FOR OFFICIAL USE

Total for Sections B and C

X007/201

NATIONAL QUALIFICATIONS 2009

THURSDAY, 28 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

Scottish candidate number

Number of seat

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)

1 (a) All questions should be attempted.

(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.

2 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**.

3 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.

4 The numbers of questions must be clearly inserted with any answers written in the additional space.

5 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.

6 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 exam, put the **answer sheet for Section A inside the front cover of this answer book**.

Sample Question

Plants compete mainly for

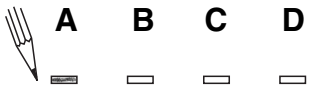
A water, light and soil nutrients

B water, food and soil nutrients

C light, water and food

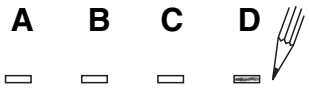
D light, food and soil nutrients.

The correct answer is **A—**water, light and soil nutrients. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).



Changing an answer

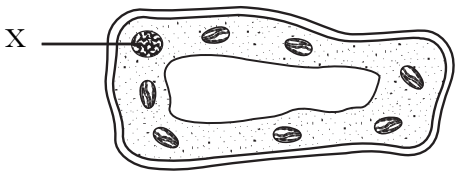
If you decide to change your answer, carefully erase your first answer and using your pencil, fill in the answer you want. The answer below has been changed to **D**.



SECTION A

All questions in this Section should be attempted.

1. The diagram below shows a cell.



The function of structure X is to

A control cell activities

B keep the cell turgid

C control entry and exit of material

D release energy from glucose.

2. Fungi destroy bacteria by producing

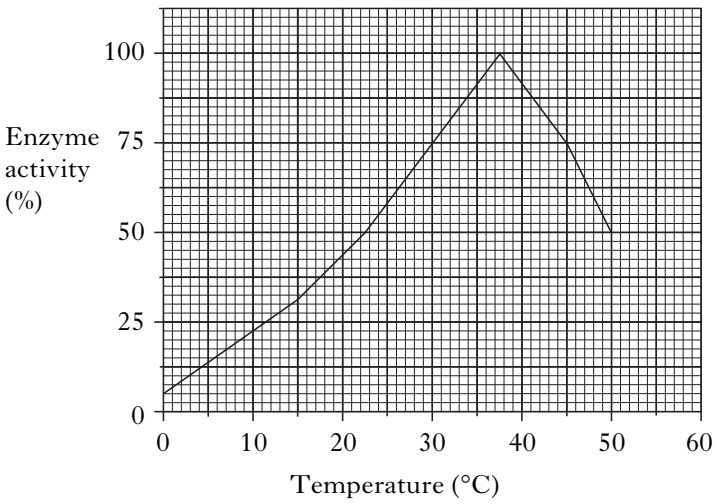
A antibiotics

B alcohol

C carbon dioxide

D biogas.

3. The graph below shows the effect of temperature on the activity of the enzyme pepsin.



Between which two temperatures is there the greatest increase in enzyme activity?

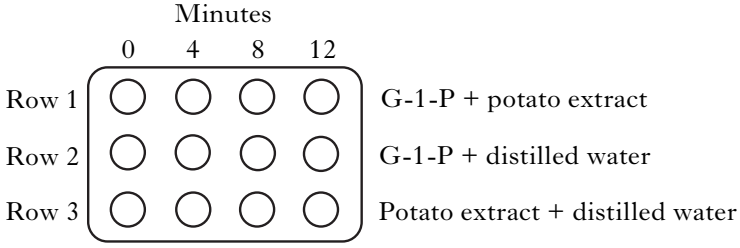
A 0 – 10 °C

B 10 – 20 °C

C 20 – 30 °C

D 30 – 40 °C

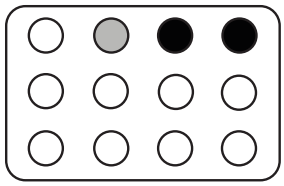
4. In an investigation into the synthesis of starch from glucose-1-phosphate (G-1-P) by the enzyme phosphorylase, a tile was set up as shown below. Starch-free potato extract was used as the source of phosphorylase.



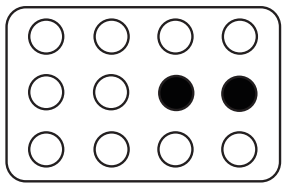
Iodine solution was added to the columns at the time intervals shown.

Which of the following tiles shows the expected result of this investigation?

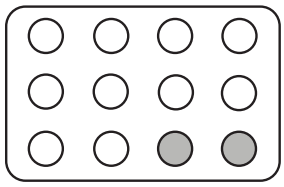
A



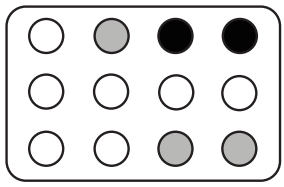
B



C



D



[Turn over

5. An investigation was carried out to measure the rate of carbon dioxide production in bread dough.

Carbon dioxide production was measured by recording the change in volume of a sample of bread dough over a 50 minute period.

The results are shown in the table below.

Time (minutes)	0	10	20	30	40	50
Volume of dough (cm^3)	10	14	18	21	23	25

The conclusion for this investigation was

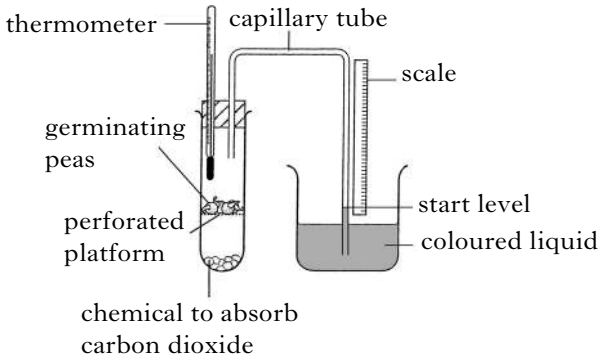
A $0{\cdot}3\,cm^3$ of carbon dioxide was produced per minute

B $0{\cdot}5\,cm^3$ of carbon dioxide was produced per minute

C $15\,cm^3$ of carbon dioxide was produced per minute

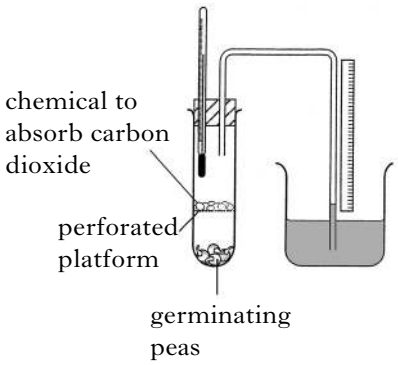
D $25\,cm^3$ of carbon dioxide was produced per minute.

6. The apparatus below was used to investigate respiration in germinating peas.

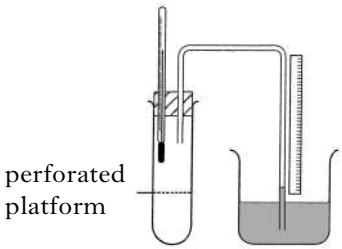


A suitable control for this investigation would be

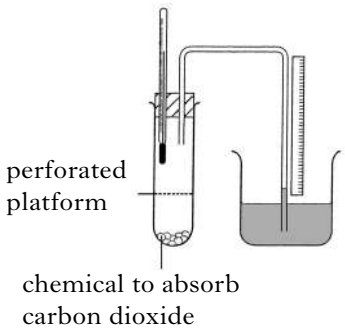
A



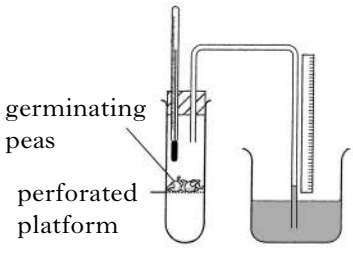
B



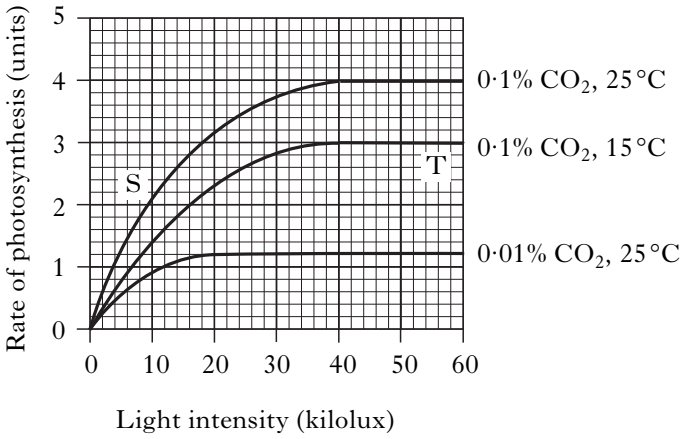
C



D



7. The graph shows the effect of varying the light intensity, temperature and carbon dioxide concentration on the rate of photosynthesis.



