

FOR OFFICIAL USE

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Total for
Sections B and C

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X007/11/02

NATIONAL
QUALIFICATIONS
2015

WEDNESDAY, 13 MAY
9.00 AM – 11.00 AM

BIOLOGY
INTERMEDIATE 2

Fill in these boxes and read what is printed below.

Full name of centre

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Town

--

Forename(s)

--

Surname

--

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

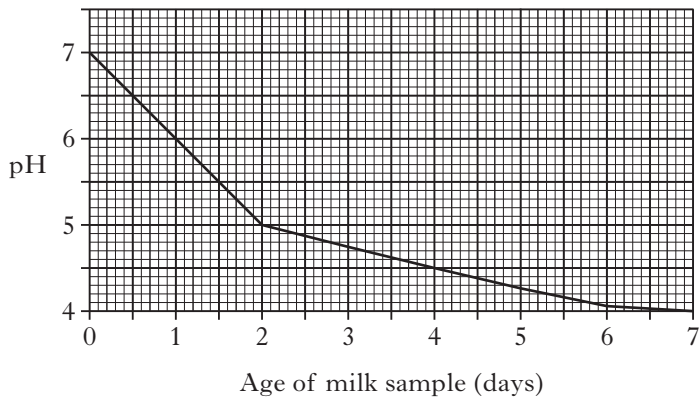
If you decide to change your answer, carefully erase your first answer and, using your pencil, fill in the answer you want. The answer below has been changed to **D**.



SECTION A

All questions in this Section should be attempted.

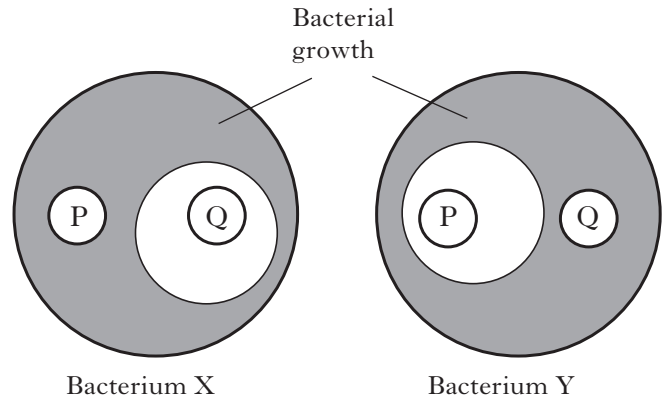
1. The graph below shows the changing pH of a sample of milk over a seven day period.



The changes in pH are due to

- A bacteria in the milk producing carbon dioxide
 - B bacteria in the milk causing the production of lactic acid
 - C lactic acid in the milk destroying the bacteria
 - D enzymes in the milk being denatured.
2. An animal cell placed in a liquid swells up and bursts. What will happen to a plant cell placed in the same liquid?
- A It will become turgid.
 - B It will become flaccid.
 - C It will become plasmolysed.
 - D It will not change.

3. The diagram below shows two Petri dishes each with two different antibiotic discs (P and Q). Each dish has a different species of bacterium (X or Y) growing on it.

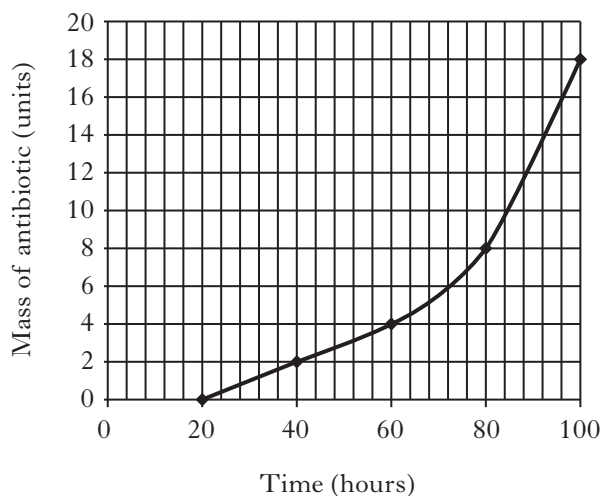


Which of the following statements is correct?
The growth of bacterium

- A X is reduced by antibiotic P
- B Y is reduced by antibiotic Q
- C X is reduced by antibiotic P and Q
- D Y is reduced by antibiotic P but not Q.

[Turn over

4. The following graph shows the mass of antibiotic produced by organisms in a flask at 10 °C for a period of 100 hours.

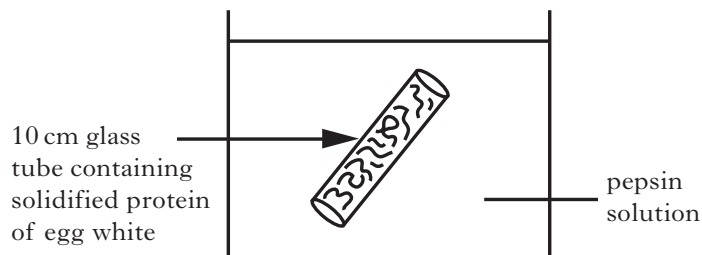


Predict the effect of raising the temperature of the flask from 10 °C to 20 °C.

- A The rate of antibiotic production would increase.
- B The organisms would be denatured.
- C The number of organisms would decrease.
- D The rate of antibiotic production would decrease.

5. An investigation was carried out into the effect of pH on pepsin activity.

Four experiments were set up as shown in the diagram below at pH2, 5, 7 and 10.



The table below shows the lengths of the protein after one hour at each pH.

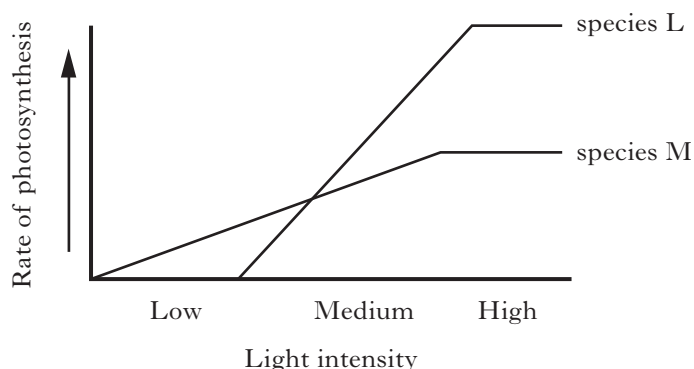
<i>pH</i>	<i>length (cm)</i>
2	6
5	8
7	9
10	10

What is the optimum pH for pepsin?

- A pH2
 - B pH5
 - C pH7
 - D pH10
6. The energy released from glucose is used to synthesise
- A Pi
 - B ADP
 - C ATP
 - D pyruvic acid.

7. The effect of high light intensity on the rate of photosynthesis was measured for two species of plants, L and M. Both species grow in a range of conditions.

The results are shown in the graph below.



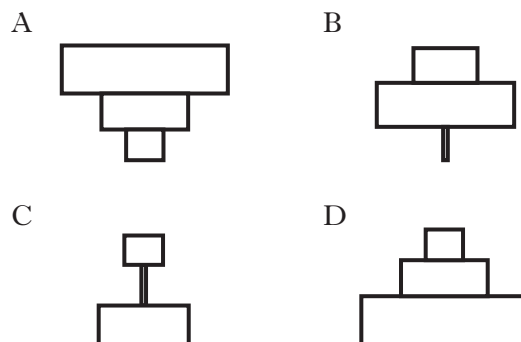
The rate of photosynthesis of species M is

- A slower than L in low light intensities
 B slower than L in high light intensities
 C faster than L in medium light intensities
 D faster than L in high light intensities.
8. Which line in the table below identifies the **best** conditions for the production of early crops?

