

FOR OFFICIAL USE

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Total for  
Sections B and C

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**X007/11/02**

NATIONAL WEDNESDAY, 23 MAY  
QUALIFICATIONS 9.00 AM – 11.00 AM  
2012

**BIOLOGY**  
**INTERMEDIATE 2**

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

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Number of seat

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**SECTION A (25 marks)**

Instructions for completion of Section A are given on *Page two*.

For this section of the examination you must use an HB pencil.

**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 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. If further space is required, a supplementary sheet for rough work may be obtained from the Invigilator.
- 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 For this section of the examination you must use an **HB pencil**, and where necessary, an eraser.
- 3 Check that the answer sheet you have been given has **your name, date of birth, SCN** (Scottish Candidate Number) and **Centre Name** printed on it.  
Do not change any of these details.
- 4 If any of this information is wrong, tell the Invigilator immediately.
- 5 If this information is correct, **print** your name and seat number in the boxes provided.
- 6 The answer to each question is **either** A, B, C or D. Decide what your answer is, then, using your pencil, put a horizontal line in the space provided (see sample question below).
- 7 There is **only one correct** answer to each question.
- 8 Any rough working should be done on the question paper or the rough working sheet, **not** on your answer sheet.
- 9 At the end of the examination, put the **answer sheet for Section A inside the front cover of this answer book**.

### Sample Question

The thigh bone is called the

- A femur
- B humerus
- C tibia
- D fibula.

The correct answer is **A**—femur. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).



### Changing an answer

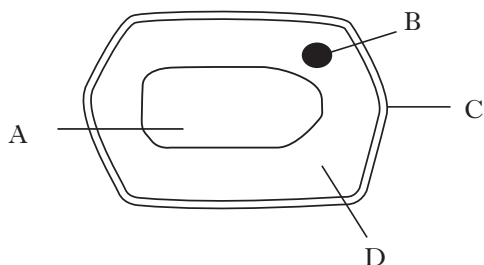
If you decide to change your answer, carefully erase your first answer and, using your pencil, fill in the answer you want. The answer below has been changed to **D**.



## SECTION A

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

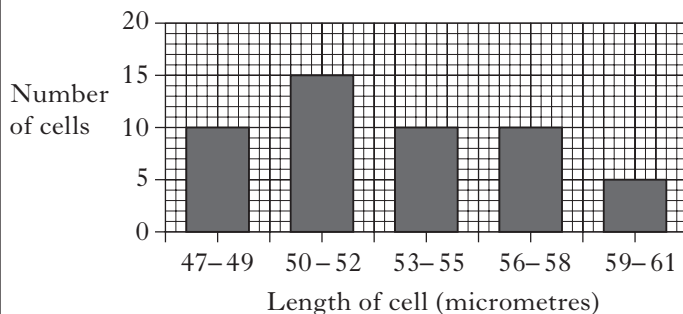
Questions 1 and 2 refer to the plant cell diagram below.



1. Which of the plant cell components shown above is made from a structural carbohydrate?
2. Which labelled part controls cell activities?
3. Which line in the table below shows what happens to cells when placed in a hypertonic solution?

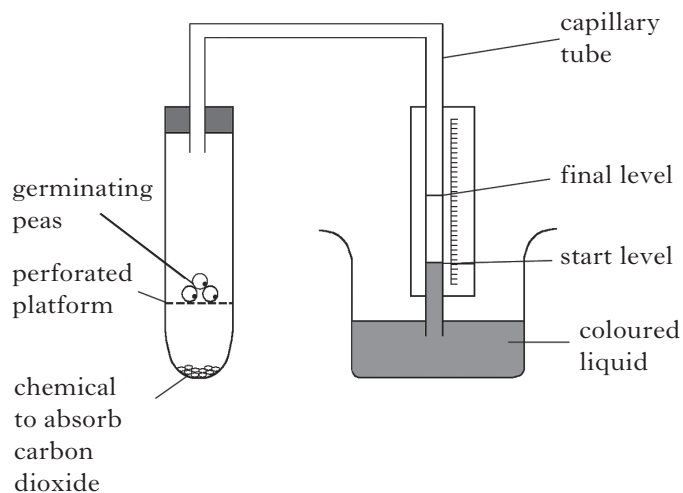
	<i>Animal Cell</i>	<i>Plant Cell</i>
A	swells and bursts	becomes turgid
B	becomes turgid	swells and bursts
C	shrinks	becomes plasmolysed
D	becomes plasmolysed	becomes plasmolysed

4. The bar chart below shows the number of cells of different lengths in a sample of onion epidermis.



The percentage of cells with a length greater than 55 micrometres is

- A 10%
  - B 15%
  - C 20%
  - D 30%.
5. The apparatus below was used to investigate gas exchange in germinating peas.



The movement of the coloured liquid in the capillary tube can be used to measure the volume of

- A oxygen produced by respiration
- B carbon dioxide used up by respiration
- C oxygen used up by respiration
- D carbon dioxide produced by respiration.

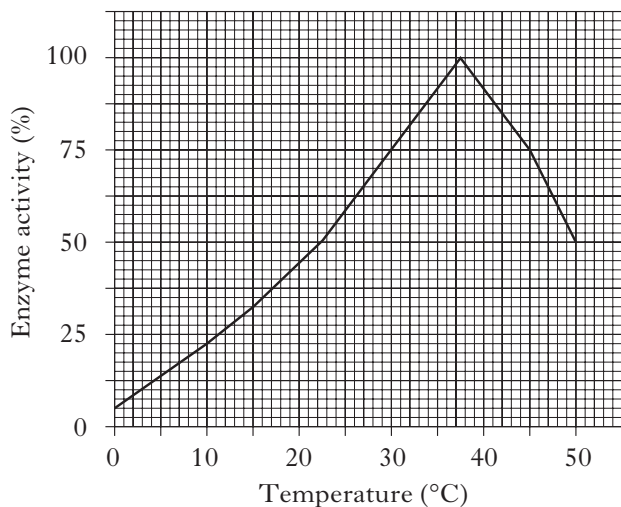
6. Which line in the table below correctly shows the functions of an enzyme?

	<i>Energy input of the chemical reaction</i>	<i>Rate of the chemical reaction</i>
A	lowers	speeds up
B	raises	slows down
C	raises	speeds up
D	lowers	slows down

7. Fungi produce

- A antibodies to destroy bacteria
- B antibiotics to engulf bacteria
- C antibiotics to destroy bacteria
- D antibodies to digest bacteria.

8. The graph below shows the effect of temperature on the activity of an enzyme.



The increase in enzyme activity (%) as the temperature rises from 22.5 °C to 30 °C is

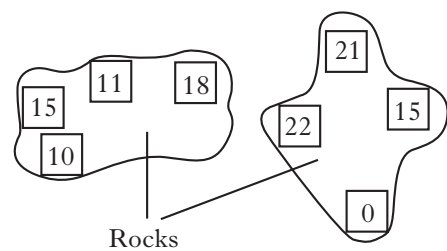
- A 25
- B 50
- C 67
- D 75.