The rate of photosynthesis is being limited by

A temperature at S and light intensity at T

B light intensity at S and temperature at T

C carbon dioxide at S and temperature at T

D light intensity at S and carbon dioxide at T.

8. Which of the following conditions in a greenhouse would produce earlier crops?

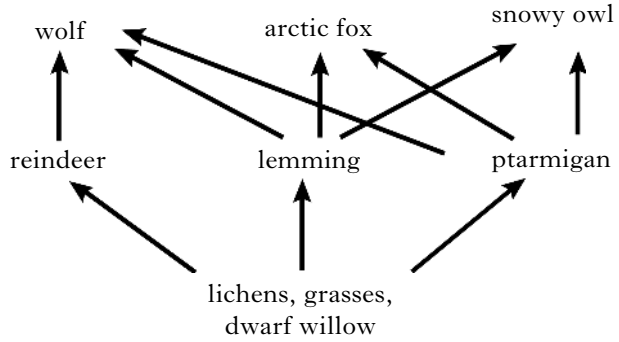
A Glass shading

B Cool air conditioners

C Additional oxygen

D Additional carbon dioxide

9. The diagram below shows part of a food chain in the Arctic tundra.



A population in this food web is all the

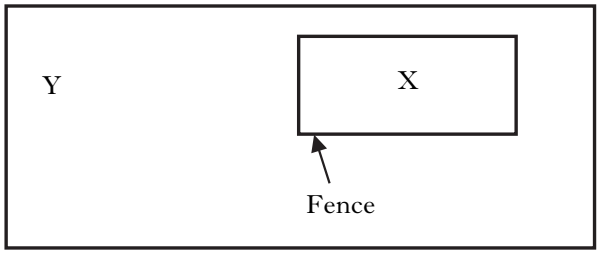
A plants

B reindeer

C animals

D living organisms.

10. The diagram below represents a field (Y) with an area (X) fenced off.



Sheep and rabbits provide very high intensity of grazing in area Y but cannot graze in fenced off area X.

Which line in the table below describes the diversity of plant species in areas X and Y after one year?

	Diversity of plant species	
	Area X	*Area Y*
A	higher	lower
B	lower	higher
C	higher	higher
D	lower	lower

11. The chromosome complement of a human individual who inherits an X-chromosome from their father is

A 44 including XX

B 44 including XY

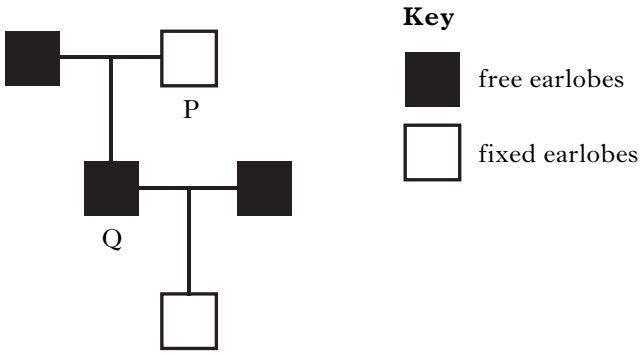
C 46 including XX

D 46 including XY

[Turn over

12. In humans, the allele for free earlobes (E) is dominant to the allele for fixed earlobes (e).

The diagram below shows the inheritance of this characteristic.



Which line in the table identifies correctly the genotypes of persons P and Q?

	Genotype	
	P	*Q*
A	ee	EE
B	ee	Ee
C	EE	Ee
D	Ee	Ee

13. A hairy stemmed pea plant was crossed with a smooth stemmed pea plant and all of the F_1 had hairy stems.

The genotype of the hairy stemmed parent plant is

A heterozygous dominant

B heterozygous recessive

C homozygous recessive

D homozygous dominant.

14. In gerbils, agouti coat colour is dominant to white.

Some heterozygous gerbils were allowed to interbreed and 56 offspring were produced. What would be the expected number of agouti gerbils?

A 14

B 28

C 42

D 56

15. Skin colour in humans is an example of

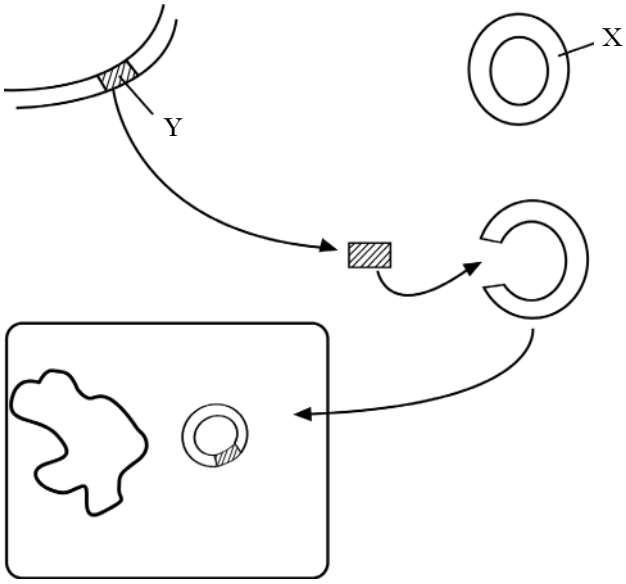
A discontinuous variation

B co-dominance

C polygenic inheritance

D random assortment.

16. The diagram below shows stages in the production of a desired product by genetic engineering.



Which line in the table identifies correctly the structures labelled above?

	X	*Y*
A	bacterium	gene
B	plasmid	chromosome
C	bacterium	chromosome
D	plasmid	gene

17. Digestion takes place in animals

A and allows insoluble molecules to pass directly through the wall of the small intestine

B as enzymes cannot act on insoluble molecules

C and makes insoluble molecules into soluble molecules to allow absorption

D and allows food to be passed along the gut by peristalsis.

18. Salivary glands produce mucus to

A lubricate the food in the stomach

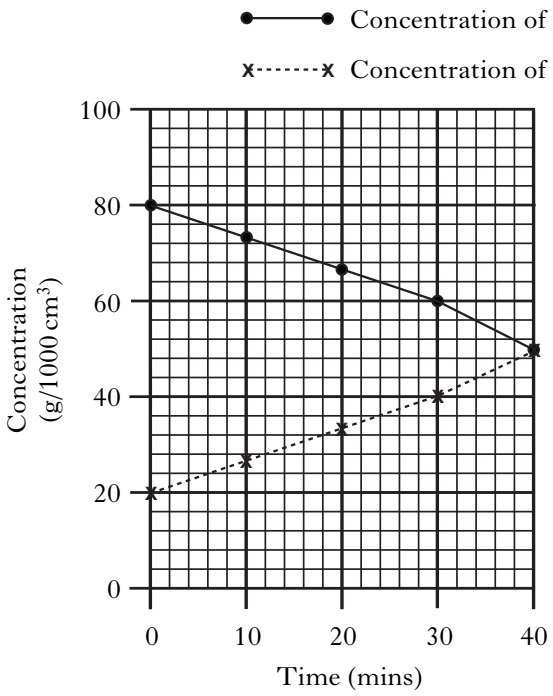
B lubricate the food to aid swallowing

C protect the mouth from amylase

D protect the oesophagus from amylase.