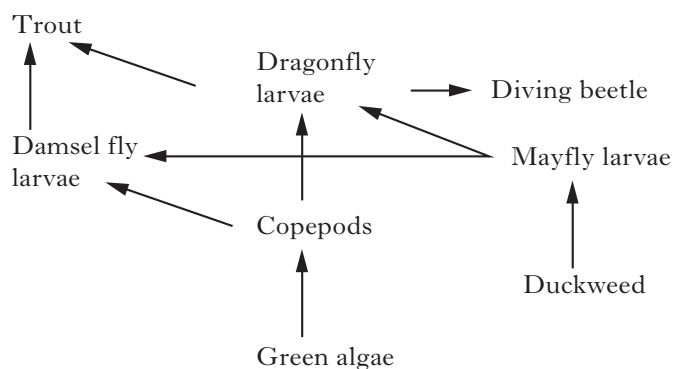
	<i>Added Factor</i>	<i>Light Intensity</i>
A	oxygen	high
B	oxygen	medium
C	carbon dioxide	medium
D	carbon dioxide	high

9. Beech tree → greenfly → ladybirds

Which of the following diagrams represents the pyramid of numbers for the above food chain?



10. The diagram below shows part of a food web in a freshwater ecosystem.

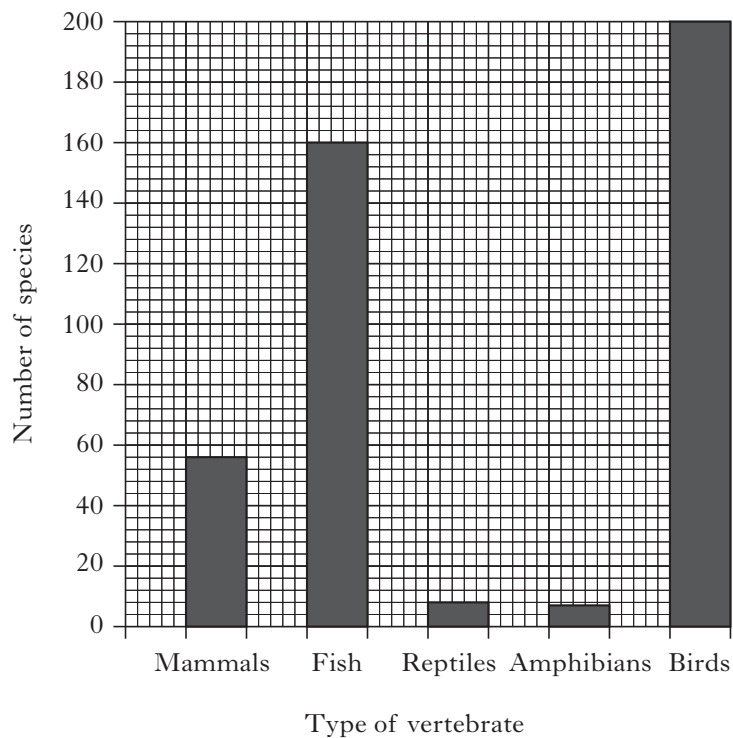


A reduction in the population of Dragonfly larvae will cause

- A an increase in the populations of both the trout and diving beetle
 B an increase in the populations of both the trout and copepods
 C a decrease in the populations of both green algae and damsel fly larvae
 D an increase in the population of copepods and a decrease in the population of mayfly larvae.

[Turn over

11. The graph below shows the number of species of each type of vertebrate found regularly in Scotland.



The simplest whole number ratio of the number of species of reptiles to the number of species of fish is

- A 1:20
 B 1:80
 C 20:1
 D 80:1.
12. Which of the following correctly describes adaptations in desert plants?
- A Thick waxy cuticle present, large leaf area.
 B Thick waxy cuticle absent, small leaf area.
 C Deep roots, small leaf area.
 D Deep roots, thick waxy cuticle absent.

13. The diagrams below show the same sections of matching chromosomes found in four flies, A, B, C and D.



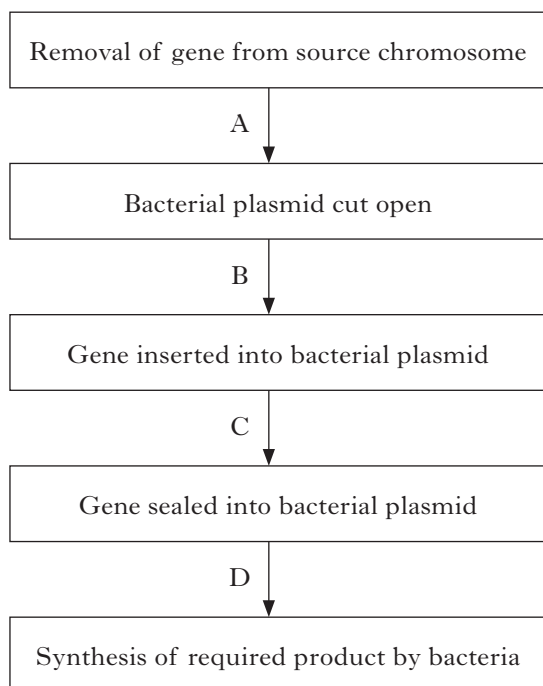
The alleles shown on the chromosomes can be identified using the following key.

- Diagonal lines allele for striped body
 Solid black allele for unstriped body
 Solid grey allele for normal antennae
 Checkerboard allele for abnormal antennae

Which fly is homozygous for body pattern and heterozygous for antennae type?

14. When different alleles of a gene are both expressed in the phenotype, the alleles are described as being
- A homozygous
 B heterozygous
 C co-dominant
 D polygenic.
15. Siamese cats kept in cool conditions have pale body fur. If they are moved to warm conditions for a few months then their body fur becomes darker.
- The change during this time is due to the
- A effect of the environment on the genotype
 B effect of selective breeding on the phenotype
 C effect of selective breeding on the genotype
 D effect of the environment on the phenotype.

16. Some stages of genetic engineering are shown below.

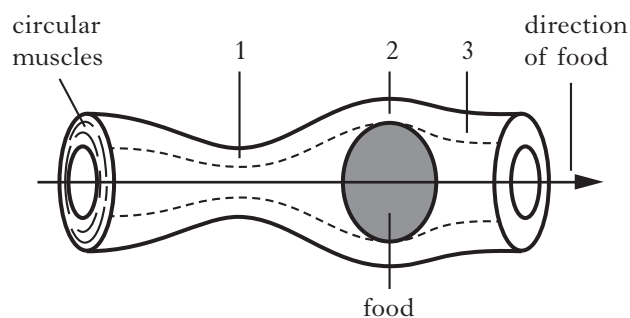


Which letter indicates the stage where the plasmid is inserted into a bacterial cell?

17. The process of digestion changes the size and solubility of food molecules. Which line in the table below correctly describes the changes in food due to digestion?

	<i>Food molecule</i>	
	<i>Size</i>	<i>Solubility</i>
A	increases	increases
B	decreases	increases
C	increases	decreases
D	decreases	decreases

18. The diagram below shows the movement of food along the oesophagus.



Which line in the table below correctly describes the state of the circular muscles at points 1, 2 and 3 on the diagram?