9. The total variety of all living things on Earth is described as

- A an ecosystem
- B biodiversity
- C a community
- D random assortment.

10. A survey was carried out on the number of mussels attached to rocks on a seashore.

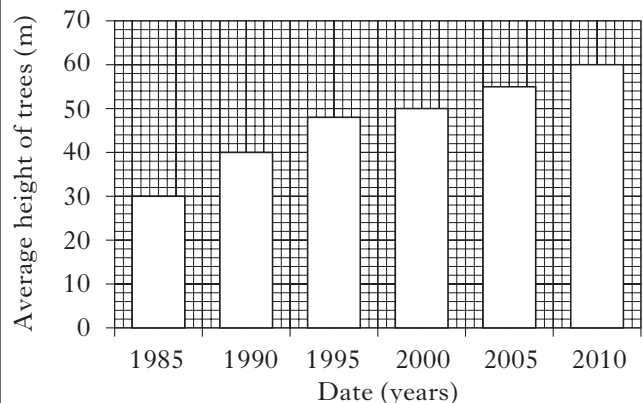
The positions of the mussels are shown by squares in the diagram below. The numbers of mussels at each position are shown in the squares.



What is the average number of mussels found per square?

- A 14
- B 16
- C 56
- D 112

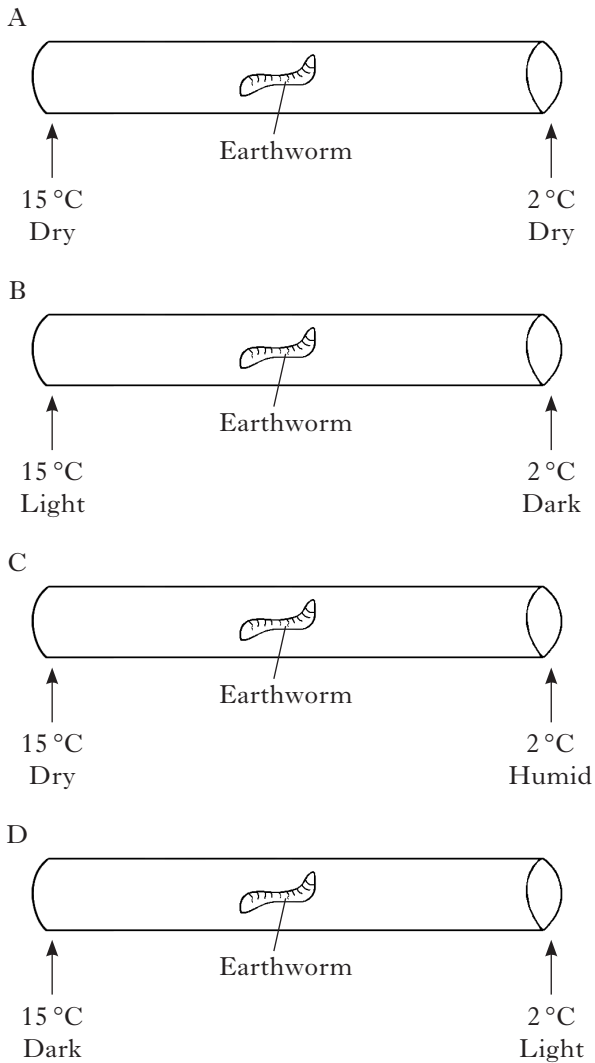
11. The chart below shows the average height of trees in a woodland over a 25 year period.



What is the percentage increase in tree height between 1985 and 2010?

- A 30%
- B 50%
- C 60%
- D 100%

12. Which of the following experiments could be used to show the response of an earthworm to temperature?



13. An organism has two different alleles of a gene.

This genotype is

- A dominant  
B homozygous  
C recessive  
D heterozygous.

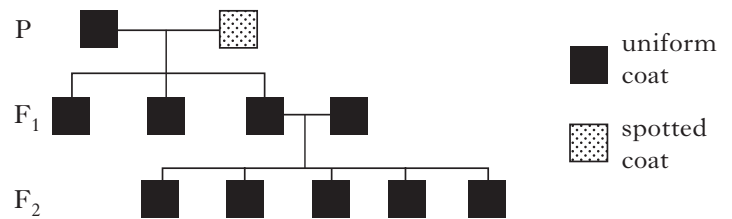
14. *Distichiasis* is a dominant characteristic in humans which causes the person to have two rows of eyelashes.

A woman who is homozygous for the condition and a man who is unaffected have children.

What proportion of their children would be expected to have *Distichiasis*?

- A 0%  
B 25%  
C 50%  
D 100%

15. In dogs, uniform coat colour is dominant to spotted coat.



From the family tree above, in which generation(s) are all the dogs heterozygous for coat colour?

- A P only  
B F<sub>1</sub> only  
C F<sub>2</sub> only  
D P and F<sub>1</sub>

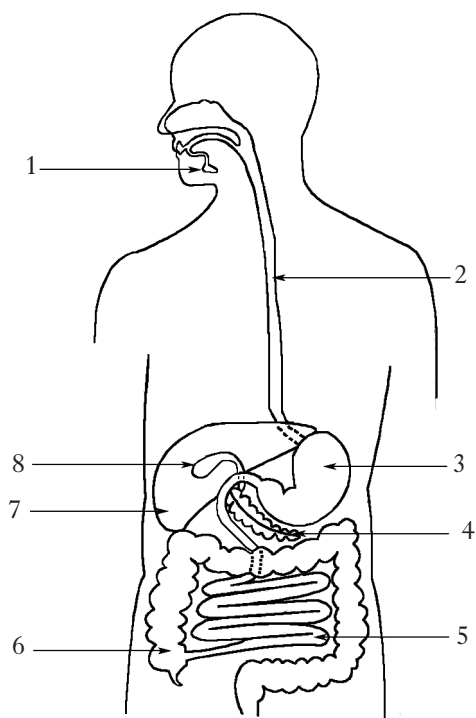
16. In a breed of cattle, coat colour is determined by two alleles R and W. The possible genotypes are expressed as follows:

Genotype	Coat colour
RR	Red
RW	Roan
WW	White

Which term best describes the two alleles R and W?

- A Heterozygous  
B Co-dominant  
C Homozygous  
D Polygenic

17. The diagram below shows the human alimentary canal and its associated organs.



Which numbered parts produce digestive enzymes?

- A 1, 2, 4  
B 3, 4, 8  
C 2, 7, 8  
D 1, 3, 4

18. When different foods were burned, the following results were obtained.

Food	Temperature rise (°C)
Carbohydrate	15
Fat	40
Protein	20

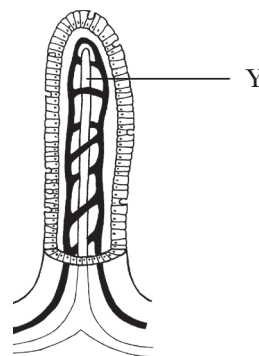
Using the equation,

$$\text{Energy value (kJ)} = 4.2 \times \text{temperature rise (°C)},$$

the energy value (kJ) of fat is

- A 40  
B 63  
C 84  
D 168.