19. In the stomach, proteins are broken down into polypeptides.

The graph below shows the concentrations of protein and polypeptides in the stomach over 40 minutes.



What was the ratio of protein concentration to polypeptide concentration after 30 minutes?

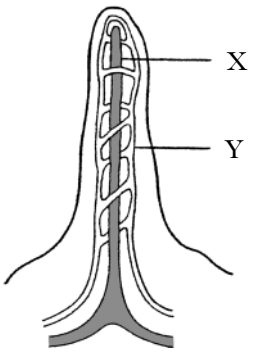
A 3 : 2

B 2 : 3

C 2 : 1

D 1 : 2

20. The diagram below shows some structures in a villus.



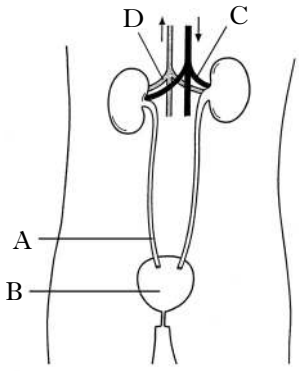
Which line in the table below correctly identifies the products of digestion which pass into structures X and Y?

	X	*Y*
A	glucose	amino acids
B	glycerol	fatty acids
C	amino acids	glycogen
D	fatty acids	glucose

21. Which line in the table identifies correctly the functions of the large intestine and the anus?

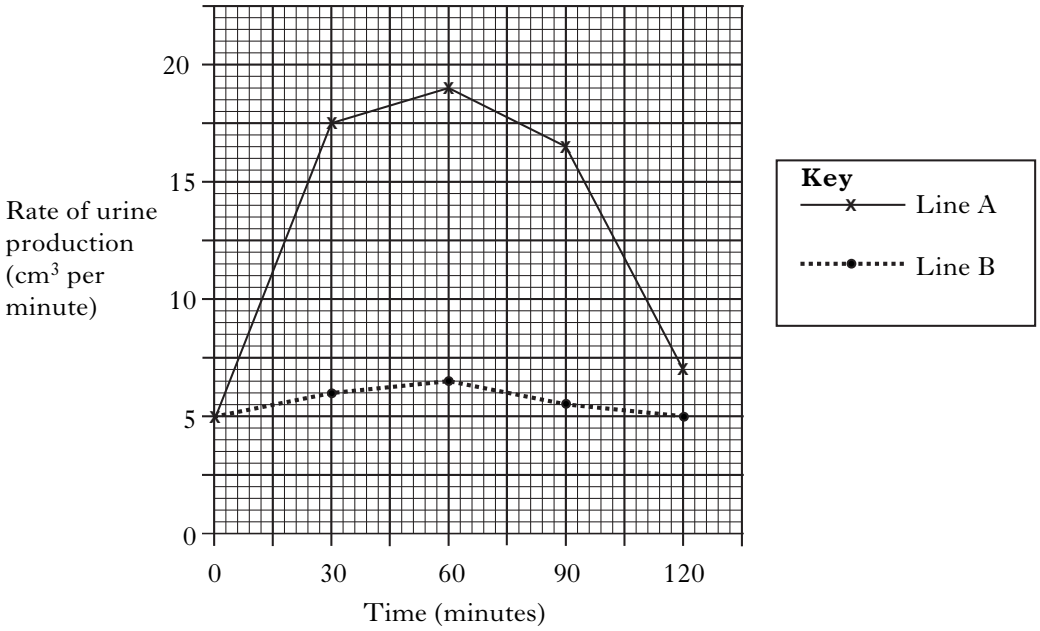
	Large intestine	*Anus*
A	digests food material	eliminates undigested material
B	stores undigested material	absorbs water from undigested material
C	absorbs water from undigested material	eliminates undigested material
D	absorbs digested food products	absorbs water from undigested material

22. The diagram below shows the human urinary system.



Which labelled part is the ureter?

23. The graph below shows the results of an investigation on the effect of ADH on urine production.



Line A shows the rate of urine production for a volunteer after drinking one litre of water.

Line B shows the rate of urine production from the same volunteer after drinking one litre of water and receiving an injection of ADH.

After 60 minutes, what was the difference between the rates of urine production with and without the ADH injection?

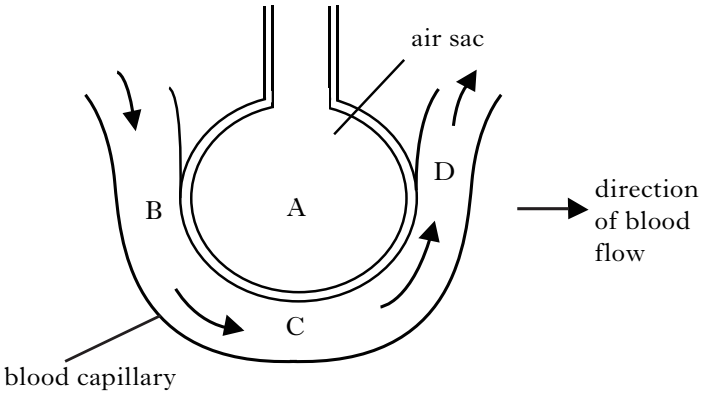
A 6·5 cm^3 per minute

B 12·5 cm^3 per minute

C 19·0 cm^3 per minute

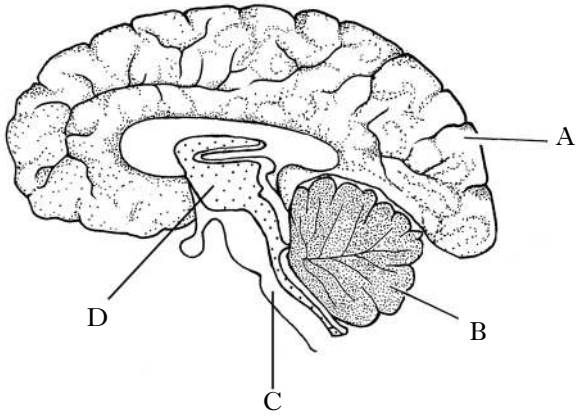
D 25·5 cm^3 per minute

24. The diagram below shows an air sac with part of its capillary network.



At which position would blood with the highest concentration of oxygen be found?

25. The diagram below shows a section through the human brain.



Which labelled part is the site of temperature regulation?

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

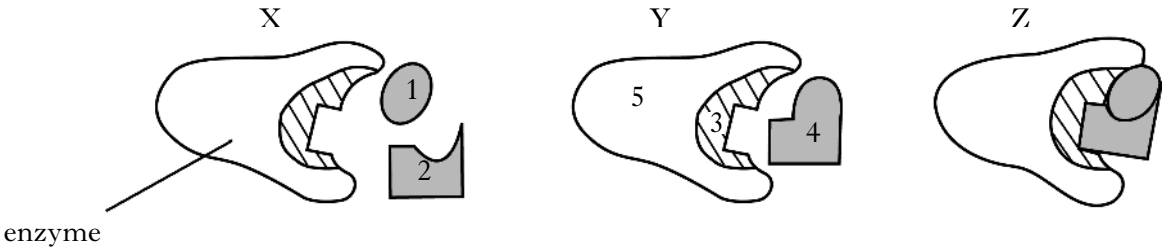
DO NOT WRITE IN THIS MARGIN

SECTION B

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

Marks

1. (*a*) The diagram below shows three stages X, Y and Z that occur when an enzyme converts its substrate into a product.



(i) This enzyme promotes the breakdown of a complex molecule into simpler molecules.

Put the stages into the correct order to show this degradation reaction.

_____ → _____ → _____ **1**

(ii) Which number in the diagram shows the active site?

_____ **1**

(*b*) Complete the following sentence by underlining the correct word from the choice in brackets.