	<i>Circular muscles</i>		
	<i>Point 1</i>	<i>Point 2</i>	<i>Point 3</i>
A	contracted	relaxed	contracted
B	relaxed	contracted	contracted
C	contracted	relaxed	relaxed
D	relaxed	contracted	relaxed

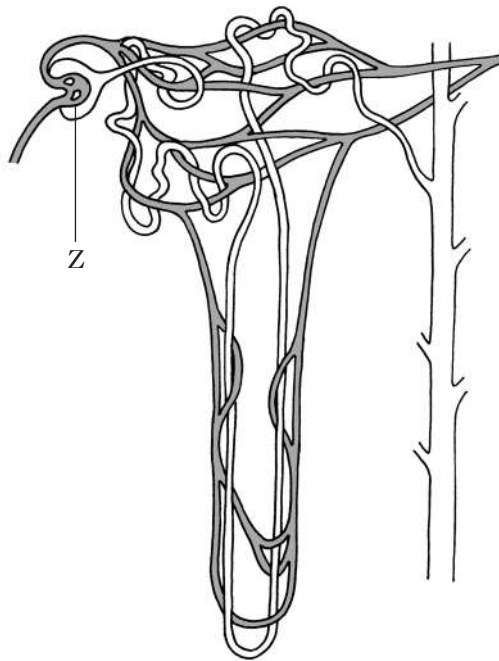
19. The pancreas produces enzymes.

Which line in the table below correctly identifies an enzyme produced by the pancreas and its substrate?

	<i>Enzyme</i>	<i>Substrate</i>
A	trypsin	protein
B	catalase	glucose
C	lipase	starch
D	amylase	fat

[Turn over

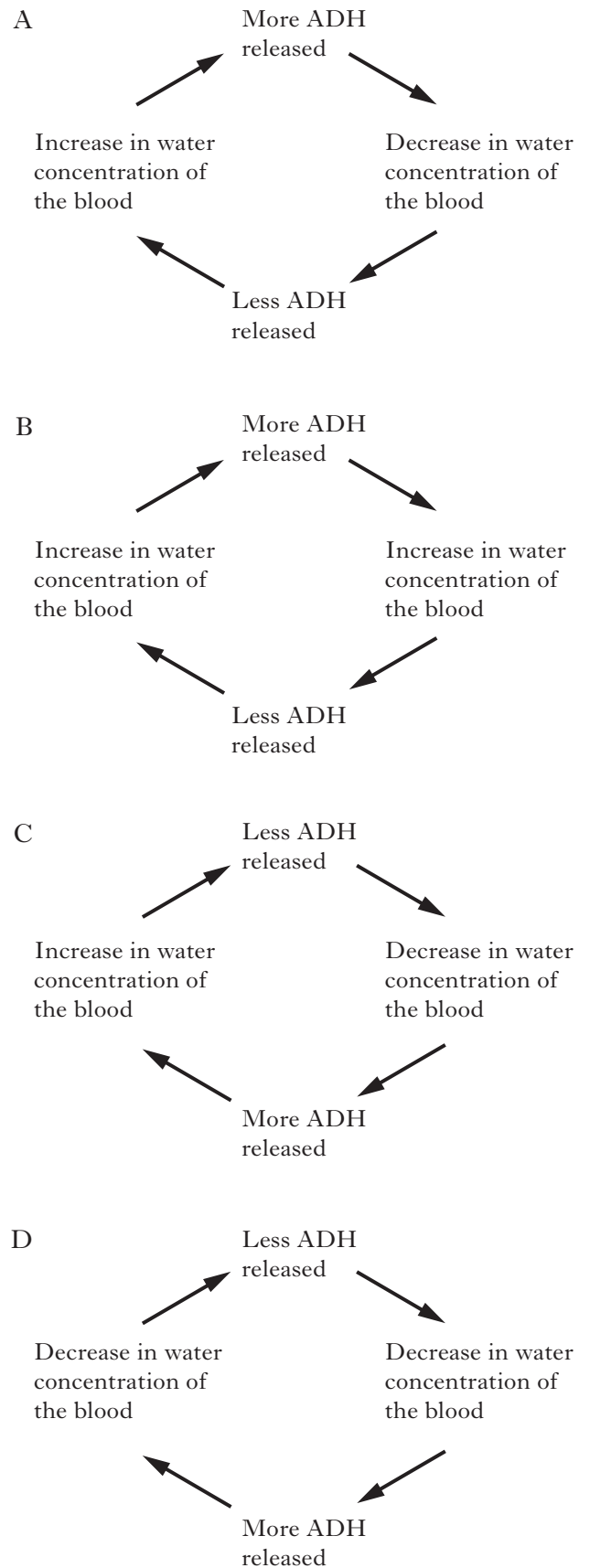
20. The diagram below represents a kidney nephron.



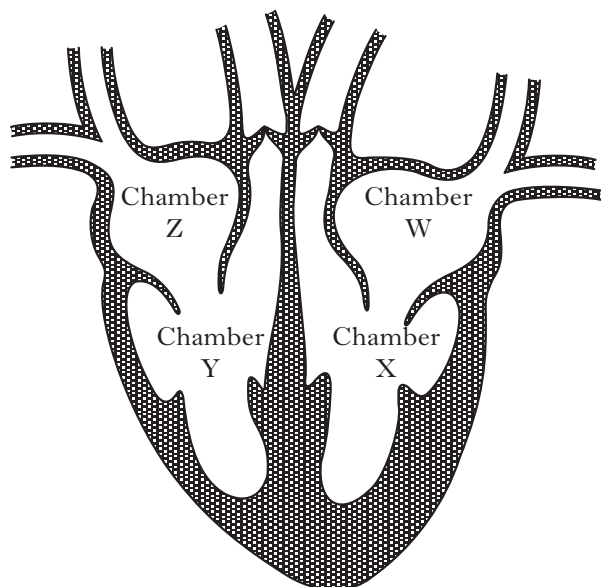
The process taking place in part Z is

- A filtration
- B reabsorption
- C osmoregulation
- D urea production.

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



22. The diagram below shows a section through a mammalian heart.



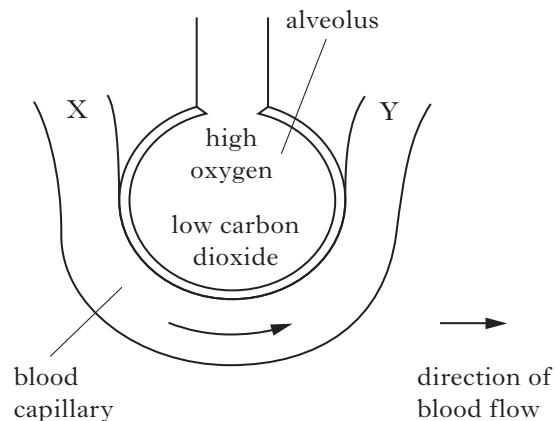
When closed, the tricuspid valve

- A prevents blood flowing from chamber X to chamber W
- B allows blood to flow from chamber X to chamber W
- C allows blood to flow from chamber Y to chamber Z
- D prevents blood flowing from chamber Y to chamber Z.

23. Which of the following correctly describes the pathway of air out of the lungs?

- A trachea → bronchi → bronchioles → alveoli
- B alveoli → bronchioles → bronchi → trachea
- C trachea → bronchioles → bronchi → alveoli
- D alveoli → bronchi → bronchioles → trachea

24. The diagram below shows an alveolus and an associated blood capillary.



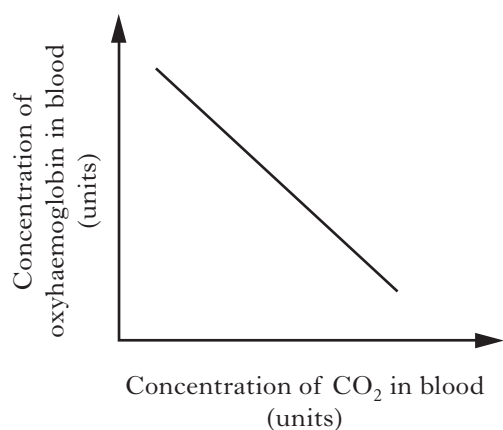
As blood flows from X to Y gases are exchanged with the alveolus.

