Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

**Pearson Edexcel International GCSE (9–1)**

Centre Number | Candidate Number

# Friday 8 January 2021

Morning (Time: 2 hours) | Paper Reference **4BI1/1BR 4SD0/1BR**

# Biology

**Unit: 4BI1**
**Science (Double Award) 4SD0**
**Paper: 1BR**

**You must have:**
Calculator, ruler

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

## Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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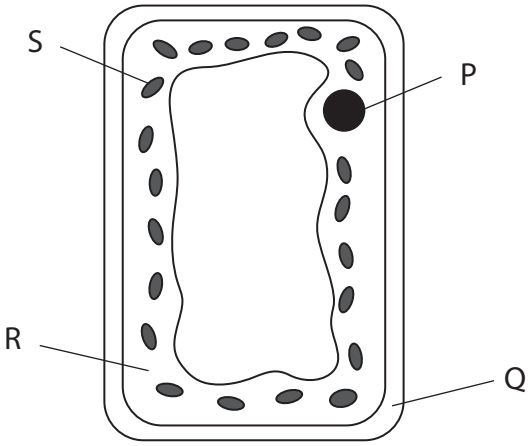
Pearson

**Answer ALL questions.**

**1** (a) The diagram shows a plant cell.




(i) Which part of this cell contains chlorophyll?

**(1)**

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

(ii) Which of these is found in chlorophyll?

**(1)**

- ☒ **A** calcium
- ☒ **B** iron
- ☒ **C** magnesium
- ☒ **D** water

(iii) Describe the role of chlorophyll.

**(2)**

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(b) Which of these is an example of positive phototropism?

**(1)**

- ☒ **A** a plant root growing away from light
- ☒ **B** a plant root growing downwards due to gravity
- ☒ **C** a plant stem growing towards light
- ☒ **D** a plant stem growing upwards due to gravity

(c) The table lists the roles of some substances found in living organisms.

Complete the table by naming each substance.

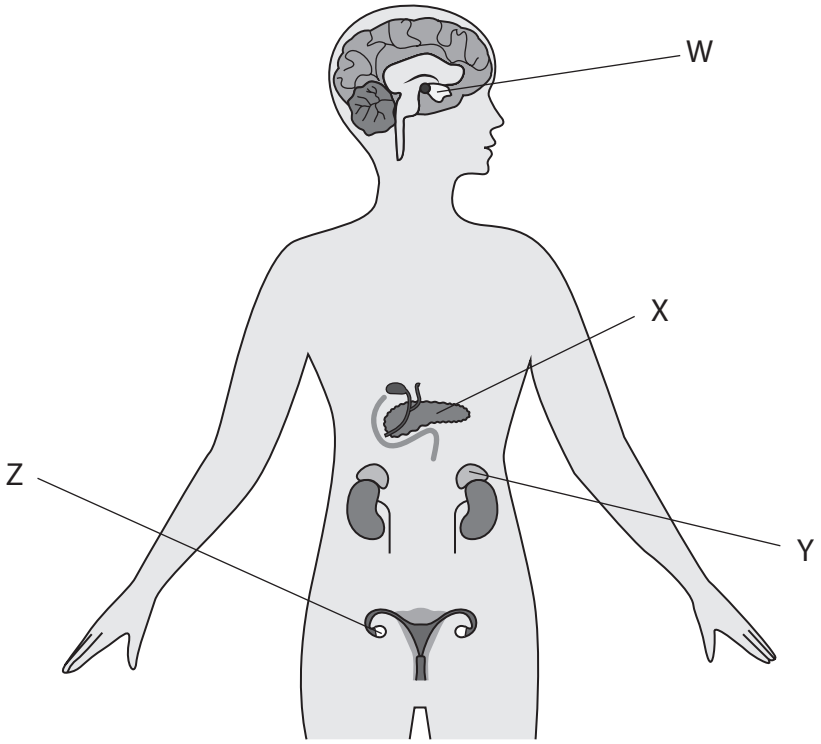
The first one has been done for you.