19. The diagram below shows the structure of a villus.



Which food molecules are absorbed by structure Y?

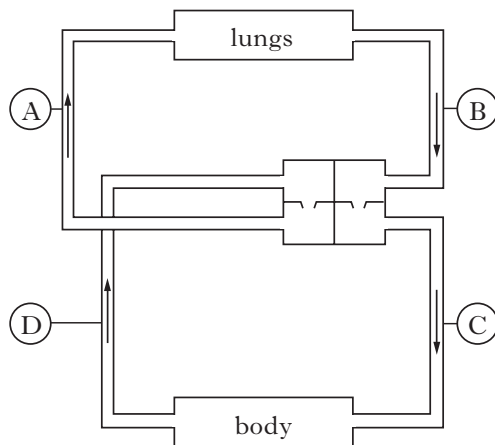
- A Amino acids  
B Fatty acids  
C Glucose  
D Glycogen

20. Excess protein in the diet is deaminated in the body.

Which line in the table below correctly describes the site of deamination and the waste product produced?

	Site of deamination	Waste product
A	liver	urea
B	kidney	urea
C	kidney	amino acids
D	liver	amino acids

21. The diagram below shows the heart and circulation.



Which labelled structure is the pulmonary artery?

22. The table below shows water gained and lost by an individual over a 24 hour period.

<i>Method of water gain</i>	<i>Volume of water gained (cm<sup>3</sup>)</i>	<i>Method of water loss</i>	<i>Volume of water lost (cm<sup>3</sup>)</i>
food	850	exhaled breath	300
drink	1000	urine	1250
metabolic water		sweating	500
		faeces	100

The individual is in water balance over the 24 hour period.

What volume of water is gained as metabolic water?

- A 100 cm<sup>3</sup>
- B 200 cm<sup>3</sup>
- C 300 cm<sup>3</sup>
- D 500 cm<sup>3</sup>

23. A scientist investigated how the salt concentration of drinks affected urine production.

Volunteers were given drinks of different salt concentrations and their urine production was measured.

Which variable should be kept constant during this investigation?

- A Volume of drink given.
- B Volume of urine measured.
- C Concentration of salt in the drink.
- D Concentration of urine measured.

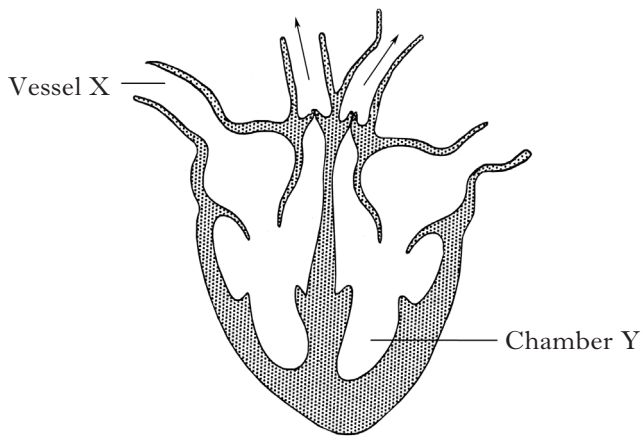
24. Marine bony fish have to overcome an osmoregulation problem.

Which line in the table is true for marine bony fish?

	<i>Salt transport at gills</i>	<i>Volume of urine produced</i>
A	absorbed	small
B	excreted	large
C	excreted	small
D	absorbed	large

[Turn over

25. The diagram below shows a cross section of a human heart.



Which line in the table identifies the parts of the heart correctly?

	<i>Vessel X</i>	<i>Chamber Y</i>
A	aorta	left ventricle
B	vena cava	left ventricle
C	vena cava	right ventricle
D	aorta	right ventricle

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



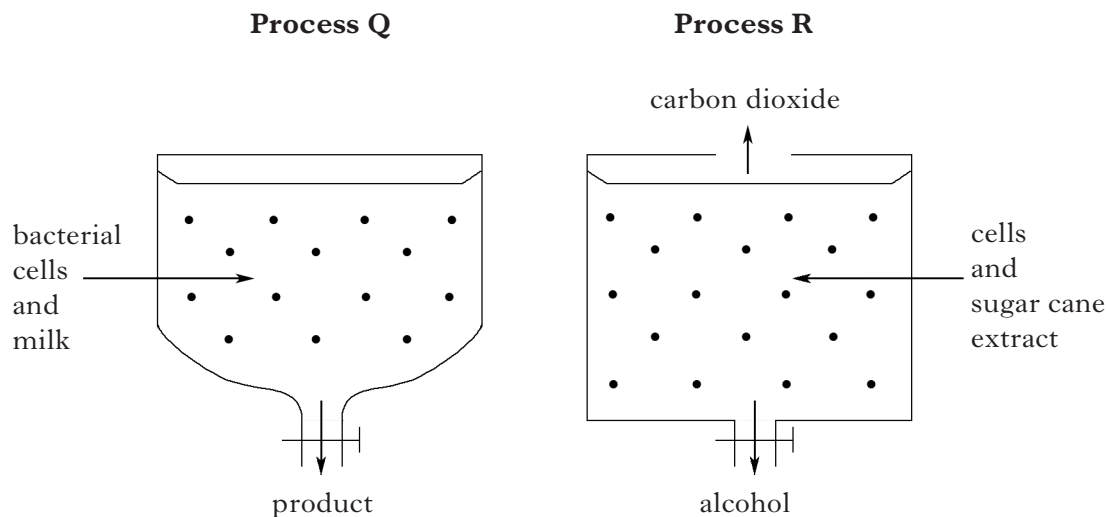
**[Turn over for Section B on *Page ten***

**SECTION B**

Marks

**All questions in this Section should be attempted.  
All answers must be written clearly and legibly in ink.**

1. The diagrams below represent two industrial processes, Q and R.  
Each process uses a different type of cell for anaerobic respiration.



- (a) (i) Complete the following equation for Process Q.



1

- (ii) The milk curdles and a product is made in Process Q.  
Name this product.

\_\_\_\_\_

1

- (b) (i) Name the cells used in Process R.

\_\_\_\_\_

1

- (ii) How is the alcohol from Process R used to fuel cars?

\_\_\_\_\_

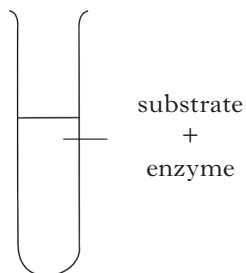
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2

Marks

2. An investigation was carried out to find the effect of pH on the activity of an enzyme.

Substrate at different pH values was added to the enzyme in different test tubes.