Which line in the table below identifies the concentrations of gases at X and Y?

	<i>Concentration at X</i>	<i>Concentration at Y</i>
A	high oxygen	high carbon dioxide
B	low oxygen	high carbon dioxide
C	low oxygen	low carbon dioxide
D	high oxygen	low carbon dioxide

[Turn over

25. The graph below shows the relationship between the concentration of carbon dioxide and oxyhaemoglobin in the blood.



Which of the following statements describes this relationship?

- A As the carbon dioxide concentration decreases the concentration of oxyhaemoglobin decreases.
- B As the carbon dioxide concentration increases the concentration of oxyhaemoglobin decreases.
- C As the carbon dioxide concentration increases the concentration of oxyhaemoglobin increases.
- D Increasing carbon dioxide concentration has no effect upon the concentration of oxyhaemoglobin.

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 twelve*

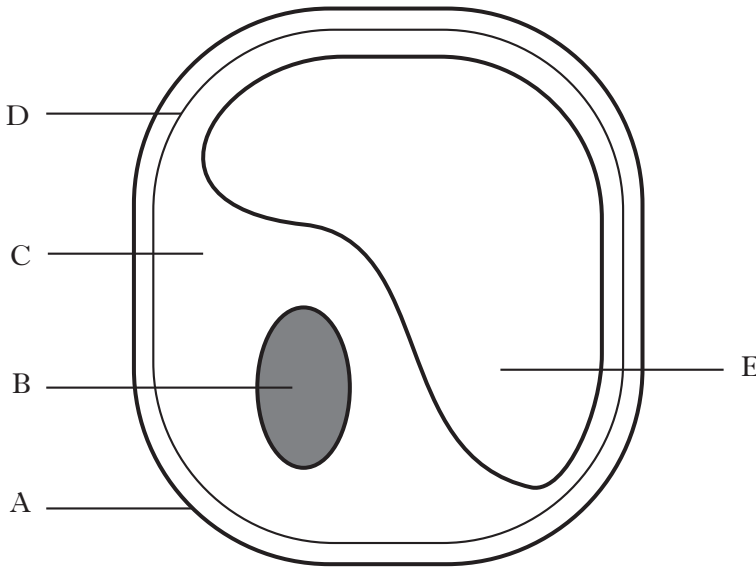
SECTION B

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

DO NOT
WRITE IN
THIS
MARGIN

Marks

1. The diagram below represents a plant cell.



- (a) Complete the table below to identify the part, the cell structures and the function.

Part	Cell structure	Function
	cell membrane	controls entry and exit of materials
E		stores cell sap
B		

2

- (b) Using evidence from the diagram, explain why this cell is more likely to be a root cell than a leaf mesophyll cell.

1

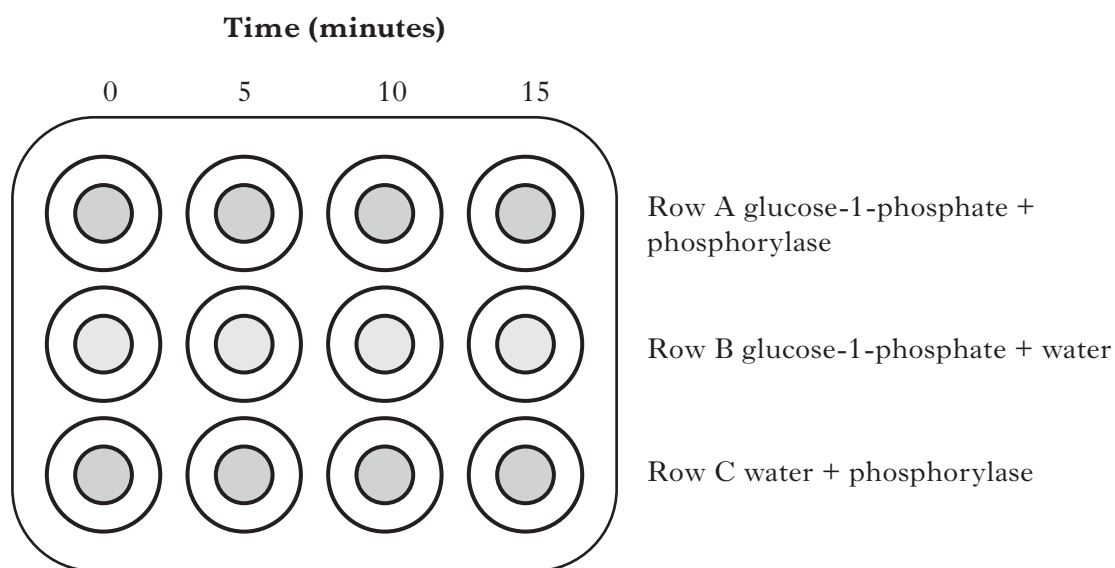
- (c) Name the structural carbohydrate that is found in cell walls.

1

Marks

2. (a) The diagram below shows an investigation into the activity of the phosphorylase enzyme.

A spotting tile was set up as shown below. Each column was then tested at the times shown.



- (i) Name the product formed in row A.

1

- (ii) Name the food test that could be used to identify this product.

1

- (iii) Row C acts as a control. Explain the purpose of this control.

1

- (b) Decide if each of the following statements about enzymes is **True** or **False**, and tick (✓) the appropriate box.

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

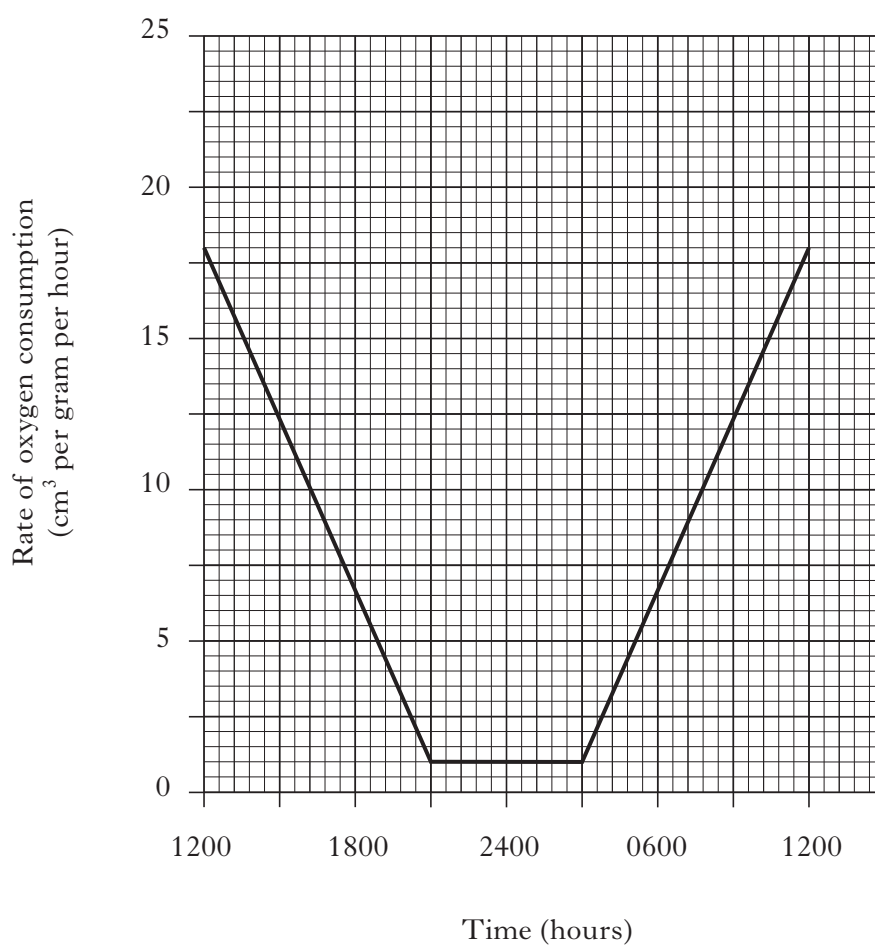
Statement	True	False	Correction
During denaturation, the <u>substrate</u> changes shape.			
Amylase is a <u>synthesis</u> enzyme.			
Enzymes <u>decrease</u> the energy input needed for a chemical reaction.			