**(3)**

| Role of substance | Name of substance |
|---|---|
| positive phototropism | auxin |
| digests fat | |
| diffuses across a synapse | |
| prevents scurvy | |

**(Total for Question 1 = 8 marks)**

**2** The diagram shows the position of some hormone producing glands in the female body.




(a) Which of these structures is the adrenal gland?

**(1)**

- ☒ **A** W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(b) The adrenal gland is an organ that secretes adrenaline.

State what is meant by the term **organ**.

**(1)**

.....

.....

(c) Adrenaline is released into the blood when there is danger.

The list gives the effects of adrenaline on different parts of the body.

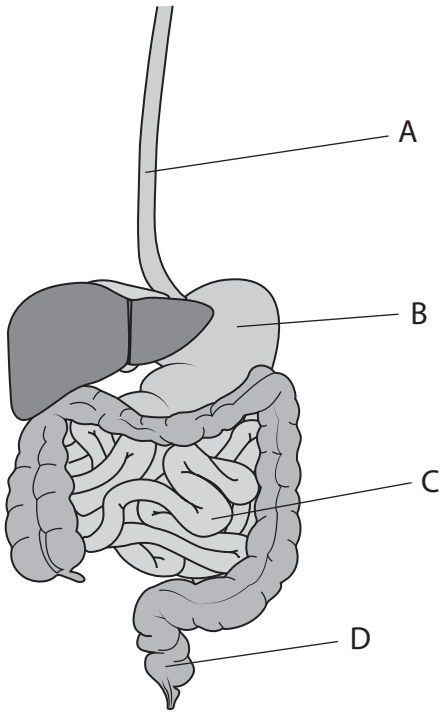
- dilates the pupil in the eye
- increases heart rate
- narrows small arteries in the intestine
- converts glycogen into glucose in the liver

Explain the advantages of these effects to a person in danger.

**(5)**

**(Total for Question 2 = 7 marks)**

**3** (a) The diagram shows part of the human digestive system.




(i) In which of these parts is hydrochloric acid produced?

**(1)**

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) In which of these parts are faeces stored?

**(1)**

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) The liver produces bile.

Explain the role of bile in digestion.

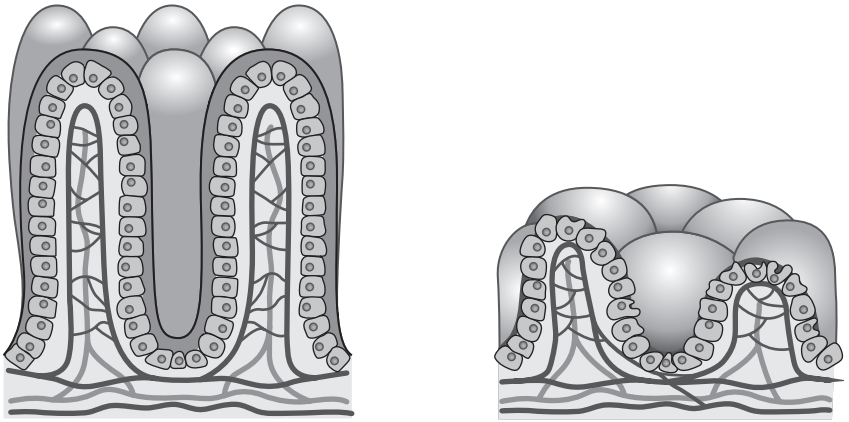
**(3)**

(c) Some people have a condition called coeliac disease.

In this condition the body reacts to eating gluten, a protein found in wheat.

This reaction damages the villi in the small intestine.

The diagram shows how the villi in the small intestine are damaged.



Undamaged Damaged

(i) Explain how the undamaged villi are adapted for their function.

**(4)**

(ii) Explain why children with untreated coeliac disease may grow more slowly and become tired more easily than children without coeliac disease.

Use the information from the diagram and your own knowledge to support your answer.