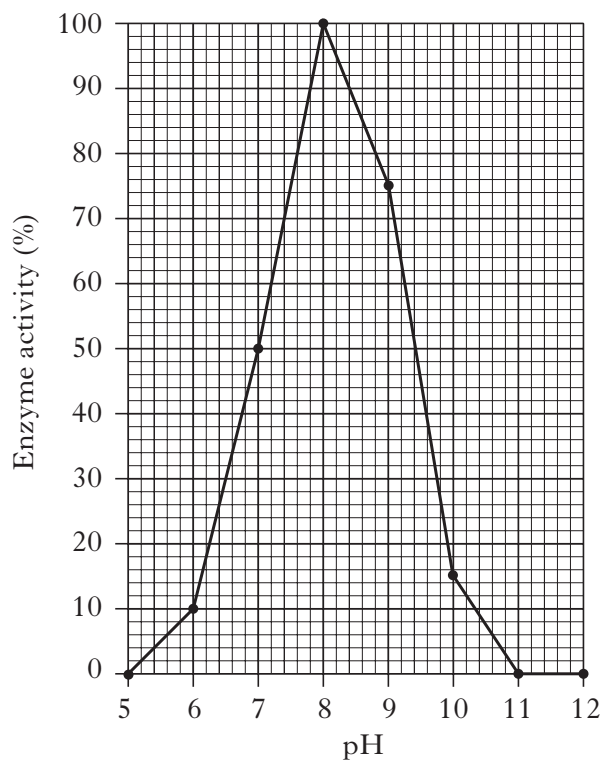
- (a) State **two** variables that must be kept constant for a valid conclusion to be made from this investigation.

1 \_\_\_\_\_

2 \_\_\_\_\_

2

- (b) The results of this investigation are shown in the graph below.



- (i) What is the optimum pH for this enzyme?

\_\_\_\_\_

1

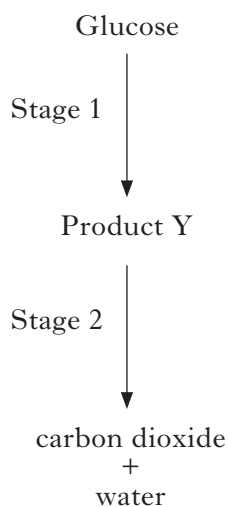
- (ii) How many times more active is the enzyme at pH 9 than at pH 10?  
*Space for calculation*

\_\_\_\_\_ times

1

Marks

3. The process of aerobic respiration in a muscle cell is outlined below.



(a) (i) Name Stage 1.

\_\_\_\_\_

1

(ii) Name product Y from Stage 1.

\_\_\_\_\_

1

(iii) What other substance must be present for Stage 2 to occur?

\_\_\_\_\_

1

(b) ATP is formed during respiration and broken down for uses in cells.

(i) How many molecules of ATP are formed from each glucose molecule during

Stage 1 only? \_\_\_\_\_

Both Stage 1 and Stage 2? \_\_\_\_\_

1

(ii) What **two** molecules are produced when ATP is broken down?

\_\_\_\_\_ and \_\_\_\_\_

1

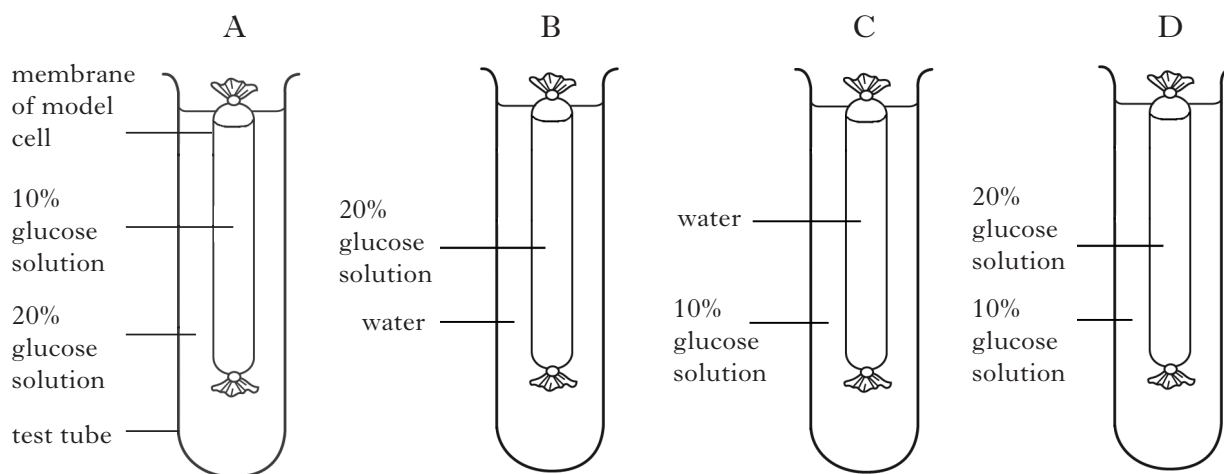
(iii) State **one** use of the energy released when ATP is broken down.

\_\_\_\_\_

1

Marks

4. The following diagrams show an investigation into osmosis using four model cells. The model cells were weighed before placing them in the test tubes. After one hour the model cells were taken out of the test tubes and reweighed.



- (a) What feature of the membrane of the model cell makes it suitable for this investigation?

\_\_\_\_\_

1

- (b) State the letters of the model cells which would have increased in mass after one hour.

\_\_\_\_\_

1

- (c) What should be done to the model cells before each weighing to obtain valid results?

\_\_\_\_\_

1

- (d) Predict which model cell would have the greatest change in mass after one hour.

Give a reason for your choice.

Model cell \_\_\_\_\_

1

Reason \_\_\_\_\_

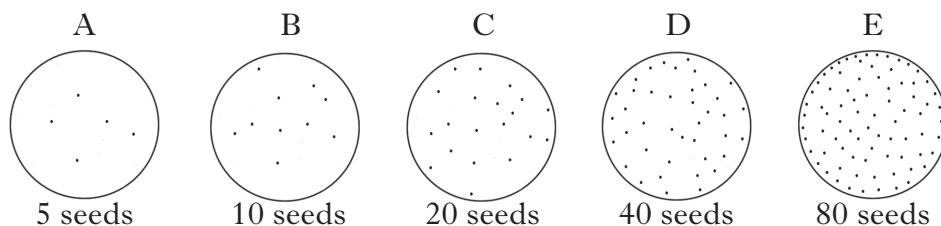
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1

[Turn over

Marks

5. (a) A student set up five petri dishes to investigate the effect of competition on the percentage of seedlings surviving after five days. Each dish contained a thin layer of wet cotton wool with different numbers of seeds placed evenly across its surface, as shown below.