3

3. Hummingbirds use a lot of energy to get their food from flowers during the day.



The graph below shows the rate of oxygen consumption of a hummingbird from 12 noon (1200) one day to 12 noon the next day.



- (a) Name the cell process which uses the oxygen taken in by the hummingbird.

1

3. (continued)

- (b) (i) State the times that the rate of oxygen consumption was lowest.

Between _____ and _____ hours.

1

- (ii) Explain the relationship between the rate of oxygen consumption and the activity of the hummingbird.

1

- (c) Predict the effect of colder weather on the rate of oxygen consumption by the hummingbird.

Give a reason for your answer.

Prediction _____

1

Reason _____

1

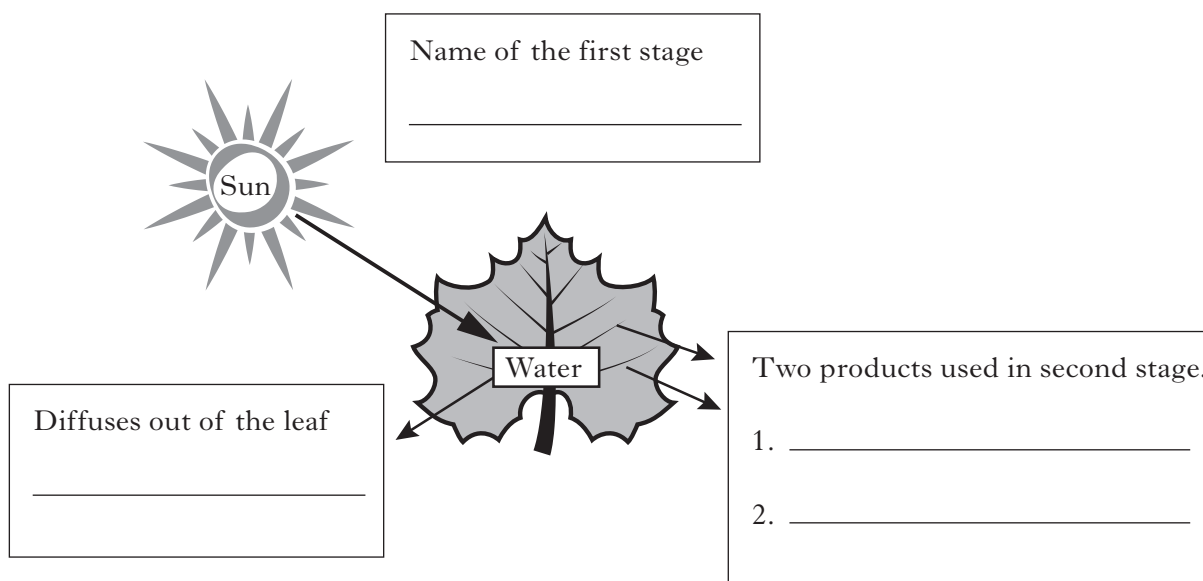
[Turn over

4. Photosynthesis is a two stage process used by green plants to produce food.

(a) The diagram below represents a summary of the first stage of photosynthesis.

Complete the diagram by filling in the three boxes, selecting terms from the list in the box below.

ATP	carbon dioxide	carbon fixation
glucose	hydrogen	oxygen
		photolysis



3

(b) Describe the second stage of photosynthesis.

2

5. The Scottish wildcat (*Felis sylvestris grampia*) is under threat of extinction with only around 400 pure-bred cats in the wild.



Wildcats live in conifer forests, dense woodland or rocky areas. They are carnivores that feed on herbivores such as rabbits, mice and voles. Although their young are eaten by pine martens and foxes, the main threat to their existence is interbreeding with the domestic cat.

- (a) (i) Using information from the passage, complete the boxes below to show a food chain.



1

- (ii) Complete the table below using named examples from the passage.

<i>Term</i>	<i>Named example</i>
habitat	
carnivore	
prey	

2

- (iii) State what further evidence would be needed to support the hypothesis that wildcats and domestic cats are the same species.

1

- (b) (i) Conifer plantations can show low biodiversity. The tall trees growing close together block the light to any ground-living plants and there is limited animal life.

State what is meant by the term biodiversity.

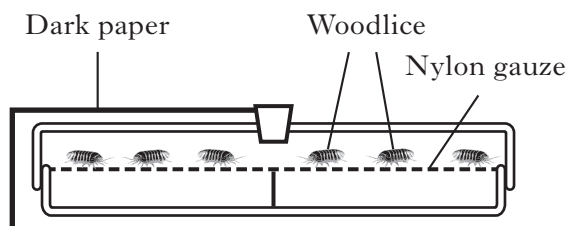
1

- (ii) Give **one** example of a human activity that could **increase** biodiversity in a conifer plantation.

1

Marks

6. A student set up the choice chamber below to investigate the response of woodlice to light.



- (a) Describe how the student would alter the set up of the choice chamber to investigate the response of woodlice to humidity.

2

- (b) Describe what the student could do to make the results more reliable.

1

- (c) Explain how the response of woodlice to humidity increases their chances of survival.

1

7. Gametes are made by plants and animals so that they can reproduce.

(a) The columns below show sites of production, types of gamete and chromosome complements.

Draw lines to connect each **human** gamete with its site of production and its chromosome complement.

<i>Site of production</i>	<i>Type of gamete</i>	<i>Chromosome complement</i>
anther	egg	
ovary	ovule	22 + X
testis	pollen	22 + Y
	sperm	

2

(b) (i) Name the process by which a zygote is formed.

1

(ii) State which parts of the gametes must fuse to produce the zygote.

1

(iii) Name **one** process which occurs during gamete production and leads to variation in zygotes.

