the waste product formed from the breakdown of protein.

\_\_\_\_\_

1

(c) Describe the effect on the kidney tubules of an increasing level of anti-diuretic hormone (ADH).

\_\_\_\_\_

1

Marks

**3. (continued)**

(d) Bony fish can live in freshwater or marine habitats.

The list below contains methods used by bony fish to overcome osmotic problems.

*Methods used by bony fish to overcome osmotic problems*

Excreting excess salt

Excreting copious urine

Producing very dilute urine

Drinking water

Use all the information above to complete the table.

<i>Habitat</i>	<i>Osmotic problem</i>	<i>Methods used by bony fish to overcome the osmotic problem</i>
	Water gain	
	Water loss	

3

[Turn over

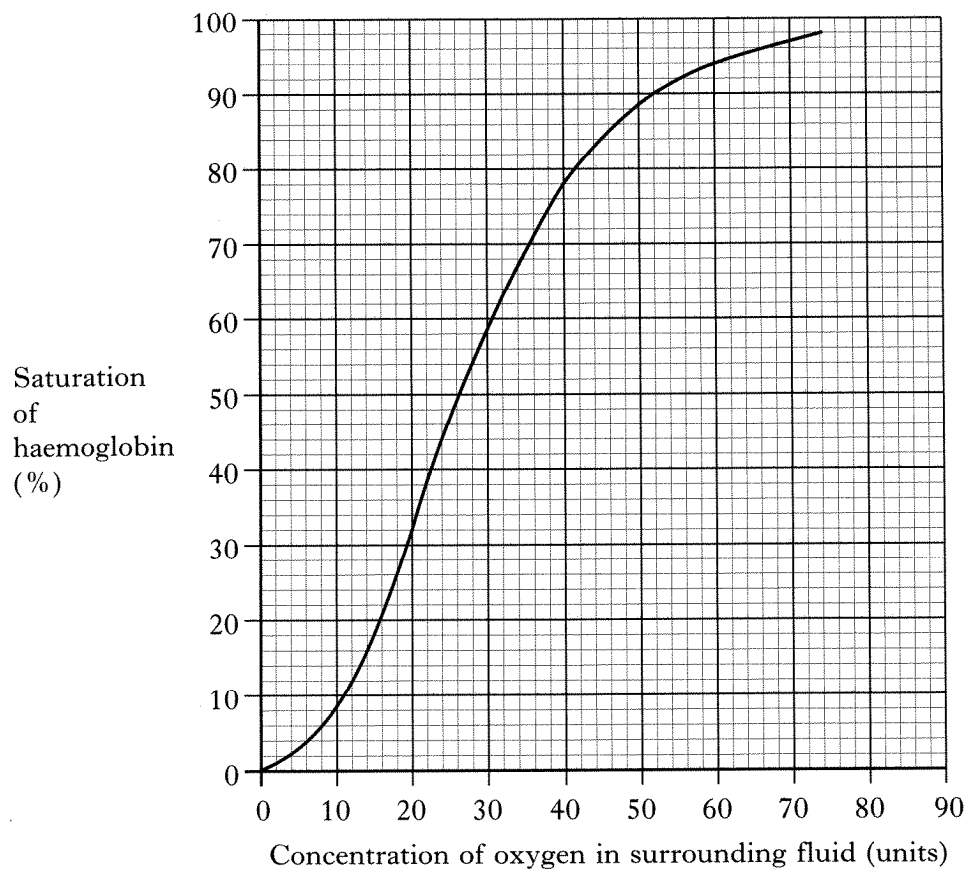
Marks

4. (a) The table below shows some substances that are transported in the blood. Tick (✓) the correct box(es) to show the part(s) of the blood in which each substance is transported.

Substance	Part of blood	
	Plasma	Red blood cells
Oxygen		
Carbon dioxide		
Amino acids		
Glucose		

2

- (b) The graph below shows the percentage saturation of a solution of haemoglobin plotted against the concentration of oxygen dissolved in the surrounding fluid.