Enzymes are made of { carbohydrate / fat / protein }. **1**

(*c*) Describe what happens to an enzyme when it is denatured.

_____

_____ **1**

[Turn over

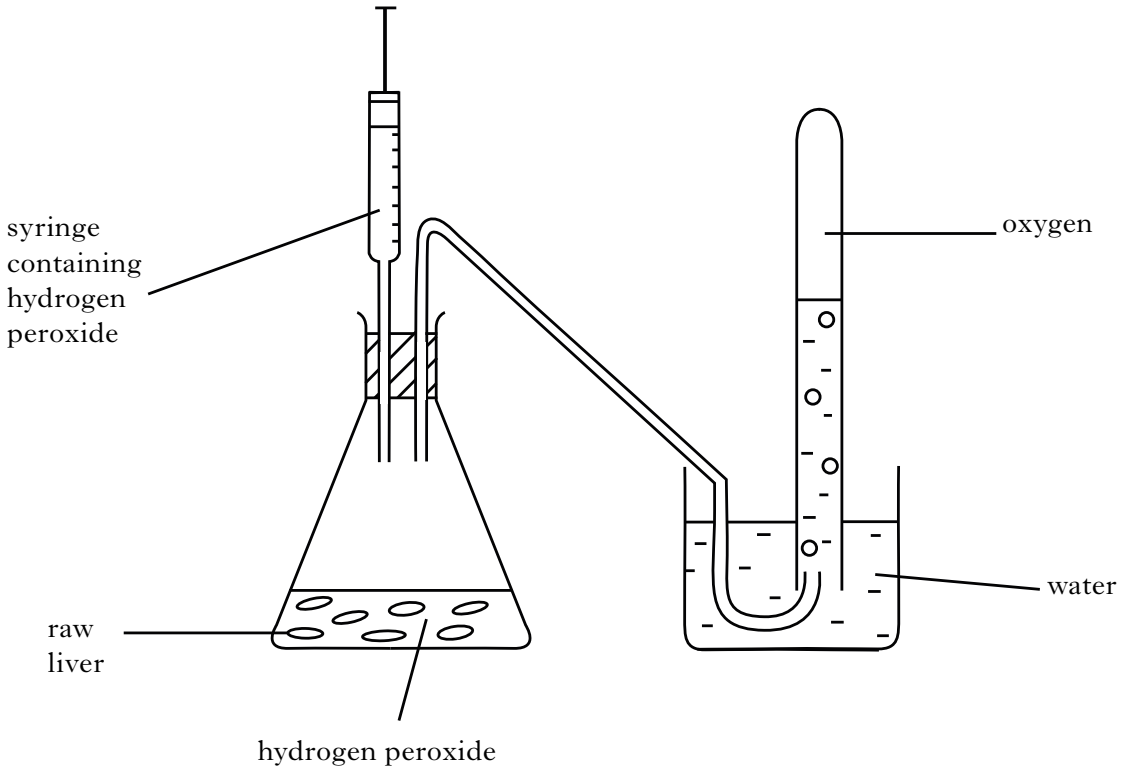
Marks

2. Liver contains the enzyme catalase which carries out the following reaction.

hydrogen peroxide ⟶ water + oxygen

The investigation shown below was carried out to demonstrate the effect of pH on catalase activity in liver.

Hydrogen peroxide of different pH values was added to 1 g of roughly chopped raw liver.



The time taken to collect 1cm^3 of oxygen was recorded and the results are shown in the table below.

pH of hydrogen peroxide solution	*Time to collect 1 cm^3 of oxygen* (seconds)			*Average time to collect 1cm^3 of oxygen* (seconds)
	Trial 1	*Trial 2*	*Trial 3*	
7	76	77	81	78
8	56	58	57	57
9	50	45	40	45
10	53	50	53	52
11	59	69	70	66

(*a*) From the table, state the optimum pH for catalase in liver.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

2. (continued)

(*b*) Name the variable altered in this investigation.

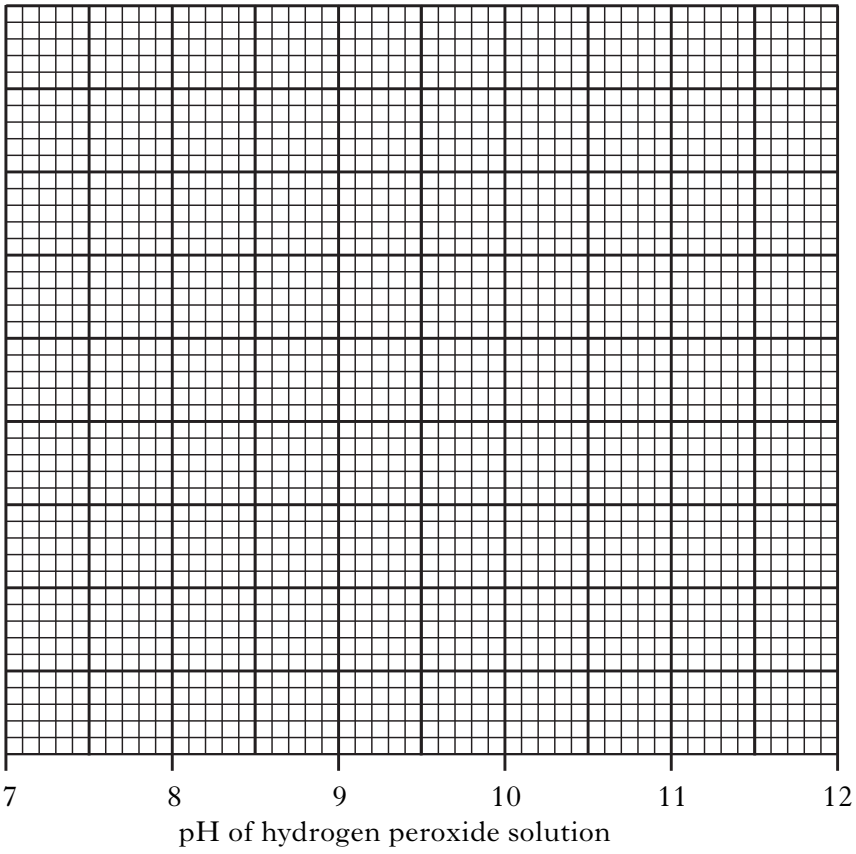
_____ **1**

(*c*) Explain why the experiment was repeated at each pH value and averages calculated.

_____ **1**

(*d*) Construct a line graph of the **average** time taken to collect 1 cm^3 of oxygen against pH of hydrogen peroxide solution.

(Additional graph paper, if required, will be found on *Page thirty-two*)



2

(*e*) Predict the average time to collect 1 cm^3 of oxygen at pH12.

_____seconds **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

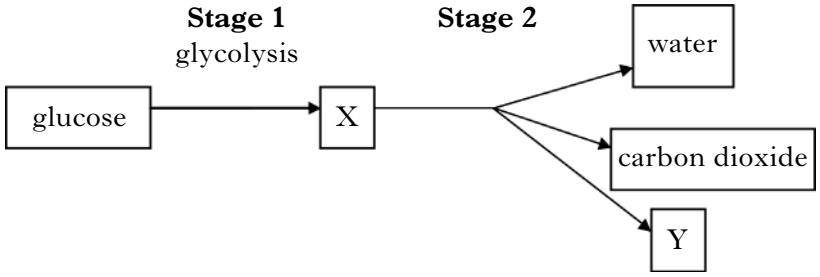
Marks

3. Yeast may carry out two different types of respiration.

(*a*) Name the type of respiration in yeast which has the highest energy yield.

_____ **1**

(*b*) The diagram below shows one type of respiration in yeast cells.



(i) Name substances X and Y.

X _____ **1**

Y _____ **1**

(ii) What other substance must be present for stage 2 to occur?

_____ **1**

(*c*) Yeast cells are used in the brewing industry.

(i) Name the type of respiration involved.