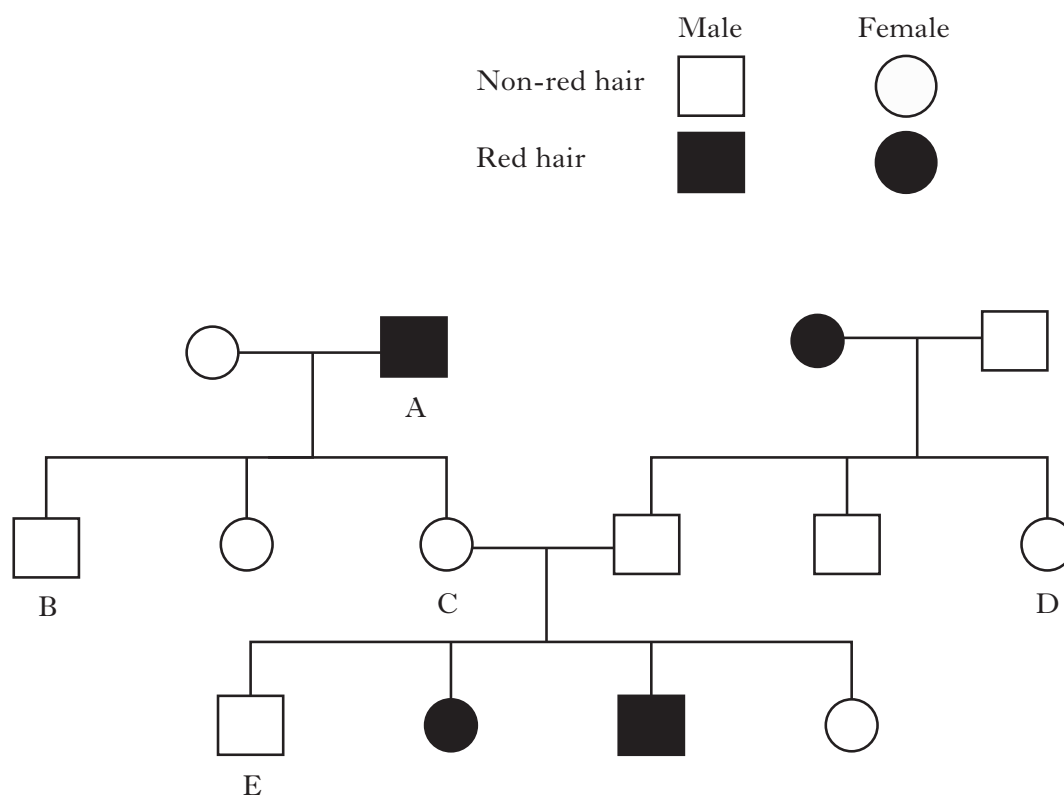
1

[Turn over

Marks

8. In humans, red hair is determined by the recessive allele (h) and non-red hair by the dominant allele (H).

The following family tree shows the inheritance of hair colour.



- (a) Use the family tree to complete the following table.

<i>Individual</i>	<i>Genotype</i>	<i>Phenotype</i>
A		red hair
C		
E	HH	

2

8. (continued)

(b) Individuals B and D have a child together.

- (i) Complete the Punnett square below to show the genotypes of their gametes and the possible genotypes of their child.

		Genotype of gametes from B	
Genotype of gametes from D			

2

- (ii) Calculate the percentage chance of their child having red hair.

Space for calculation

_____ % 1

[Turn over

Marks

9. (a) The peppered moth (*Biston betularia*) rests on the bark of trees.
The moth has two forms (P and Q) which are different colours.



Peppered moth

clean environment

polluted environment

<i>Form</i>	<i>Population numbers</i>
P	high
Q	low

<i>Form</i>	<i>Population numbers</i>
P	low
Q	high

- (i) Underline one option in each set of brackets to make the following sentences correct.

In the polluted environment form Q is $\left\{ \begin{array}{l} \text{difficult} \\ \text{easy} \end{array} \right\}$ for predators

to see since it is the $\left\{ \begin{array}{l} \text{dark} \\ \text{light} \end{array} \right\}$ form.

The numbers of each form in a population change over many

generations due to $\left\{ \begin{array}{l} \text{environmental impact} \\ \text{natural selection} \end{array} \right\}$.

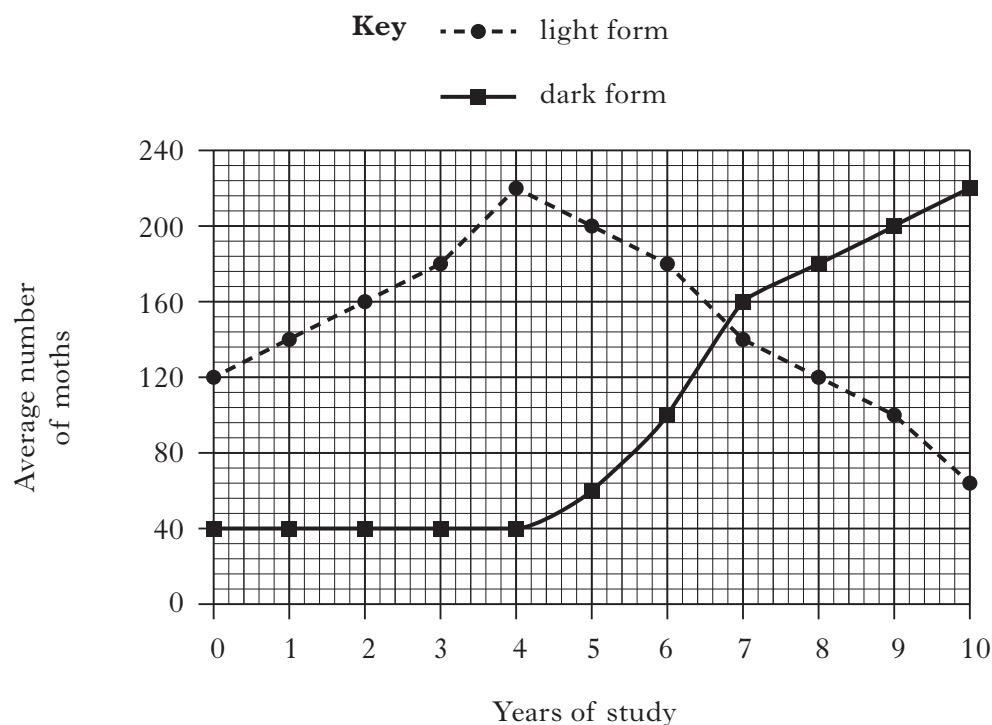
2

- (ii) State the expected appearance of tree bark in the clean environment.

1

9. (continued)

- (b) The graph below shows the average number of peppered moths counted in June of each year in a 10 year study.



Use data from the graph to describe the change in the average number of dark moths during the study.

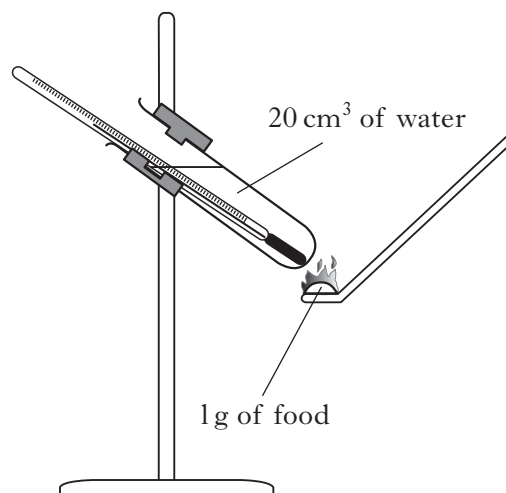
2

[Turn over

10. (a) An investigation was carried out to find the energy content of some types of food.

One gram of each food type was burned and the energy released used to heat 20cm^3 of water.

The starting and finishing temperatures of the water were measured.



- (i) During the investigation, mass of food and volume of water were kept constant.

Name **one** other variable that should have been kept constant.

1

10. (a) (continued)

- (ii) The energy content of the food (kJ per g) can be calculated using the formula below:

$$\text{Energy content} = \text{volume of water (cm}^3\text{)} \times \text{temperature rise} \times 0.042$$

Complete the table below to show the temperature rise **and** energy content of the carbohydrate.

<i>Food</i>	<i>Water temperature (°C)</i>		<i>Temperature rise (°C)</i>	<i>Energy content (kJ per g)</i>
	<i>Start</i>	<i>Finish</i>		
protein	22	32	10	8.4
fat	23	48	15	12.6
carbohydrate	20	32.5		

Space for calculation

- (b) (i) Name the chemical element always present in proteins but not present in fats or carbohydrates.