Marks

4. (b) (continued)

- (i) What is the percentage saturation of haemoglobin when the oxygen concentration is 20 units in the surrounding fluid?

\_\_\_\_\_ %

1

- (ii) What is the concentration of oxygen in the surrounding fluid when the percentage saturation of haemoglobin is 90%?

\_\_\_\_\_ units

1

- (iii) Describe the relationship between the oxygen concentration of the surrounding fluid and the percentage saturation of haemoglobin.

\_\_\_\_\_  
\_\_\_\_\_

1

- (c) Oxygen is used up in respiration in the tissues of the body.

Describe the effect of low oxygen concentration in the tissues on oxyhaemoglobin in the blood in the capillaries.

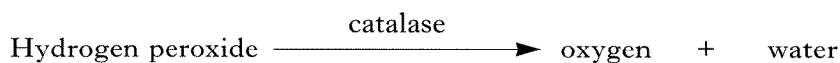
\_\_\_\_\_  
\_\_\_\_\_

1

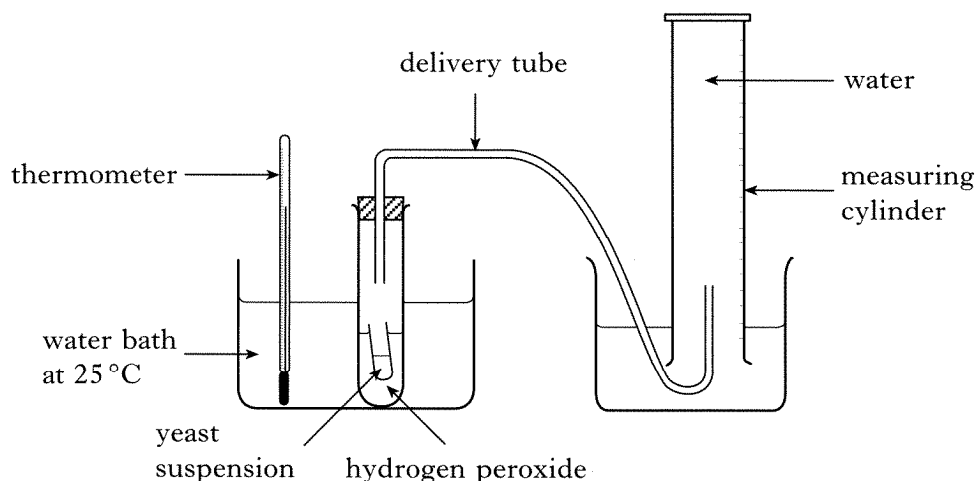
[Turn over

Marks

5. Yeast cells contain the enzyme catalase which breaks down hydrogen peroxide into oxygen and water.



The following diagram and description outlines how an investigation was set up and carried out.



After ten minutes in the water bath at 25°C, the yeast suspension was mixed with the hydrogen peroxide by shaking the test-tube.

The volume of oxygen released from the hydrogen peroxide in one minute was measured.

The procedure was then repeated at 25°C.

The same apparatus was then used to investigate the effect of a range of temperatures.

- (a) In this investigation temperature is the only variable which should be changed.

State **two** variables which should be constant.

1 \_\_\_\_\_

2 \_\_\_\_\_

2

- (b) (i) Explain why the procedure was repeated at each temperature and an average calculated.

\_\_\_\_\_

1

- (ii) Explain why the yeast and hydrogen peroxide were not mixed **before** they were placed in the water bath.