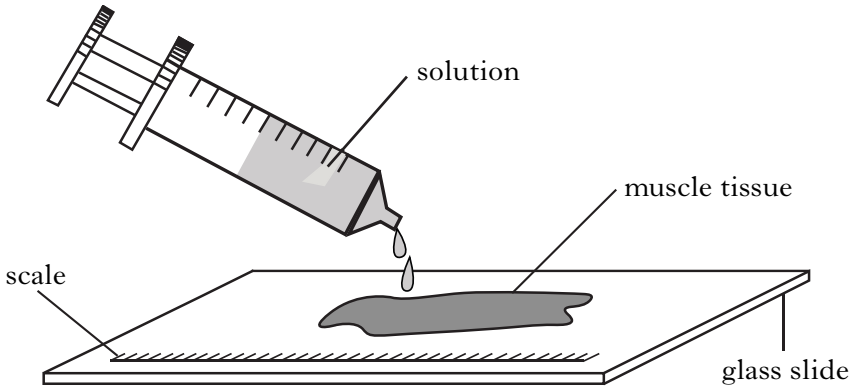
_____ **1**

(ii) Explain why yeast cells are used in the brewing industry.

_____ **1**

Marks

4. (*a*) The diagram below shows an investigation into the effect of adding three different solutions to three pieces of muscle tissue.



The results of the investigation are given in the table below.

Muscle tissue	*Solution added*	*Length of muscle tissue*			
		at start (mm)	*after 5 minutes* (mm)	*difference in length* (mm)	*percentage difference* (%)
1	1% glucose	50	50	0	0
2	1% ATP	45	41·5	4·5	10
3	0·5% ATP	48	45·6	2·4	

(i) Calculate the percentage difference in length for muscle tissue 3.

Space for calculation

_____% **1**

(ii) What conclusion can be drawn from the results?

_____

_____ **1**

(*b*) (i) What term is used to describe the effect of lactic acid build up in muscle tissue?

_____ **1**

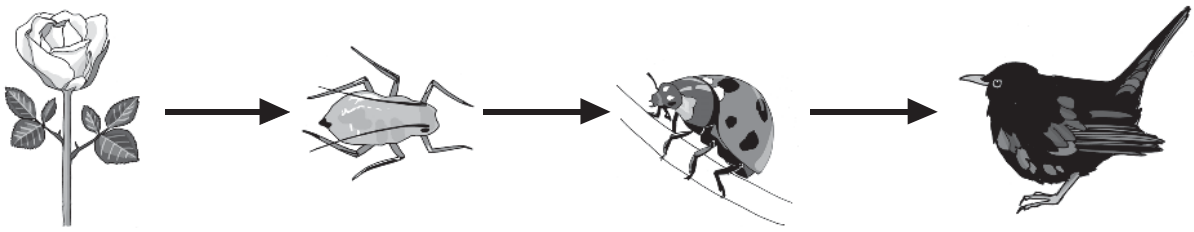
(ii) How can lactic acid be removed from muscle tissue?

_____ **1**

Marks

5. (*a*) The diagram below represents a food chain in a garden.

(*The organisms are not to scale.*)



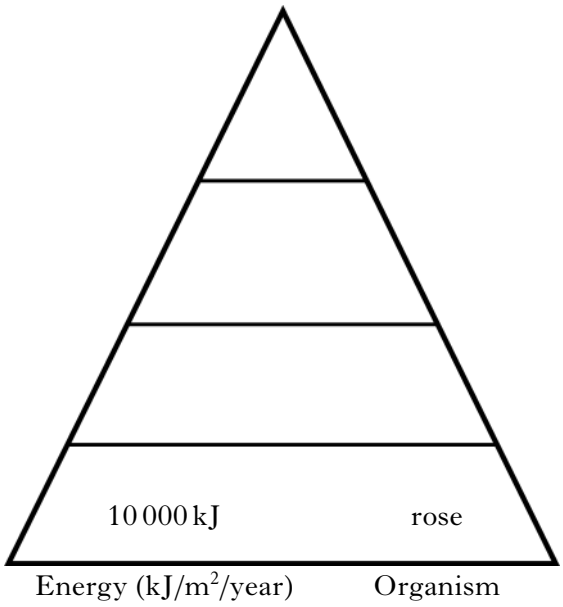
rose bush → greenfly → ladybird → blackbird

(i) What term describes the greenfly in this food chain?

_____ **1**

(ii) A rose bush contains 10 000 kJ/m^2/year of energy and only 10% of this energy is passed on at each stage of the food chain.

Use this information to complete the pyramid of energy below for this food chain.



2

(iii) What happens to the energy that is **not** passed on at each stage of the food chain?

_____ **1**

(*b*) Many ladybirds were seen over the summer in the garden.

They were able to interbreed and produce fertile offspring.

What can be concluded about the ladybirds, using all this information?

_____ **1**

Marks

6. The following table shows four blood groups and their frequency in a population.

Blood Group	*Frequency in population* (%)
O	44
A	42
B	10
AB	4

(*a*) Calculate the simplest whole number ratio of the frequency of blood groups O to AB.

Space for calculation

Blood group _____ : _____ **1**
O AB

(*b*) Name the type of variation shown by these blood groups.

_____ **1**

(*c*) Blood group is determined by three alleles A, B, O.

The table below shows the possible genotypes of each blood group.

Genotype	*Blood group*
OO	O
AO, AA	A
BO, BB	B
AB	AB

(i) Which of these alleles are co-dominant?

_____ **1**

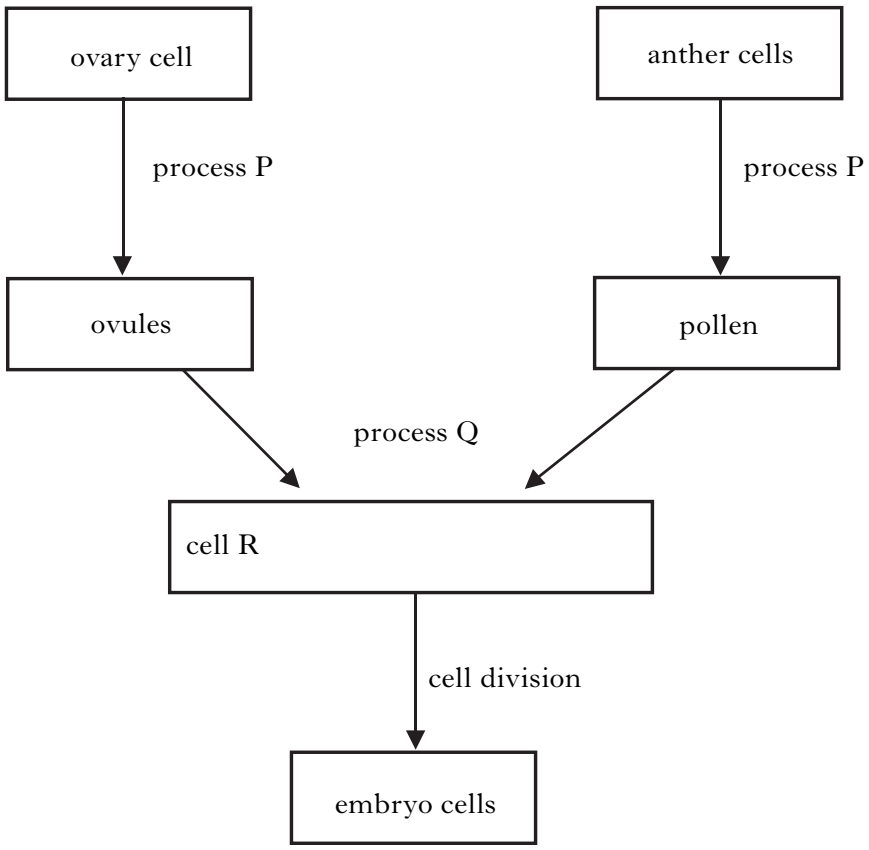
(ii) Explain the meaning of co-dominant alleles.

_____

_____ **1**

Marks

7. (*a*) The diagram below shows a summary of events that occur during reproduction in a flowering plant.