- (ii) State the waste product formed in the liver by the process of deamination.

- (c) Describe the role of bile in fat digestion.

1

1

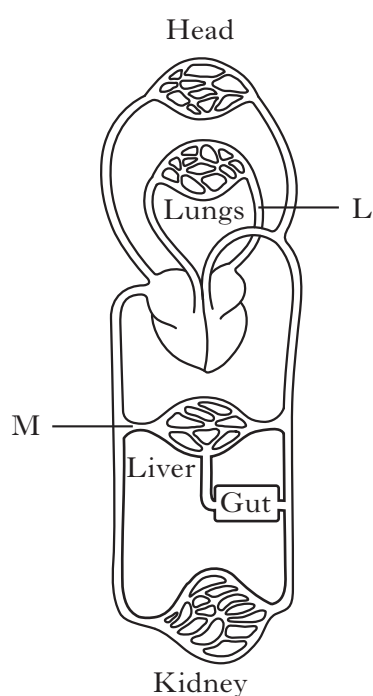
1

1

[Turn over

Marks

11. (a) The diagram below represents the human circulatory system.
Two blood vessels are labelled L and M.



Draw lines to connect L and M with the correct named blood vessel.

Label

Blood vessel

L

hepatic vein

renal vein

pulmonary vein

M

hepatic portal vein

1

11. (continued)

Marks

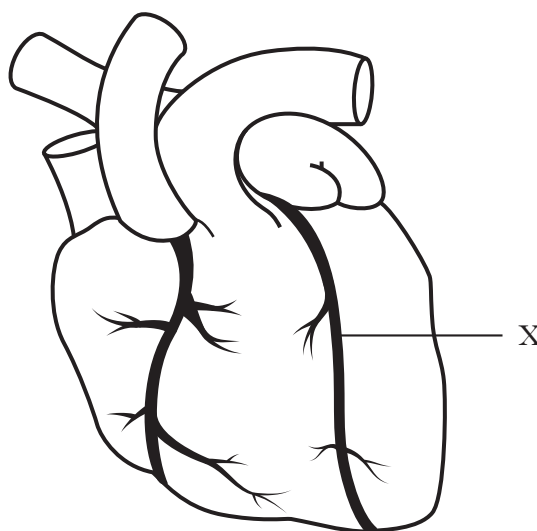
- (b) The table below shows features of arteries and capillaries.

Complete the table by entering the words **yes** or **no** in each blank space.

<i>Type of blood vessel</i>	<i>Thick muscular walls present</i>	<i>Valves present</i>	<i>Pulse present</i>
artery		no	
capillary	no		no

1

- (c) The diagram below represents a surface view of the human heart.



Describe the effect of a blockage in blood vessel X.

1

- (d) At rest the heart muscle receives blood at a rate of
- 300 cm^3
- per minute. Immediately after exercise the heart muscle receives
- 1050 cm^3
- per minute.

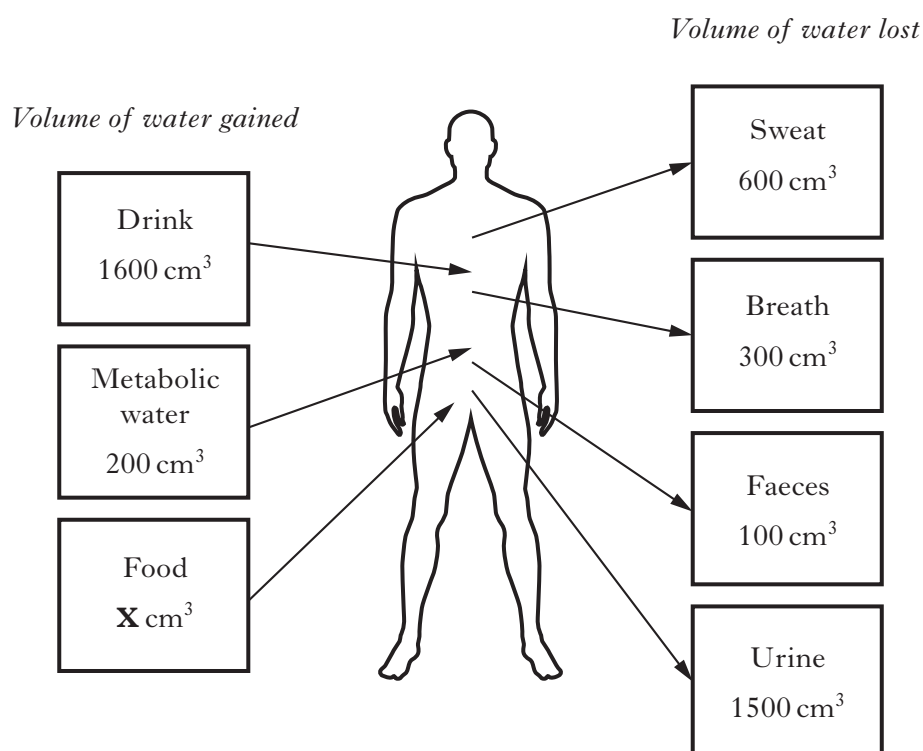
Calculate how many times greater the blood supply to the heart muscle is after exercise than at rest.

Space for calculation

_____ times greater 1

12. (a) In an investigation, a student's water gains and losses were measured for 24 hours.

The results are shown in the diagram below.



- (i) The total volume of water gained equals the total volume of water lost.
Calculate the volume of water (**X**) gained from food.

Space for calculation

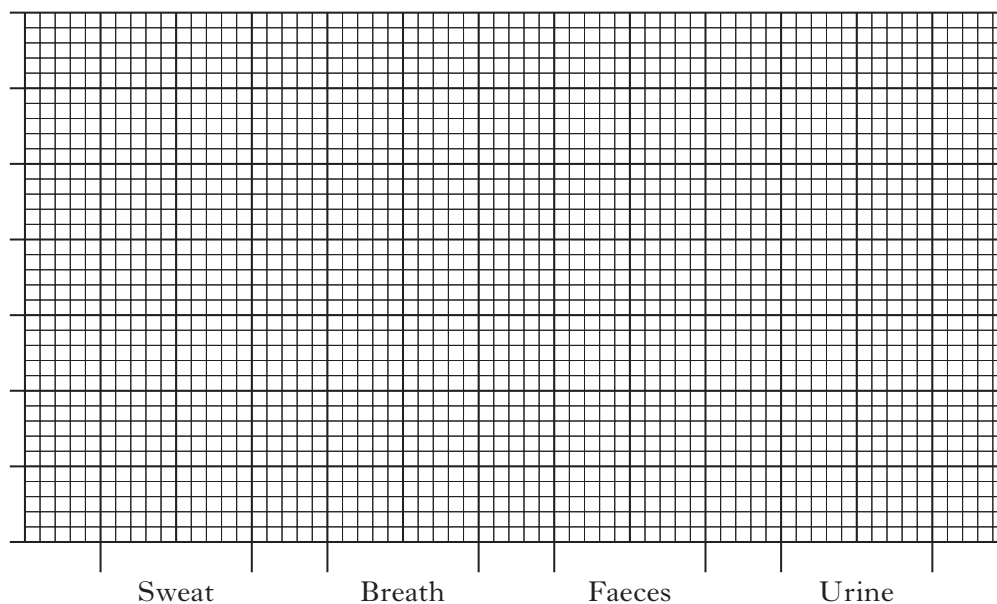
X = _____ cm³ **1**

Marks

12. (a) (continued)

- (ii) Use the information on volume of water lost from the diagram to construct a **bar graph** on the grid below.