\_\_\_\_\_

1

Marks

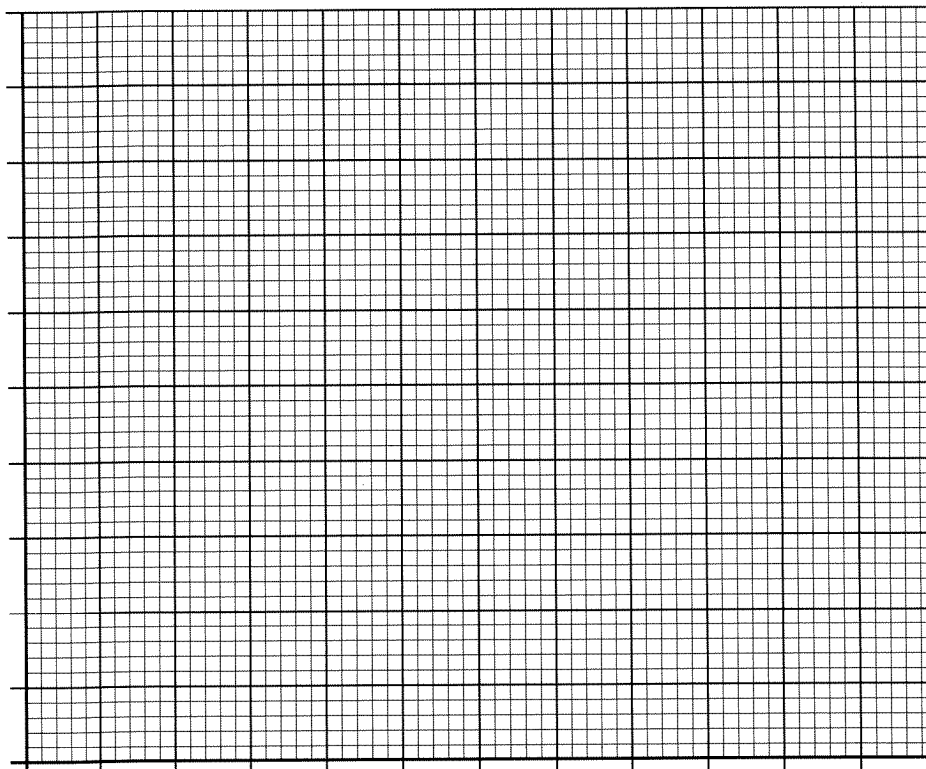
5. (continued)

(c) The results are shown in the table below.

Temperature (°C)	Volume of oxygen collected (cm <sup>3</sup> /minute)		
	First run	Second run	Average
25	15	15	15
30	20	22	21
35	36	40	38
40	46	46	46
45	10	8	9
50	0	0	0
60	0	0	0

Present the results in an appropriate format on the grid below.

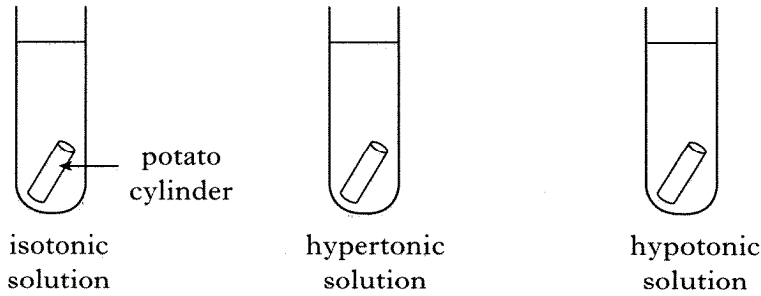
(Additional graph paper, if required, will be found on page 28.)



3

Marks

6. (a) Three similar cylinders were cut from the same potato, dried and weighed. Each cylinder was placed in a different solution as shown in the diagrams below.



After one hour, the cylinders were removed from the solutions, dried and reweighed.

- (i) Use the information in the diagrams to complete the table below.

<i>Solution</i>	<i>Initial weight (g)</i>	<i>Final weight (g)</i>
	10	8
	10	10
	10	12

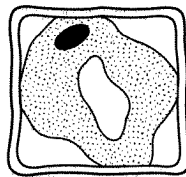
1

- (ii) Which process has caused these changes in weight?

\_\_\_\_\_

1

- (iii) The diagram below shows a cell from one of the potato cylinders.



What term would be used to describe the condition of this cell?