**(4)**

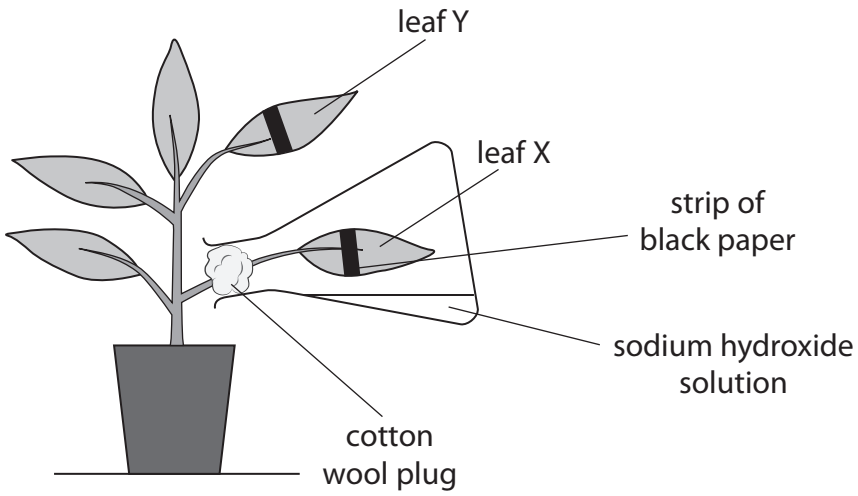
**(Total for Question 3 = 13 marks)**

**4** A teacher does an investigation to show that plants require carbon dioxide and light for photosynthesis.

This is the teacher's method.

- place a potted plant in the dark for 24 hours
- place a strip of black paper over two of the plant's leaves
- pour some sodium hydroxide solution into a flask
- insert one of the leaves into the flask
- seal the flask with a cotton wool plug
- place the plant in bright light for 12 hours
- remove the two leaves and safely test them for starch

This diagram shows the teacher's apparatus.




(a) (i) Explain why the potted plant is placed in the dark for 24 hours.

**(2)**

(ii) Explain one role of leaf Y in the investigation.

**(2)**

(iii) Describe how to test the leaves for starch safely.

**(4)**

(b) Explain how the results of this investigation would show that light is required for photosynthesis.

**(3)**

(c) Plants convert the glucose they produce into starch.

Explain why plants store carbohydrate as starch rather than as glucose.

**(2)**

**(Total for Question 4 = 13 marks)**

**5** The chromosomes found in human cells can be photographed and arranged in order to produce a karyotype.

The karyotype shown in Diagram 1 is from a normal human body cell.