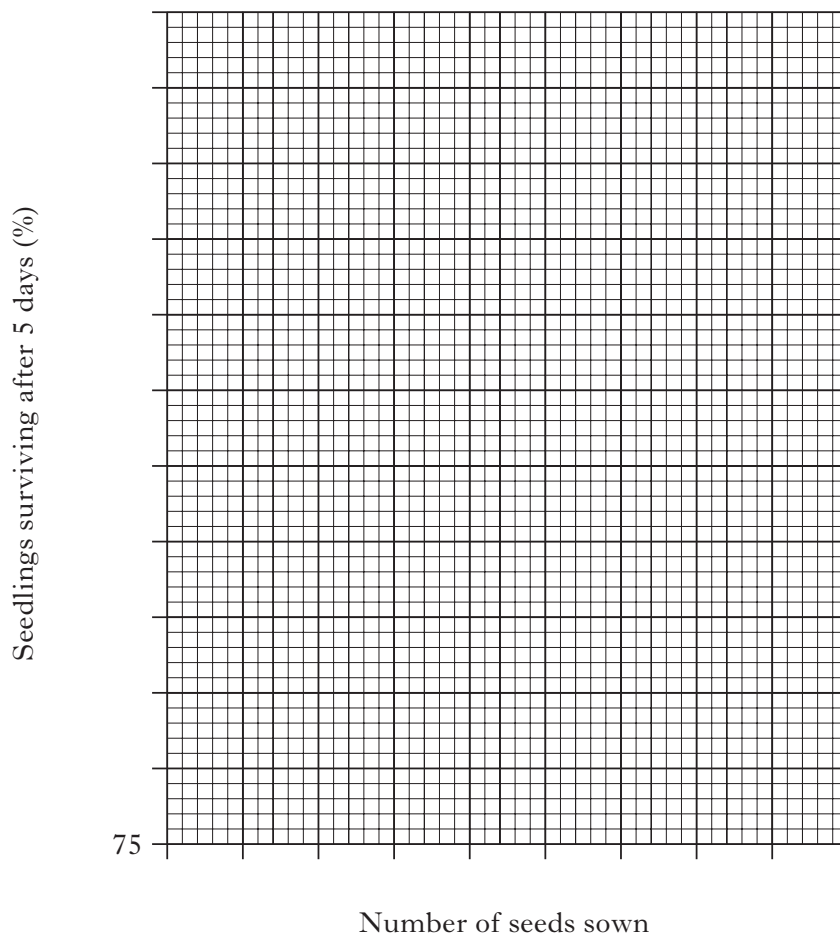


The table of results for this investigation is shown below.

<i>Dish</i>	<i>Number of seeds sown</i>	<i>Seedlings surviving after five days (%)</i>
A	5	100
B	10	100
C	20	95
D	40	85
E	80	75

- (i) Construct a **line graph** to show the number of seeds sown against percentage of seedlings surviving after five days.

(Additional graph paper, if required, will be found on *Page twenty-eight*.)



Marks

5. (a) (continued)

(ii) Name the variable which is altered in this investigation.

\_\_\_\_\_

1

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

\_\_\_\_\_

\_\_\_\_\_

1

(iv) Calculate the simple whole number ratio of the percentage of seedlings surviving in dish A compared to dish E.

*Space for calculation*

\_\_\_\_\_ : \_\_\_\_\_  
Dish A    Dish E

1

(v) Another dish was set up with 160 seeds and 88 seedlings survived for five days.

Calculate the percentage of seedlings surviving in this dish.

*Space for calculation*

\_\_\_\_\_ %

1

(b) Name **one** requirement, other than water, for which plants may be in competition.

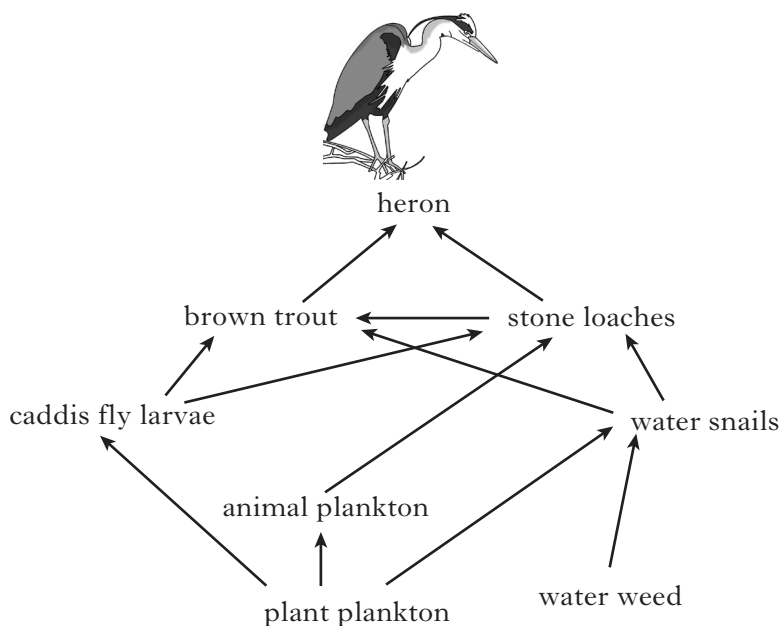
\_\_\_\_\_

1

[Turn over

6. The diagram below represents a food web from a Scottish river ecosystem.

Marks



(a) Decide if each of the following statements about this food web is **True** or **False**, and tick (✓) the appropriate box.

If the statement is **False**, write the correct word in the **Correction** box to replace the word underlined in the statement.

Statement	True	False	Correction
The stone loaches are the <u>predators</u> of the brown trout.			
There are <u>three</u> producers in this food web.			
The caddis fly larvae are <u>herbivores</u> .			

3

(b) (i) Complete the food chain below with four organisms from this food web.

water weed → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_ → \_\_\_\_\_

1

(ii) What do the arrows in the food chain represent?

\_\_\_\_\_

1

(c) A pyramid of biomass shows the mass of living organisms at each level. Explain why the heron has the lowest biomass in this food web.

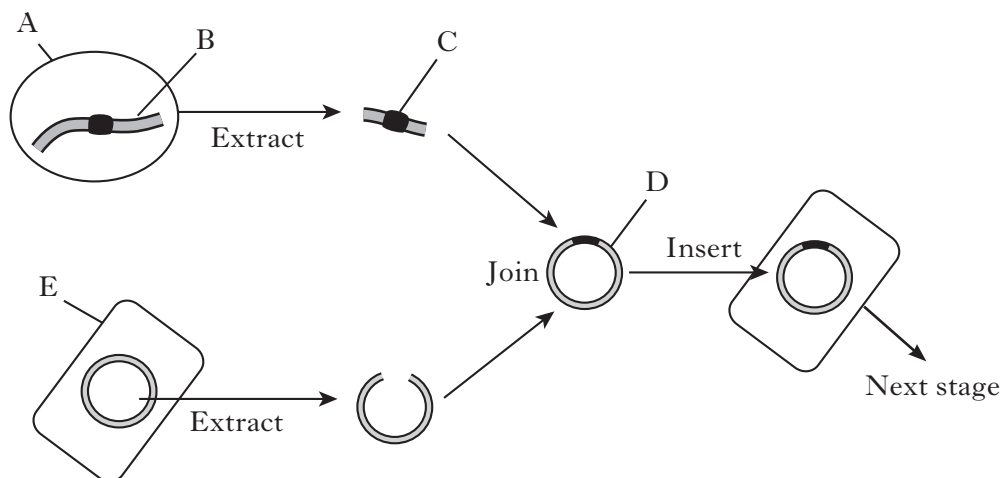
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2



Marks

7. The diagram below represents some of the stages of genetic engineering which are used to produce medicines such as insulin for human use.