\_\_\_\_\_

1



Marks

6. (continued)

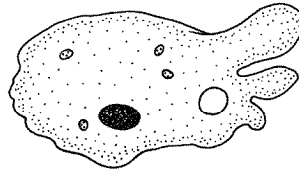
(b) (i) Some structures that are found in cells are listed below.

Tick (✓) boxes to show those structures which are found in animal cells.

- Chloroplasts
- Cytoplasm
- Large central vacuole
- Cell wall
- Nucleus
- Cell membrane

1

(ii) Explain why diffusion is important to a unicellular animal such as *Amoeba*.



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1

[Turn over

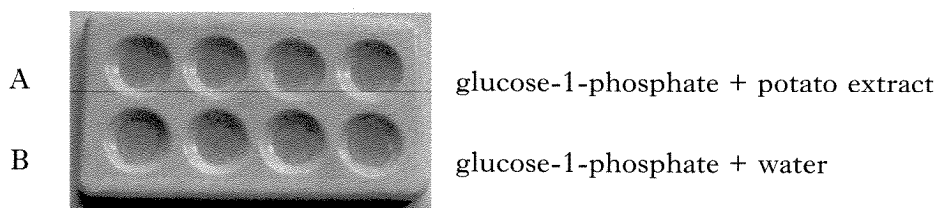
Marks

7. Potatoes store carbohydrate in the form of starch.  
An enzyme found in potato cells converts glucose-1-phosphate into starch.



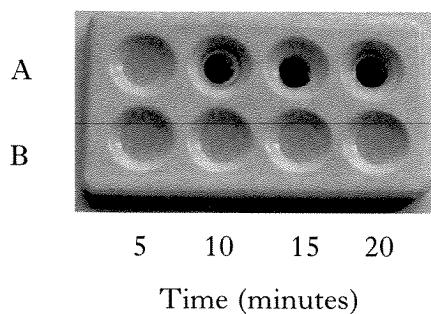
The following description outlines how an investigation into the time taken for the synthesis of starch to occur was carried out.

- 1 A starch-free potato extract was prepared.  
This potato extract contained the enzyme.
- 2 Two rows of a spotting tile were set up as shown in the diagram.



- 3 A stop clock was started.
- 4 Iodine was added to each column at 5 minute intervals.  
Iodine turns black when starch is present.

The results are shown below.



Marks

**7. (continued)**

(a) Name the enzyme present in the potato extract.

\_\_\_\_\_

1

(b) Explain why all the starch was removed from the potato extract before it was used in the investigation.

\_\_\_\_\_  
\_\_\_\_\_

1

(c) What evidence is there to show that the enzyme is necessary for the synthesis of starch?

\_\_\_\_\_

1

(d) What conclusion can be drawn from the results in row A?

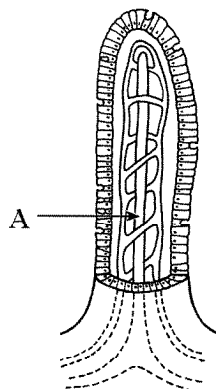
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1

**[Turn over**

Marks

8. The diagram below shows a single villus from the small intestine.



(a) Name the part labelled A.

\_\_\_\_\_

1

(b) Absorption of glucose takes place in the small intestine.

(i) Name the part of the villus into which glucose passes.

\_\_\_\_\_

1

(ii) Name the organ to which the glucose is transported after leaving the small intestine.

\_\_\_\_\_

1

(iii) Describe **one** possible use of glucose in the body.

\_\_\_\_\_

1

(c) The stomach is a major organ of the alimentary canal.

(i) Name **two** types of secretory cell found in the stomach.