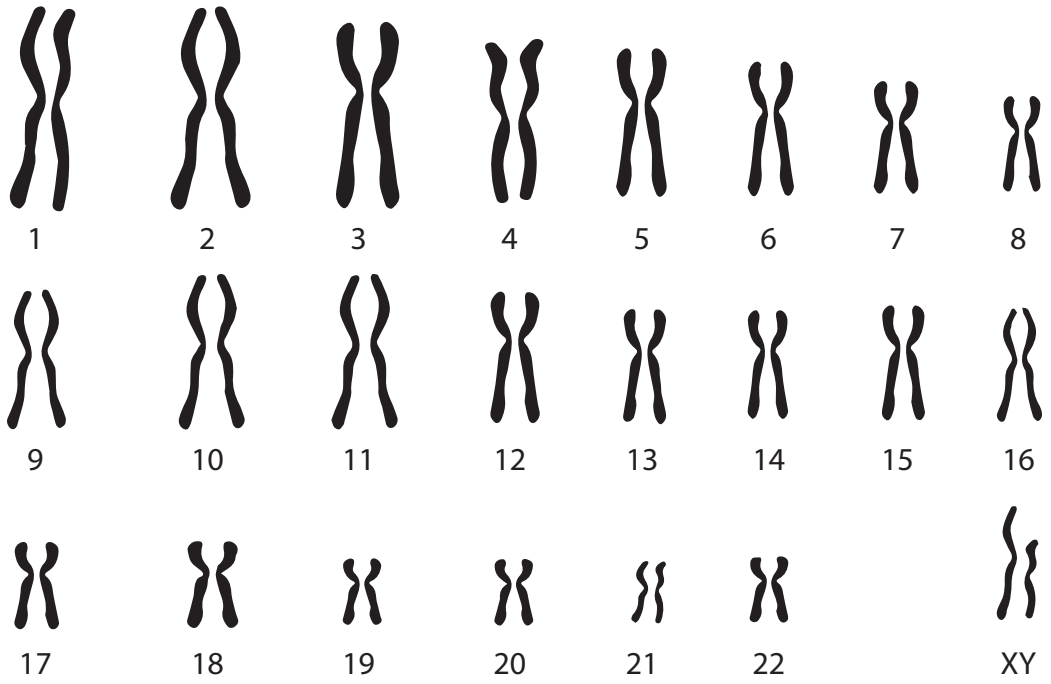



**Diagram 1**

(a) (i) Explain how you can identify the sex of the person from the karyotype shown in Diagram 1.

**(2)**

(ii) Cells can be described using the terms diploid or haploid.

Explain the difference between these two terms using the information in Diagram 1.

**(2)**

(b) The karyotype shown in Diagram 2 is from a body cell of a person with a condition called Klinefelter syndrome.

This condition only affects males.

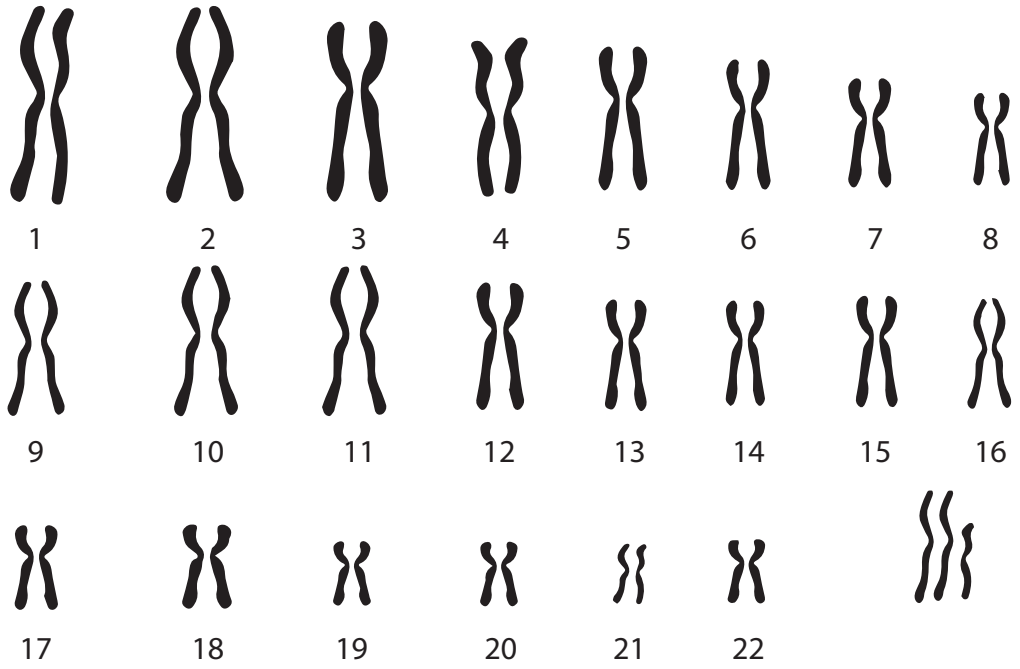



**Diagram 2**

(i) Describe the differences between the karyotype in Diagram 1 and the karyotype in Diagram 2.

**(2)**

(ii) Suggest how the karyotype in Diagram 2 may have been caused.

**(2)**

(iii) The frequency of Klinefelter syndrome in the United Kingdom is 1 in every 660 males.

The population of the United Kingdom is 66 million, of which 49% are male.

Calculate the total number of males in the United Kingdom with Klinefelter syndrome.

**(2)**

number of males = .....

(iv) Suggest why females who are aged over 35 are more likely to give birth to a baby with the Klinefelter karyotype.

**(1)**

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**(Total for Question 5 = 11 marks)**

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**6** Scientists have developed genetically modified (GM) crops in order to increase food production by increasing crop yields.

(a) (i) Some GM crops are described as transgenic.

Explain what is meant by the term **transgenic**.

**(2)**

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(ii) Give the role of **two** named enzymes in the production of GM organisms.