- (a) Complete the table below to identify the labelled parts of the diagram.

<i>Name of structure</i>	<i>Letter</i>
bacterial cell	
insulin gene	
plasmid	

2

- (b) Describe the next stage needed to produce insulin for use as a medicine.

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1

- (c) Name another human hormone produced by genetic engineering.

---

1

- (d) State **one** advantage of genetic engineering.

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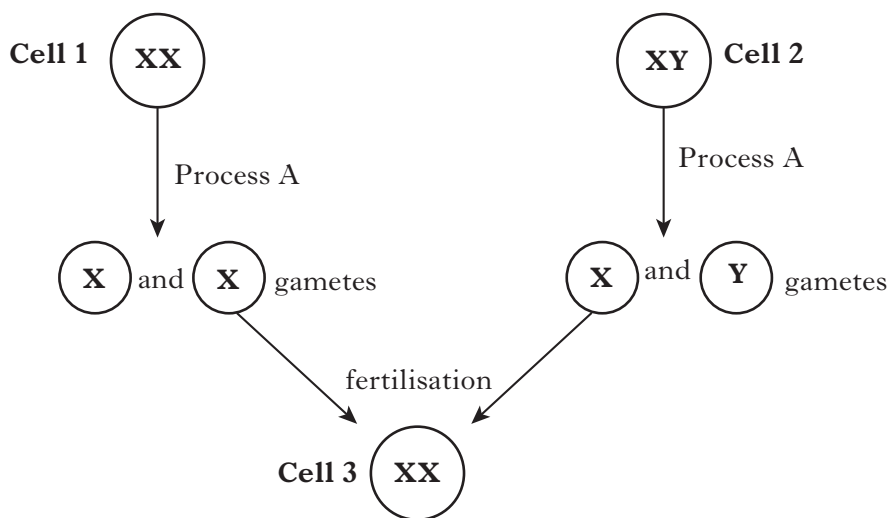
1

[Turn over

Marks

8. The diagram below represents some of the processes involved in human reproduction.

The sex chromosomes are shown in each cell.



(a) Which cell(s) are female?

**Circle the correct cell(s) below.**

Cell 1 / Cell 2 / Cell 3

1

(b) (i) Name process A which forms gametes.

\_\_\_\_\_

1

(ii) Explain what happens to the chromosomes during process A.

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

2

(c) Underline one option in each set of brackets to make the following sentence about fertilisation correct.

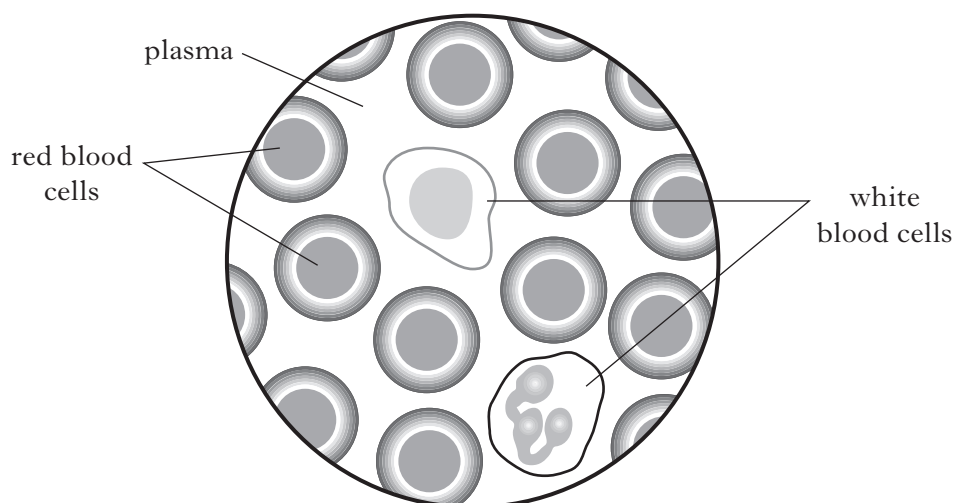
Cell 3 is a { body cell } formed when the { cytoplasm } of the two gametes

{ divide }  
{ fuse } at fertilisation.

2

Marks

9. (a) Blood contains plasma and cells which are used for transport and in defence.



- (i) Name the type of white blood cell that can produce antibodies.

\_\_\_\_\_

1

- (ii) Carbon dioxide is carried in blood plasma. Name the other part of the blood that also carries carbon dioxide.

\_\_\_\_\_

1

- (iii) Name the chemical formed in red blood cells at high oxygen levels in the lungs.

\_\_\_\_\_

1

- (b) The table below shows how altitude affects the percentage oxygen carried in blood.

<i>Altitude (metres)</i>	<i>Percentage oxygen carried in blood (%)</i>
(sea level) 0	97
2800	91
3700	85
4700	80

**Use the data in the table** to explain why a runner who lives at an altitude of 2800 metres would fatigue more quickly if racing in an event at 4700 metres.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