1 \_\_\_\_\_

2 \_\_\_\_\_

2

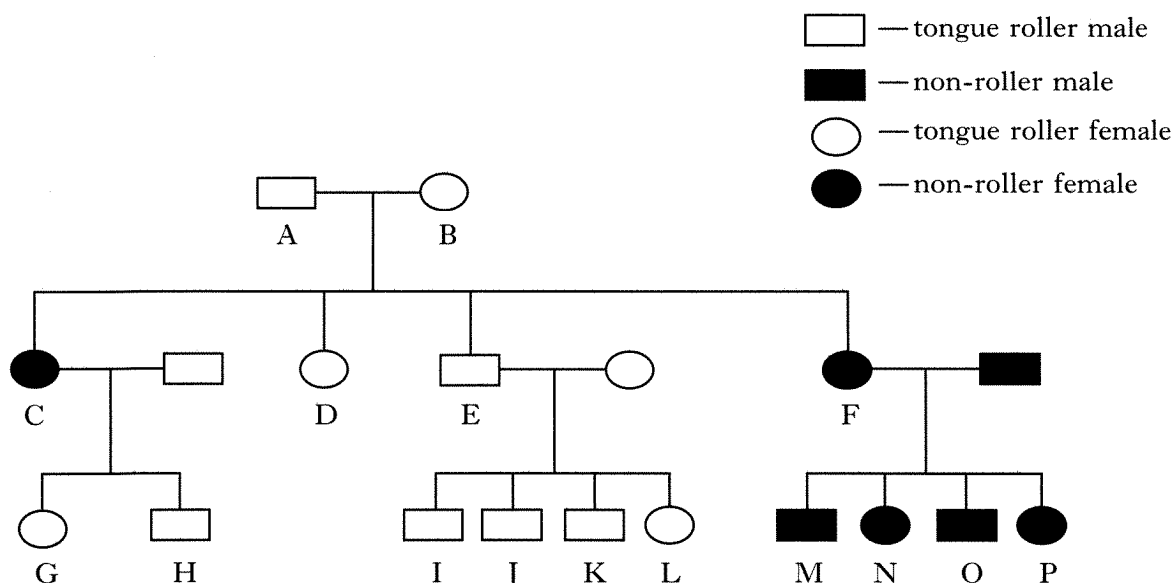
(ii) Describe the function of the muscles in the stomach wall.

\_\_\_\_\_

1

Marks

9. The diagram below shows the occurrence of tongue rolling in a family.



(a) State the dominant form of the gene.

\_\_\_\_\_

1

(b) Identify the individuals in the F<sub>1</sub> generation.

\_\_\_\_\_

1

(c) (i) Use the information in the diagram to complete the table below.

<i>Individual</i>	<i>Genotype</i>
A	
B	Tt
C	
G	
L	TT

3

(ii) Name an individual from the table who is heterozygous for the gene.

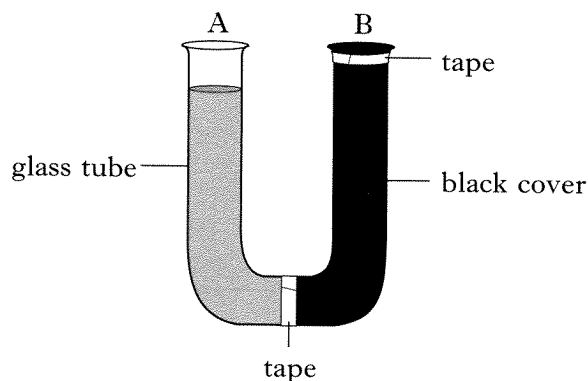
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1

[Turn over

Marks

10. The apparatus shown below was set up to investigate the response of a small freshwater organism called *Daphnia* to an environmental factor.



Fifteen *Daphnia* were placed in each side of the glass tube and allowed to swim around for 10 minutes.

A black cover was then placed over side B.

The number of *Daphnia* in each side was then counted at 5 minute intervals for 30 minutes.

The results are shown below.

<i>Time (minutes)</i>	<i>Number of Daphnia in side A</i>	<i>Number of Daphnia in side B</i>
0	15	15
5	25	5
10	27	3
15	24	6
20	28	2
25	28	2
30	29	1

- (a) Name the environmental factor causing the response.