(i) **Complete the diagram** by entering the name of cell type R. **1**

(ii) Which process in the diagram represents fertilisation?

_____ **1**

(iii) Complete the following table by inserting a tick (✓) in the correct boxes to show which of the cells in the diagram have a double or single set of chromosomes.

Cell	*Double set of chromosomes*	*Single set of chromosomes*
anther		
ovule		
R		
embryo		

2

DO NOT WRITE IN THIS MARGIN

Marks

7. (continued)

(*b*) Explain the need to produce cells with a single set of chromosomes in reproduction.

_____

_____ **1**

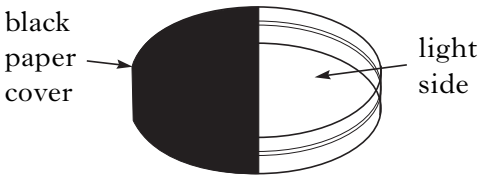
(*c*) Underline one option in each set of brackets to make the following sentence correct.

Random assortment of chromosomes occurs during {meiosis / fertilisation}

which {increases / decreases} the {biodiversity / variation} of gametes. **2**

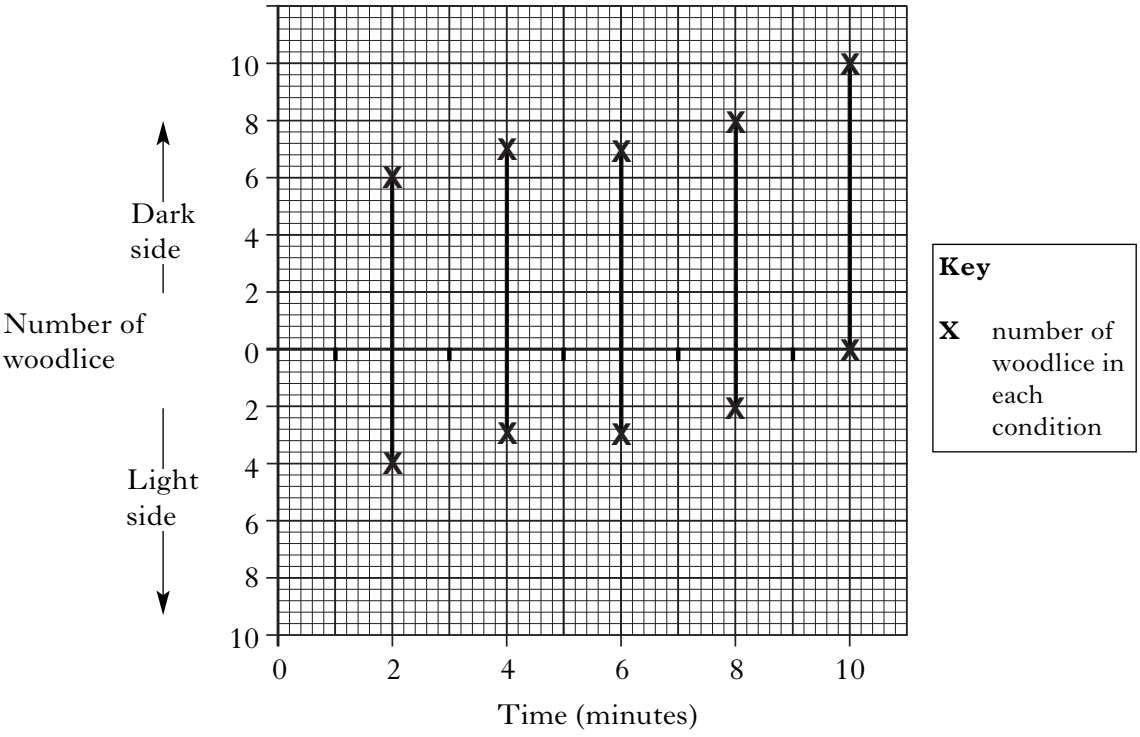
[Turn over

8. An investigation to demonstrate the responses of woodlice to light was carried out in a choice chamber. Half of the choice chamber was covered in black paper and the other half left in light.



Ten woodlice were introduced into the choice chamber. The number of woodlice in each side was counted every two minutes for ten minutes.

The graph shows the results of this investigation.



(*a*) Name two environmental conditions that should be kept constant in this investigation.

1 _____

2 _____ **2**

(*b*) What conclusion can be made from the results of this investigation?

_____

_____ **1**

(*c*) Explain the advantage of this behaviour to the woodlice.

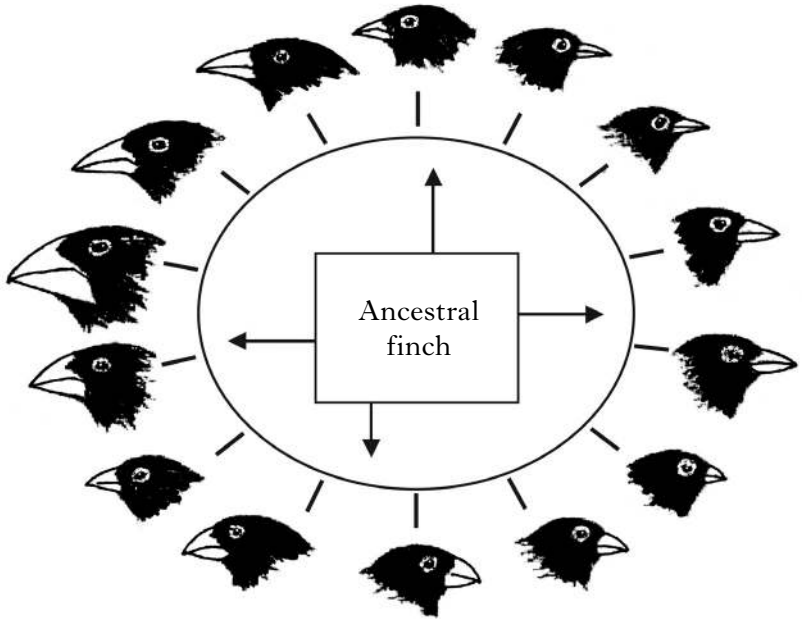
_____

_____ **1**

Marks

9. It is thought that Darwin's finches evolved from one type of ancestral finch.

The diagram below shows examples of different species of Darwin's finches.



(*a*) (i) What **two** observations can be made from the diagram about the structure of the finches' beaks?

_____ **1**

(ii) Name one environmental factor which has led to this variation.

_____ **1**

(*b*) What term is used to describe the role that each finch plays within its community?

_____ **1**

(*c*) The existence of some Darwin's finches is under threat in the Galapagos Islands due to human activity.

(i) Give an example of a human activity that could be affecting the finches.

_____ **1**

(ii) What could be an effect of this human activity on finch biodiversity?

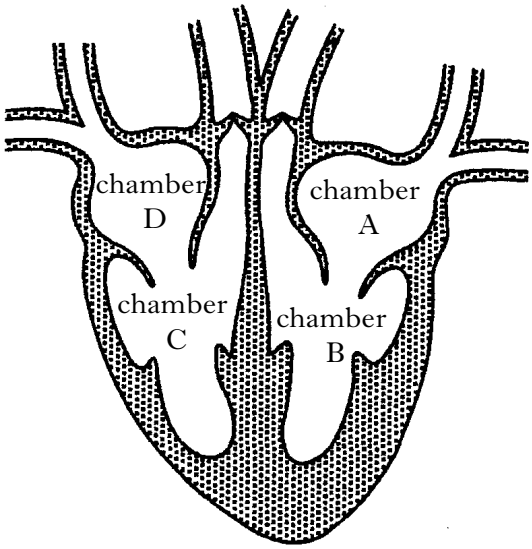
_____ **1**

[Turn over

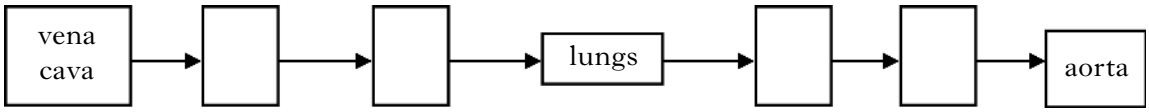
DO NOT WRITE IN THIS MARGIN

Marks

10. The diagram below shows a section through the heart.



(*a*) (i) Blood follows a pathway through the heart and lungs from the vena cava to the aorta. Use letters from the diagram to complete the following flow chart to show the correct pathway.