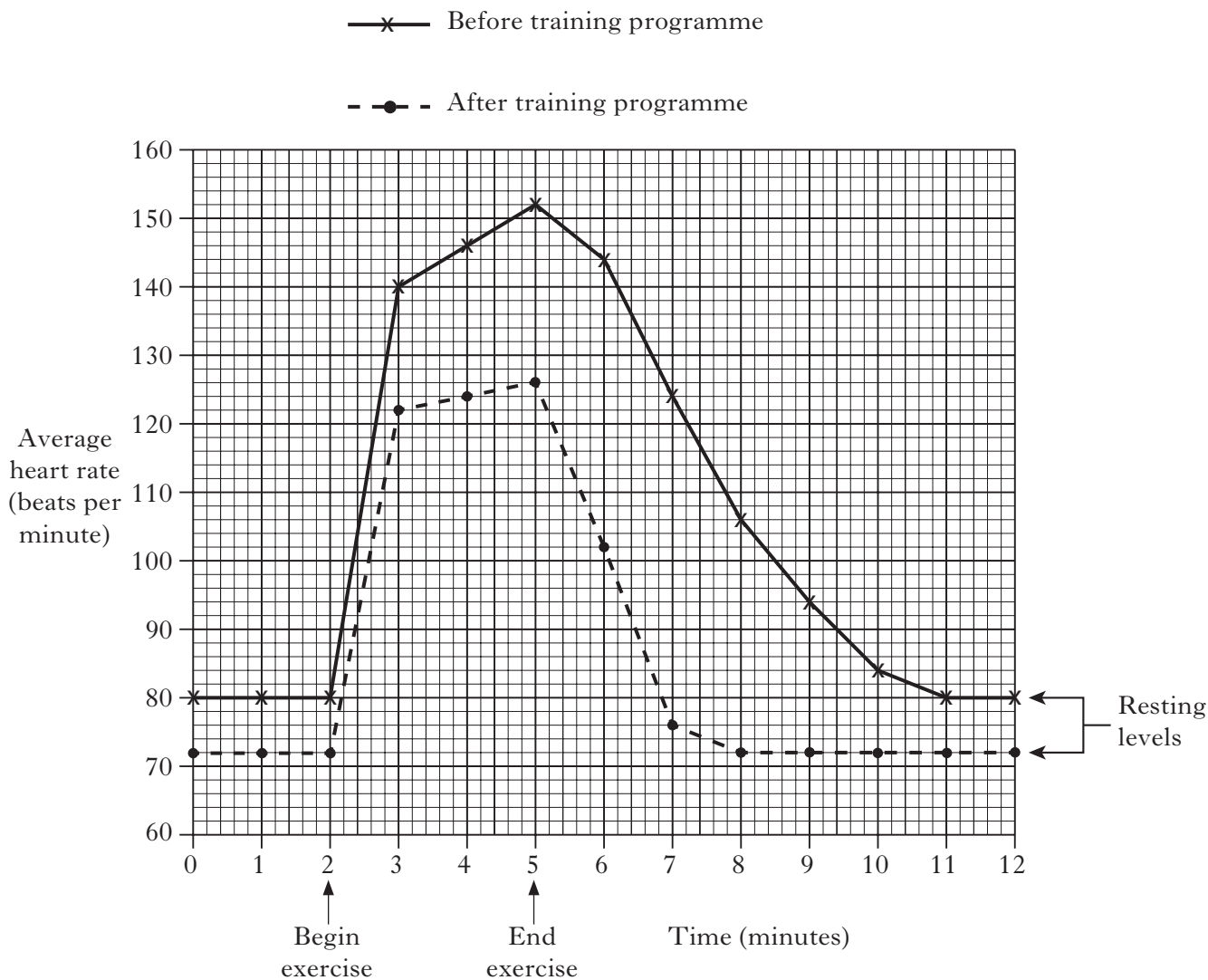
Marks

10. An investigation was carried out to study the effect of physical training on recovery time.

The investigation was carried out as described below.

- Twenty students did an exercise test.
- Their heart rates were recorded before, during and after the exercise test.
- The students then did a training programme for 8 weeks.
- At the end of the training programme, the twenty students repeated the exercise test.
- Average heart rates were calculated.

The graph below shows the results of this investigation.



Recovery time is the length of time taken for heart rate to return to resting level after exercise.

(a) How long was the recovery time before the training programme?

\_\_\_\_\_ minutes

1

Marks

**10. (continued)**

- (b) (i) What was the percentage increase in average heart rate during the first minute of exercise before the training programme?

*Space for calculation*

\_\_\_\_\_ % **1**

- (ii) What was the highest average heart rate during the exercise test for the students after the training programme?

\_\_\_\_\_ beats per minute **1**

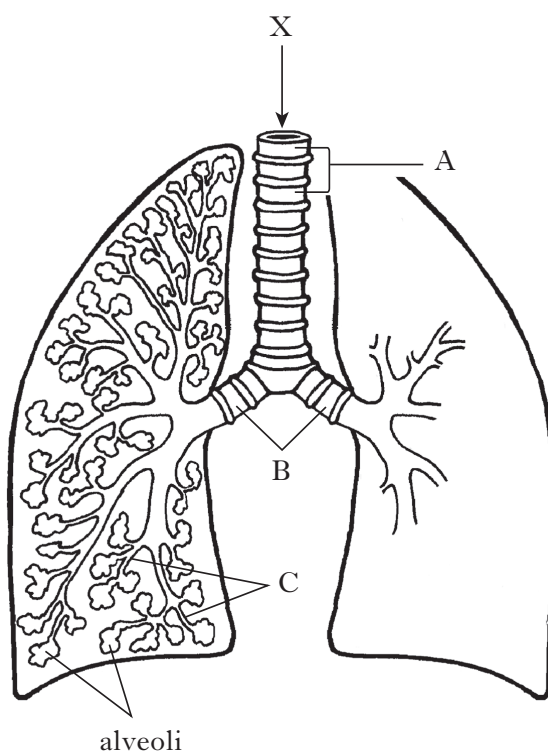
- (c) What feature of this investigation helped to improve the reliability of the results?

\_\_\_\_\_ **1**

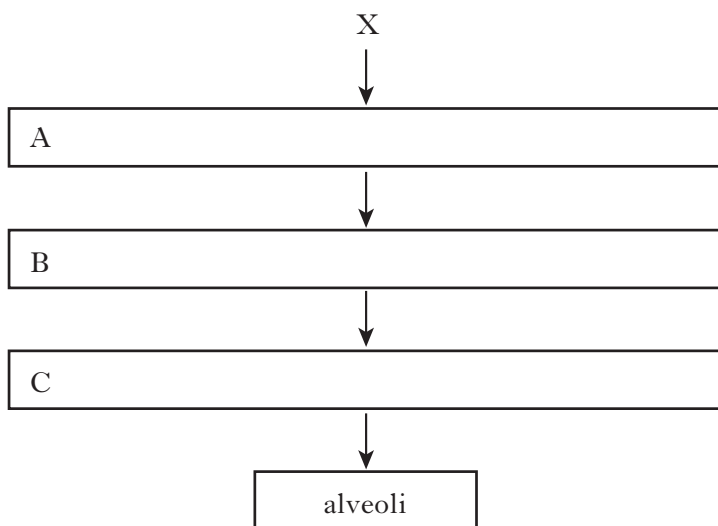
**[Turn over**

Marks

11. The diagram below shows some structures of the human lungs.



(a) Complete the following flow chart to give the pathway of air from X to the alveoli by inserting the names of the structures labelled in the diagram.



2

(b) (i) Name the process by which oxygen moves from the lungs into the blood.

\_\_\_\_\_

1

(ii) State **two** features of alveoli which allow efficient gas exchange.

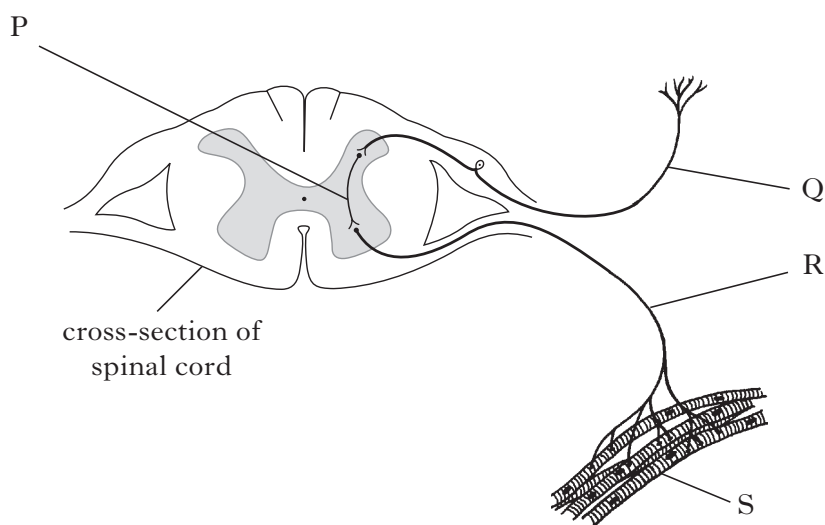
1 \_\_\_\_\_

2 \_\_\_\_\_

2

Marks

12. (a) The diagram below shows the structures found in a reflex arc.