\_\_\_\_\_

1

- (b) Express, as a simple ratio, the number of *Daphnia* on side A to the number on side B after 10 minutes.

*Space for calculation*

\_\_\_\_\_ : \_\_\_\_\_

1

Marks

10. (continued)

(c) What conclusion can be drawn from these results?

\_\_\_\_\_

1

(d) *Daphnia* feed on green algae at the surface of the water.

Explain the significance of the behaviour observed in this investigation to *Daphnia*.

\_\_\_\_\_

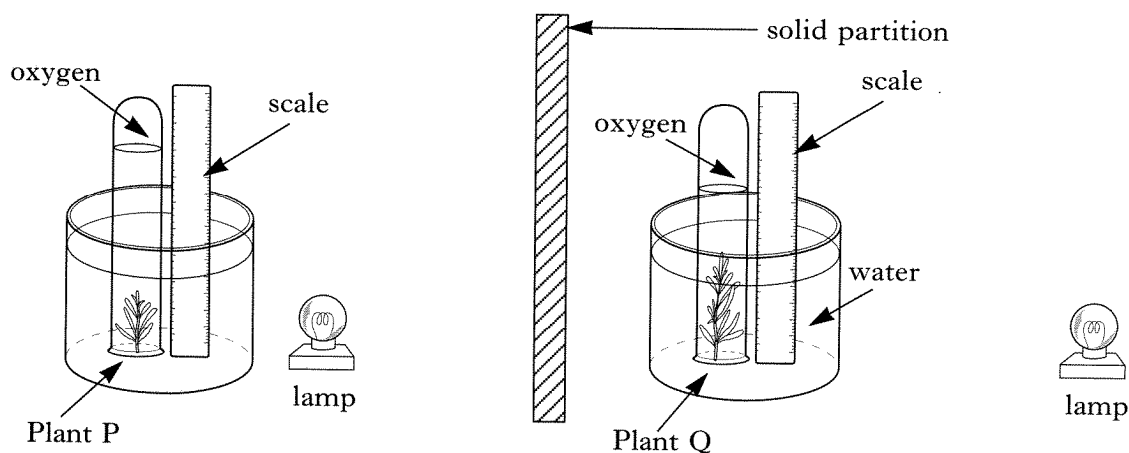
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1

[Turn over

Marks

11. (a) Some students were asked to design an investigation to compare the rate of production of oxygen gas by two different species of water plant. The diagrams below show the proposed procedure.



Identify **two** changes to the procedure that should be made to ensure that a valid conclusion can be made.

- 1 \_\_\_\_\_  
2 \_\_\_\_\_

2

- (b) When changes were made to ensure validity, the following results were obtained.

Plant	Total volume of oxygen produced in 8 minutes (cm <sup>3</sup> )	Rate of oxygen production (cm <sup>3</sup> /minute)
P	64	8
Q	96	

- (i) Calculate the rate of oxygen production for Plant Q.  
*Space for calculation*

\_\_\_\_\_ cm<sup>3</sup>/minute

1

- (ii) Calculate the ratio of oxygen produced by Plant P to that produced by Plant Q.  
*Space for calculation*