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



Method of water loss

2

- (iii) Body mass is 70% water. The student had a body mass of 65 kg.

Calculate the mass of water in the student's body.

Space for calculation

_____ kg water 1

[Turn over

12. (continued)

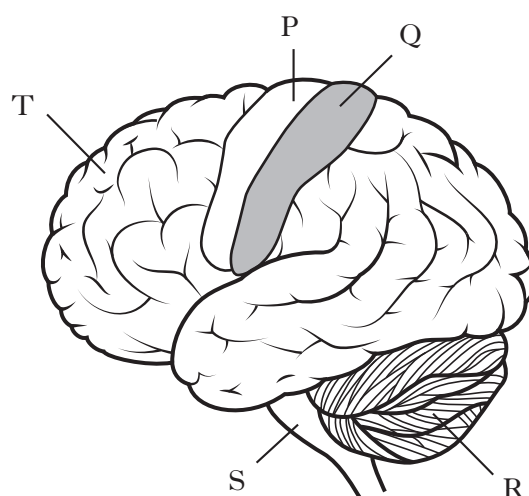
(b) Fish also have to balance water gain and water loss.

Underline the correct option in each column of the table below to show why and how fresh water bony fish maintain a water balance.

<i>Problem</i>	<i>Tissues</i>	<i>Urine</i>
dehydration influx of water	hypertonic hypotonic	concentrated dilute

2

13. The following diagram represents the human brain.



- (a) Complete the table below to identify parts of the brain and their functions.

<i>Letter</i>	<i>Part</i>	<i>Function</i>
R		
	Motor strip	Sends nerve impulses to muscles
		Controls breathing rate

3

- (b) Underline one option in each set of brackets to make the following sentences about temperature regulation correct.

An increase in body temperature is detected by the $\left\{ \begin{array}{l} \text{hypothalamus} \\ \text{pituitary gland} \end{array} \right\}$

and $\left\{ \begin{array}{l} \text{decreases} \\ \text{increases} \end{array} \right\}$ sweat production.

The blood vessels carrying blood to the skin $\left\{ \begin{array}{l} \text{constrict} \\ \text{dilate} \end{array} \right\}$ bringing the body

temperature back to normal.

2

[Turn over for Section C on Page thirty-two]

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 should be written clearly and legibly in ink.

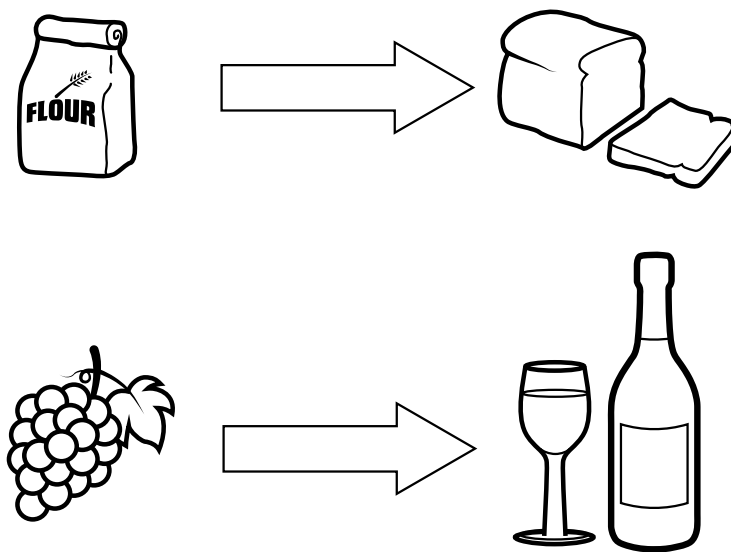
Supplementary sheets, if required, may be obtained from the Invigilator.

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1. Answer either A or B.

- A The diagram below represents bread and wine production which use the same type of microbial cell.

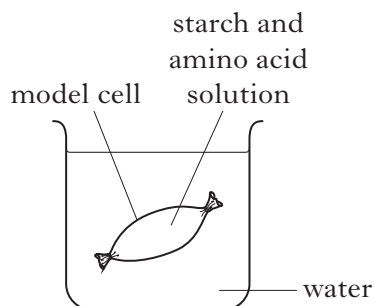


- (a) Name the type of microbial cell used.
- (b) Describe how anaerobic respiration in these cells is used to make bread and wine.

5

OR

- B A model cell was set up as shown below and left for two hours.



Describe the movement of molecules during the two hours by

- (a) diffusion **and**
- (b) osmosis.

5

Question 2 is on Page thirty-four

SPACE FOR ANSWER TO QUESTION 1

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

Marks

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

Labelled diagrams may be included where appropriate.

A In the small intestine, a villus increases the absorption of digested food.

Describe the features of villi **and** how they are involved in the absorption of digested proteins and fats.

5

OR

B Touching a hot object produces a reflex action.

Describe the pathway of a nerve impulse through a reflex arc **and** the functions of this reflex action.

5

[END OF QUESTION PAPER]

SPACE FOR ANSWER TO QUESTION 2

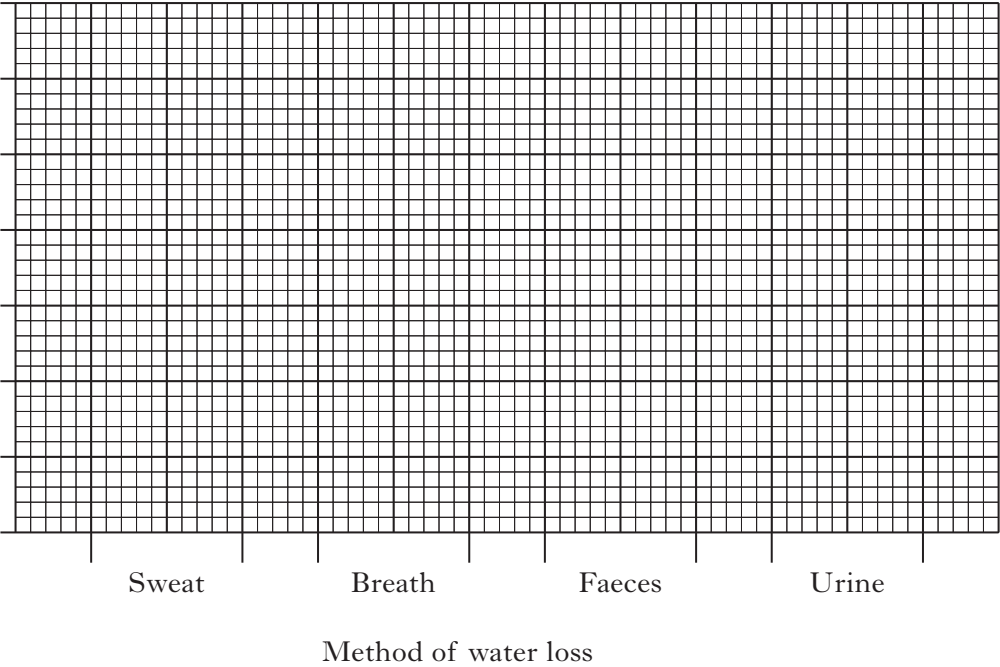
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ADDITIONAL SPACE FOR ANSWERS

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ADDITIONAL GRAPH PAPER FOR QUESTION 12(a)(ii)



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ACKNOWLEDGEMENTS

Section B Question 3 – Steve Byland/shutterstock.com

Section B Question 5 – Elaine Nash/shutterstock.com

Section B Question 9(a) – Martin Fowler/shutterstock.com