Complete the table below to identify the structures and their functions.

<i>Structure</i>	<i>Letter</i>	<i>Function</i>
Sensory neurone		Carries impulses from the receptor to the spinal cord
	P	Passes impulses from the sensory neurone to the motor neurone
Effector		

3

- (b) The sentences below give the functions of some parts of the central nervous system.

Underline one option in each set of brackets to make the sentences correct.

The  $\left\{ \begin{array}{l} \text{medulla} \\ \text{spinal cord} \end{array} \right\}$  controls the breathing rate and the  $\left\{ \begin{array}{l} \text{cerebellum} \\ \text{cerebrum} \end{array} \right\}$  coordinates movements of the body.

A change in the water concentration of the blood is detected by the

$\left\{ \begin{array}{l} \text{hypothalamus} \\ \text{pituitary gland} \end{array} \right\}$ .

2

- (c) Name the hormone which is released to control reabsorption of water in the kidney.

\_\_\_\_\_

1

[Turn over for Section C on Page twenty-four

## SECTION C

Both questions in this section should be attempted.

Note that each question contains a choice.

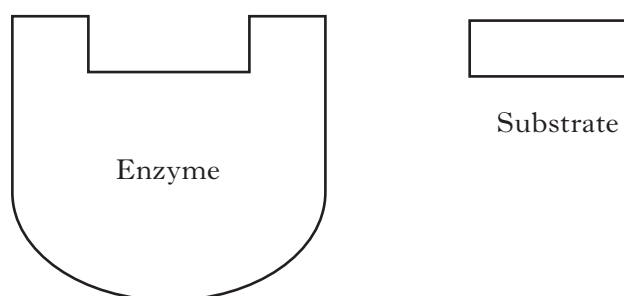
Questions 1 and 2 should be attempted on the blank pages which follow.

All answers must be written clearly and legibly in ink.

Supplementary sheets, if required, may be obtained from the Invigilator.

1. Answer **either A or B**.

A. The diagram below shows an enzyme and its substrate.

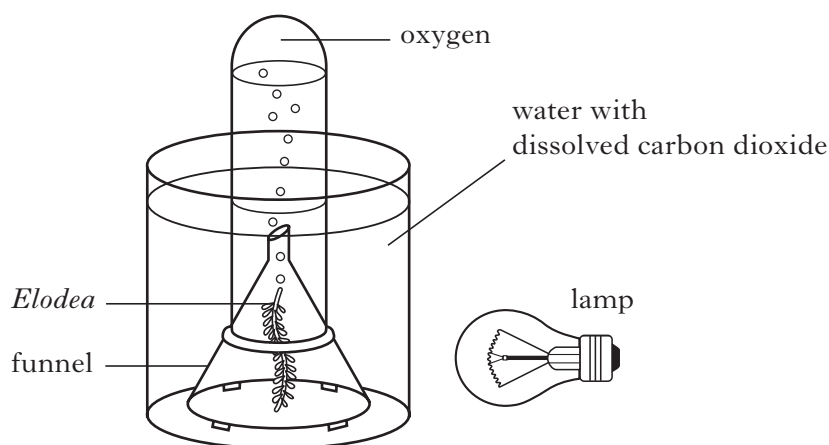


Using a **named example**, describe what happens to this enzyme and its substrate during a **degradation** reaction.

5

OR

B. The diagram below shows the green water plant *Eloдея* used in an experiment to investigate photosynthesis.



Describe how the requirements for photosynthesis shown in the diagram are used in photolysis and carbon fixation to produce oxygen and starch.

5

Question 2 is on Page twenty-six.



*Marks*

**SPACE FOR ANSWER TO QUESTION 1**

**[Turn over for Question 2 on *Page twenty-six***

Marks

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

**Labelled diagrams may be included where appropriate.**

A. The stomach wall contains muscles and cells that produce acid and mucus.  
Explain the functions of these muscles and cells in digestion.

5

**OR**

B. The human body can detect and respond to an increase in body temperature.  
Explain how the brain and the skin are involved in returning the body temperature to normal.

5

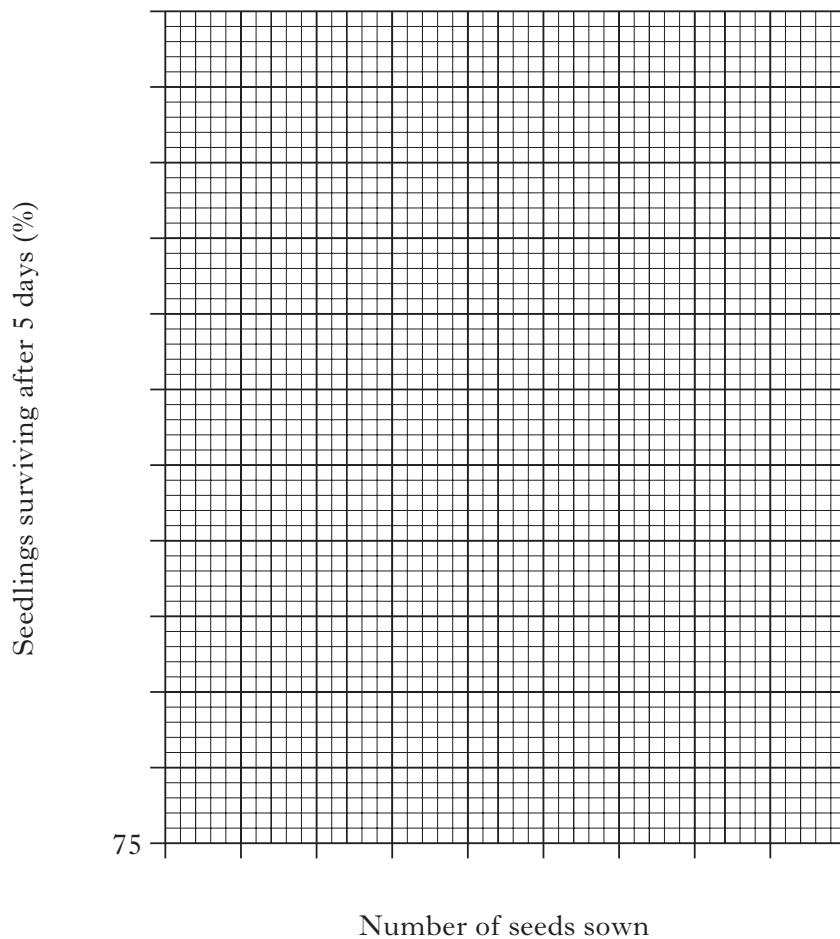
[END OF QUESTION PAPER]

SPACE FOR ANSWER TO QUESTION 2

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**ADDITIONAL SPACE FOR ANSWERS**

ADDITIONAL GRAPH PAPER FOR QUESTION 5(a)(i)



**ADDITIONAL SPACE FOR ANSWERS**

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**ADDITIONAL SPACE FOR ANSWERS**

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