\_\_\_\_\_ : \_\_\_\_\_

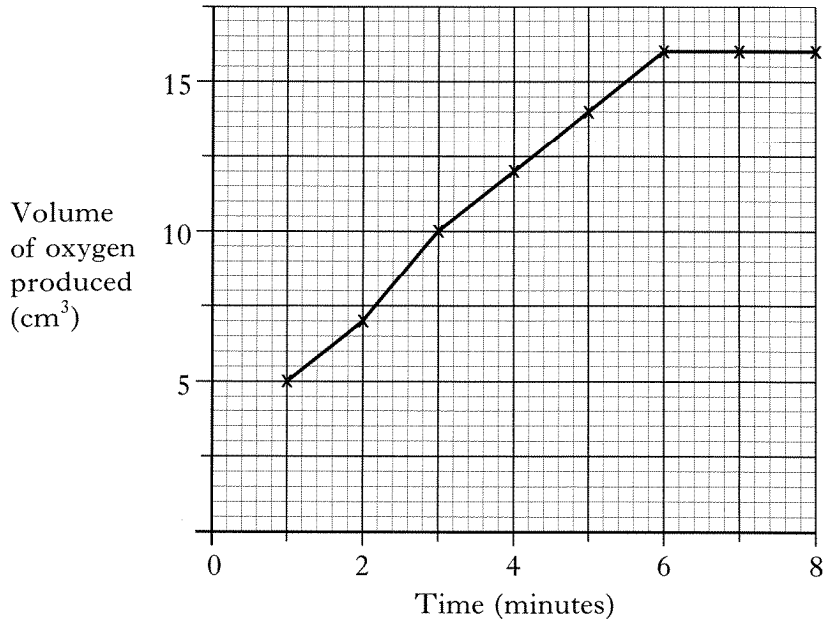
1



Marks

11. (continued)

- (c) The volume of oxygen produced was measured at time intervals of one minute. The results for Plant Q are shown in the line graph below.



Describe what happens to the volume of oxygen produced per minute as the investigation proceeds.

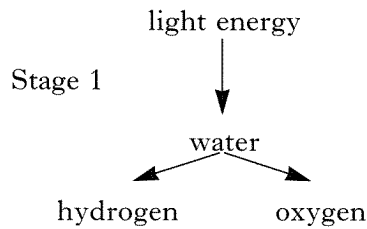
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2

- (d) The diagram below shows the first stage in photosynthesis.



- (i) Name the substance which captures the light energy needed at Stage 1.

---

1

- (ii) The energy is used to split water molecules. What name is given to this process?

---

1

- (iii) The hydrogen then combines with carbon dioxide to form glucose. Name this second stage in photosynthesis.

---

1

SECTION C

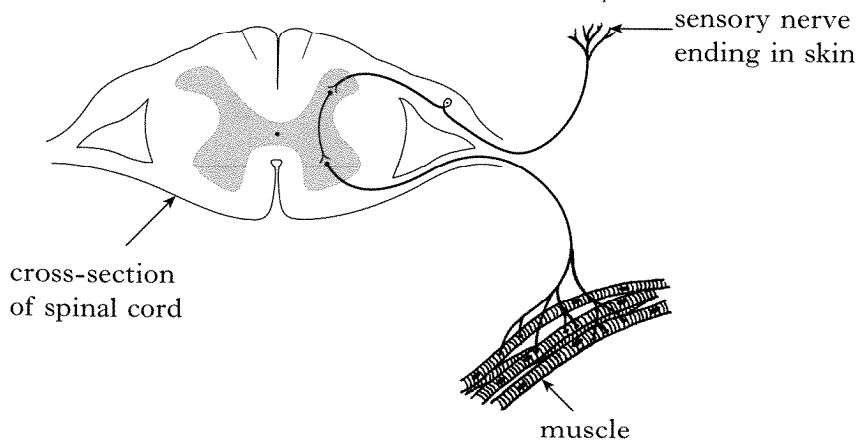
Answer BOTH questions 1 and 2 on the blank pages provided.

You may use labelled diagrams where appropriate.