**(2)**

1 .....

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2 .....

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(b) Some GM crops that are available to farmers are resistant to herbicides (weedkillers).

Other GM crops are resistant to diseases caused by viruses and to damage by insects.

Some people are for the use of GM crops because they may be beneficial to ecosystems.

Some people are against the use of GM crops because they could harm ecosystems.

Discuss these opinions for and against the use of GM crops.

**(4)**

**(Total for Question 6 = 8 marks)**

**7** In some countries, snails are farmed as a source of protein.

The photograph shows a snail.

(Source: © PAL/Shutterstock)

(a) A scientist investigates the effect of temperature on the growth of snails.

The scientist measures the mean (average) shell height of groups of snails kept at three different temperatures for 24 weeks.

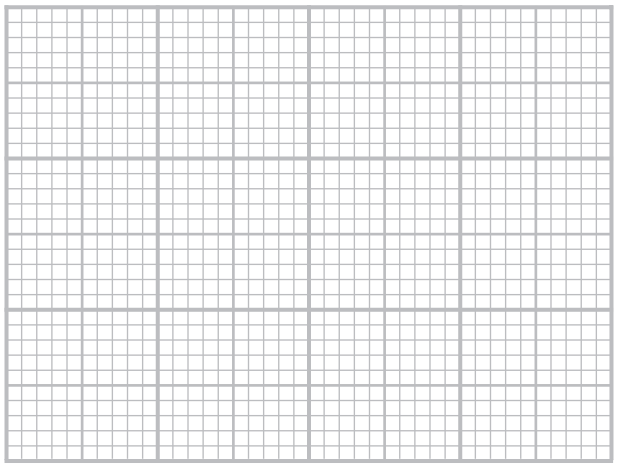
The table shows the scientist's results.

| Time in weeks | Mean shell height in mm | | |
|---|---|---|---|
| | at 8 °C | at 15 °C | at 23 °C |
| 0 | 15.0 | 15.0 | 15.0 |
| 8 | 15.2 | 15.8 | 17.0 |
| 16 | 15.5 | 16.8 | 20.4 |
| 24 | 16.4 | 18.2 | 21.8 |

(i) Plot a line graph to show how the mean shell height increases with time for each temperature.

Use a ruler to join the points with straight lines.

**(5)**



(ii) Explain the effect of temperature on the growth of snails in this investigation.

**(3)**

(iii) State the dependent variable in the investigation.

**(1)**

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(iv) State how the scientist made sure their results were reliable.

**(1)**

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(b) Assimilation efficiency is the percentage of food that is eaten and not egested as faeces.

Assimilation efficiency is calculated using this formula.

$$\text{assimilation efficiency (\%)} = \frac{\text{mass of food eaten} - \text{mass of faeces egested}}{\text{mass of food eaten}} \times 100$$

(i) A snail eats 1.2 g of food and produces 0.30 g of faeces.

Calculate the assimilation efficiency of this snail.

**(2)**

assimilation efficiency = ..... %

(ii) Explain why the assimilation efficiency of a primary consumer is less than the assimilation efficiency of a secondary consumer.

**(2)**

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(c) The production efficiency of an animal is the percentage of assimilated food that is made into new biomass.

The table shows the production efficiency of a mammal and a snail, both of which are primary consumers.

| Animal | Production efficiency (%) |
|---|---|
| mammal | 2 |
| snail | 35 |

Suggest why there is a difference in the production efficiency of the mammal and the snail.

**(2)**

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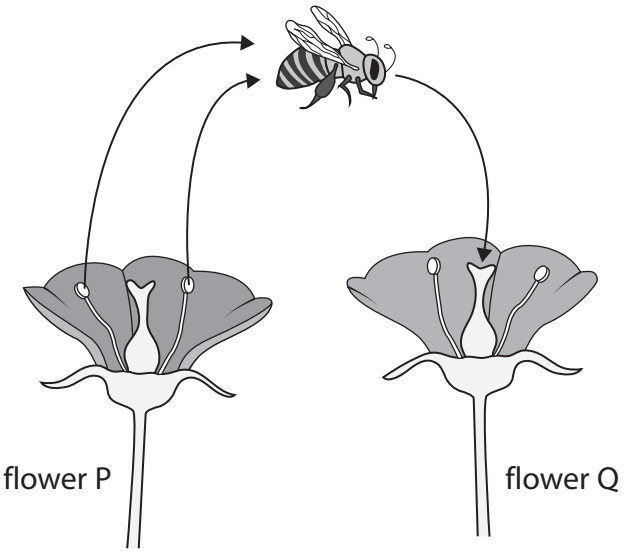
**(Total for Question 7 = 16 marks)**