1

(ii) State the letter of a chamber of the heart which contains oxygenated blood.

Chamber _____ **1**

Marks

10. (continued)

(*b*) Decide if each of the following statements about the transport of gases by the bloodstream 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.

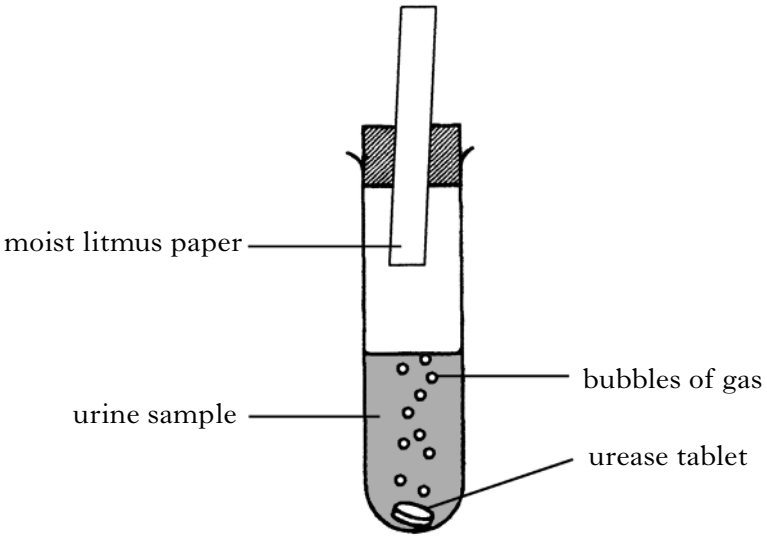
Statement	*True*	*False*	*Correction*
Oxygen forms oxyhaemoglobin at low oxygen levels in the lungs.			
Carbon dioxide is transported in red blood cells.			
Carbon dioxide dissolved in the blood plasma decreases acidity.			

3

[Turn over

Marks

11. (*a*) An investigation was carried out to estimate the concentration of urea in two unknown urine samples. A tablet of the enzyme urease was added to a test tube containing the urine sample. When urease reacted with urea in the sample the gas produced turned moist litmus paper blue.



The time taken for the litmus paper to turn blue was recorded in each case.

The table below shows the results obtained when various urine samples of known and unknown urea concentration were tested.

Concentration of urea in urine sample (g/100 cm^3)	*Time taken for litmus paper to turn blue* (seconds)
0·5	300
1·5	210
2·5	115
3·5	10
unknown A	75
unknown B	225

(i) Which unknown urine sample, A or B, has the lowest concentration of urea?

_____ **1**

(ii) Suggest a reason for a low concentration of urea in urine.

_____ **1**

Marks

11. (*a*) (continued)

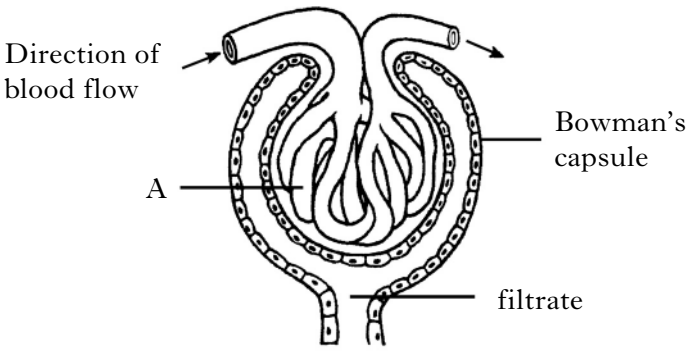
(iii) Predict the effect on the results if the temperature was increased from 20°C to 30°C in this investigation.

_____ **1**

(iv) Describe a suitable control for this investigation.

_____ **1**

(*b*) The diagram below shows the parts of a kidney nephron involved in filtration.



(i) Name part A which consists of a bundle of blood capillaries.

_____ **1**

(ii) Describe the process which forms urine from the filtrate.

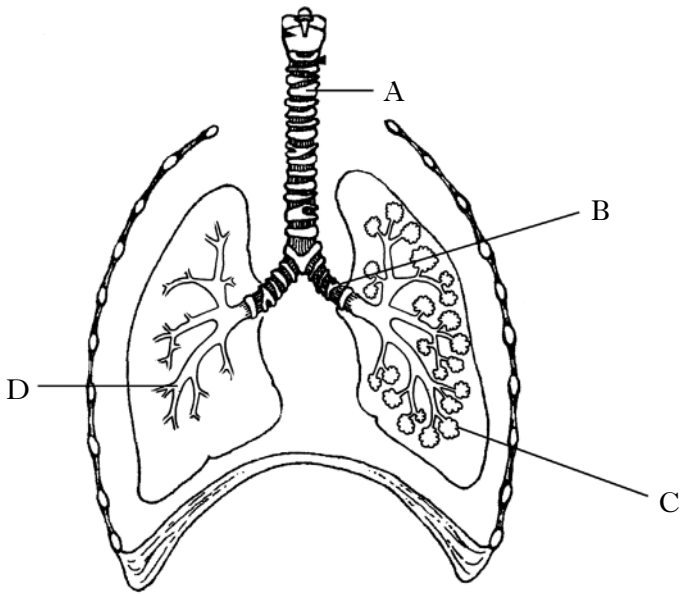
_____

_____ **1**

[Turn over

Marks

12. (*a*) The diagram below shows the human breathing system.



Complete the table below to identify the labelled structures.

Letter	*Name of structure*
	bronchiole
B	
	trachea
C	

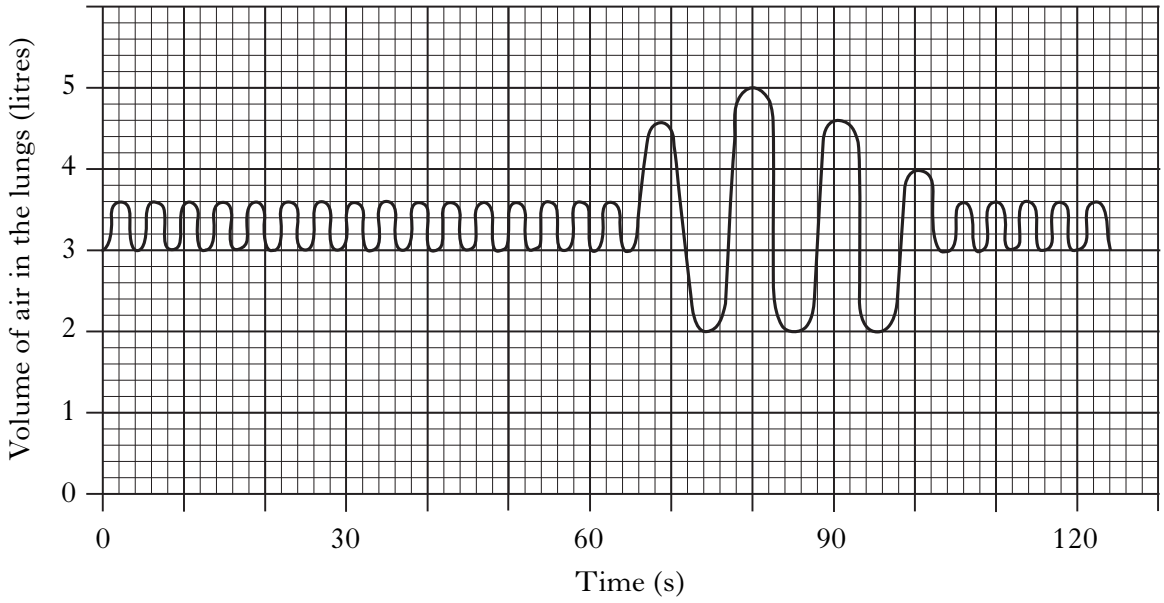
2

Marks

12. (continued)

(*b*) A person breathed normally, took deep breaths, then returned to normal breathing.