Marks

1. Answer either A or B.

A. The diagram below shows the nerve cells (neurones) involved in a reflex arc.

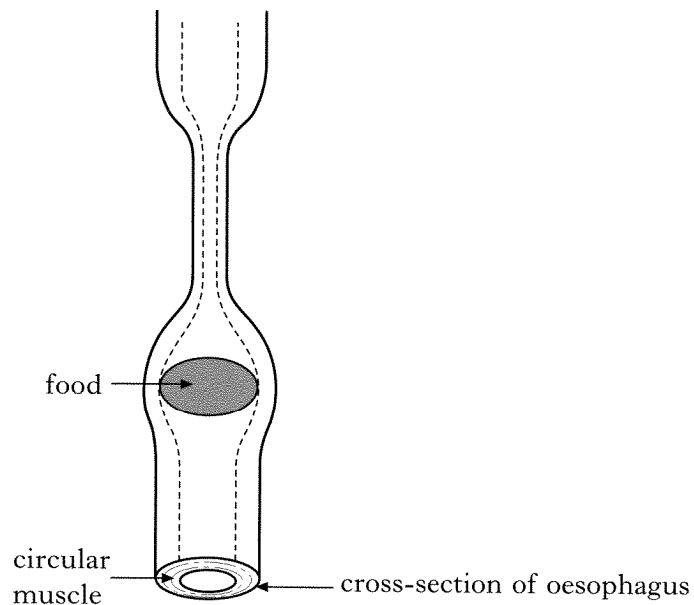


Describe the pathway of a nerve impulse through the reflex arc.

5

OR

B. The diagram below shows a stage in the movement of food down the oesophagus.



Name and describe the movement of the food through the oesophagus.

5

*Marks*

2. Answer **either** A or B.

**You may use labelled diagrams where appropriate.**

A. Give an account of gamete formation in human females.

5

**OR**

B. Describe, including examples, commercial and industrial uses of cells.

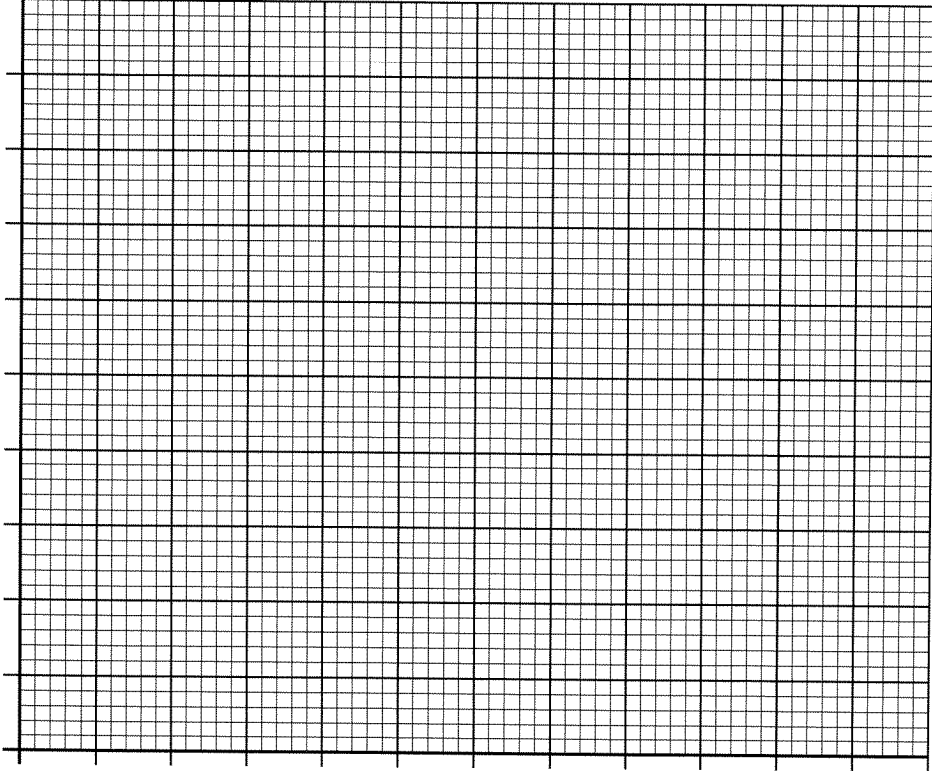
5

[END OF QUESTION PAPER]

[Turn over

**SPACE FOR ANSWERS**

ADDITIONAL GRAPH PAPER FOR QUESTION 5(c)



DO NOT  
WRITE IN  
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**SPACE FOR ANSWERS**

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SPACE FOR ANSWERS

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