The volume of air in the lungs was measured and the results are shown in the graph below.



(i) What was the normal breathing rate for this person?

_____ breaths per minute **1**

(ii) What was the highest volume of air inhaled in a single breath?

_____ litres **1**

[Turn over

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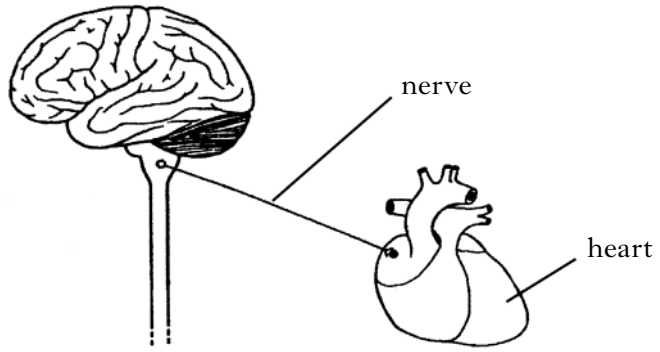
Marks

13. (*a*) The diagram below shows parts of the central nervous system (CNS) and a nerve to the heart.



(i) Name the two parts, shown in the diagram, which make up the central nervous system (CNS).

1 _____

2 _____ **1**

(ii) Name the area, shown in the diagram, which controls heart rate.

_____ **1**

(*b*) Reflex arcs contain relay fibres.

(i) Which structure sends impulses to the relay fibre?

_____ **1**

(ii) What is the function of relay fibres in a reflex arc?

_____ **1**

(*c*) Explain the function of a reflex response.

_____

_____ **1**

[Turn over for Section C on *page twenty-eight*

SECTION C

Marks

Both questions in this section should be attempted.

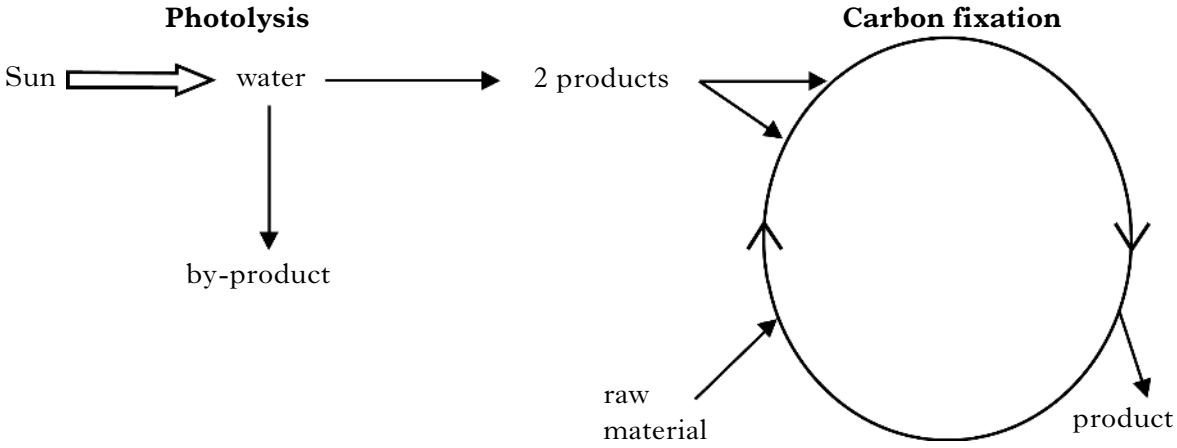
Note that each question contains a choice.

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 diagrams below show the two stages of photosynthesis.



Describe what happens during the two stages

(*a*) photolysis

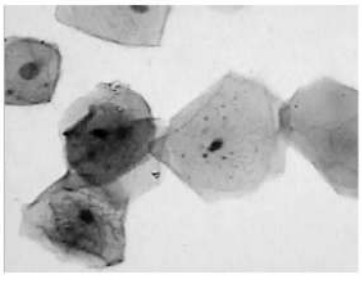
and

(*b*) carbon fixation. **5**

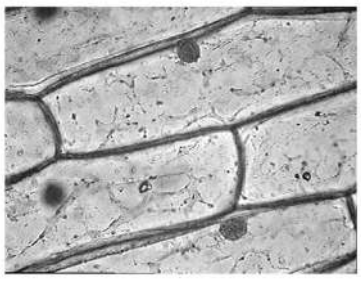
OR

B. The diagrams below show animal and plant cells in isotonic solutions.
These diagrams are not to scale.

Animal cells



Plant cells



Describe the osmotic effect of transferring

(*a*) the animal cells into a hypotonic solution (water)

(*b*) the plant cells into a hypertonic solution (strong salt). **5**

Question 2 is on *Page thirty*

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SPACE FOR ANSWER TO QUESTION 1

**[Turn over for Question 2 on *Page thirty*

DO NOT WRITE IN THIS MARGIN

Marks

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

Labelled diagrams may be included where appropriate.

A. Describe the role of the liver and pancreas in digestion. Include in your answer the processing of absorbed materials such as glucose and amino acids. **5**

OR

B. Describe the role of antibodies and phagocytosis in defence. Name the cells involved in each of these defence mechanisms. **5**

[*END OF QUESTION PAPER*]

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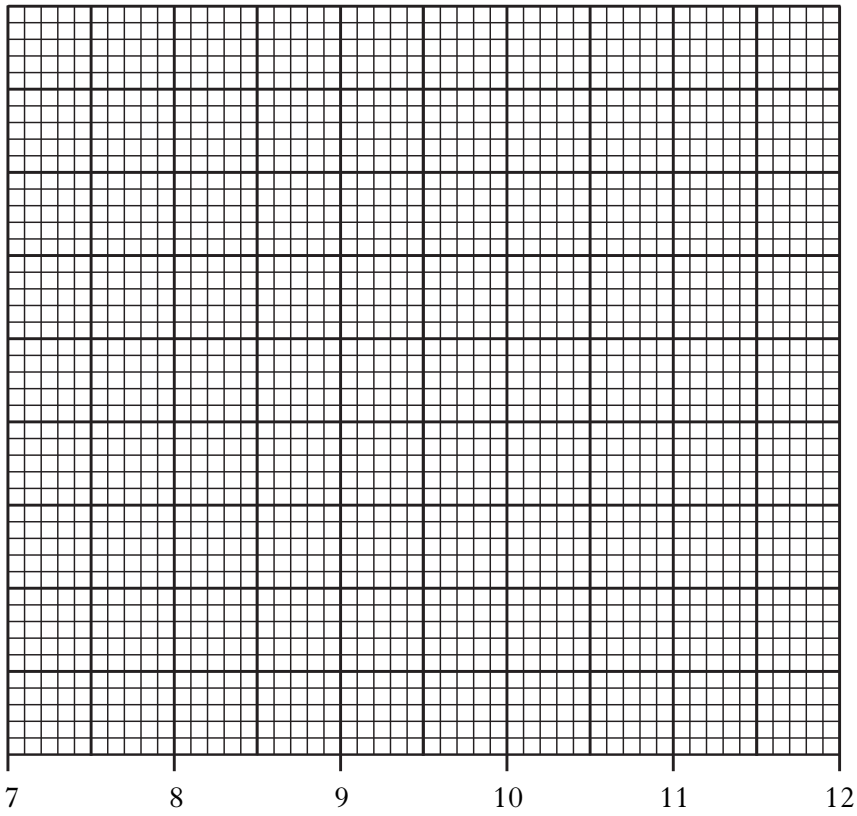
SPACE FOR ANSWER TO QUESTION 2

ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 2(*d*)



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ADDITIONAL SPACE FOR ANSWERS

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