**8** The diagram shows an insect transferring pollen grains from flower P to flower Q.




(a) Which structure in flowers contains pollen grains?

**(1)**

- ☒ **A** anther
- ☒ **B** ovary
- ☒ **C** petal
- ☒ **D** sepal

(b) (i) Pollen grains are deposited on the stigma and grow tubes down the style.

Suggest how style tissue helps the tube to grow.

**(2)**

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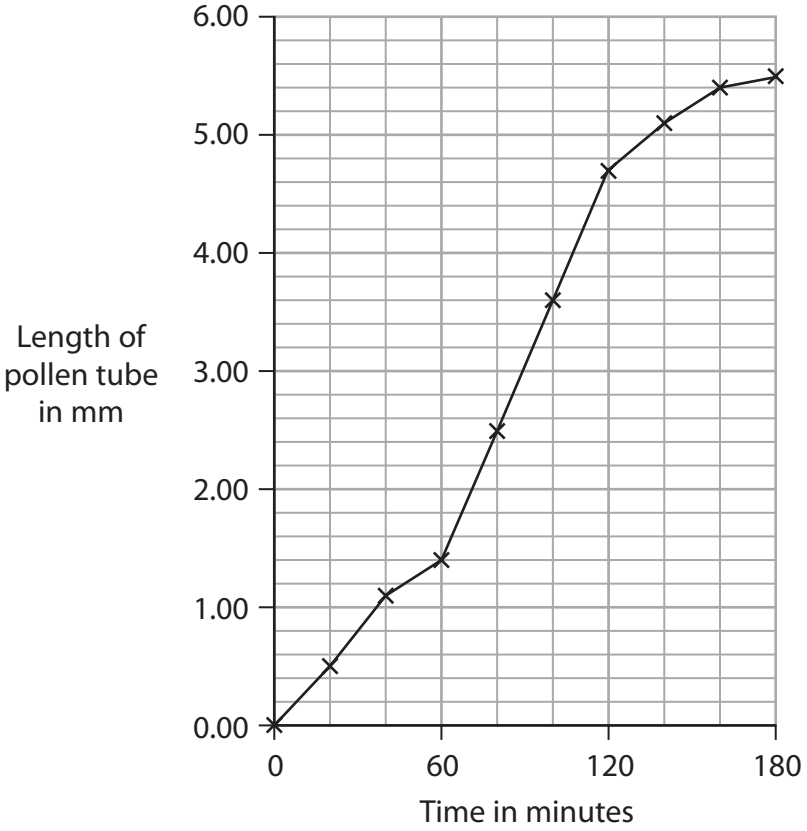
(ii) The graph shows the change in the length of a pollen tube over a 180 minute period.




Calculate the fastest rate of pollen tube growth in mm per minute.

**(3)**

fastest rate of growth: ..... mm per minute

(c) A farmer grows apple trees.

The flowers on the apple trees must be pollinated by insects to produce an apple crop.

The farmer is concerned that the use of pesticides may affect the yield of apples.

Design an investigation to find out if pesticides reduce the yield of apples.

Include experimental details in your answer and write in full sentences.

**(6)**

**(Total for Question 8 = 12 marks)**

**9** Aerobic respiration uses oxygen and produces ATP.

(a) Complete the word equation for aerobic respiration.

**(2)**

oxygen + ..... ⟶ ..... + ..... + ATP

(b) A scientist investigates the rates of aerobic respiration of some animals.

The scientist calculates the rate of respiration per gram of each animal.

The results are shown in the table.

| Animal | Rate of aerobic respiration per gram of animal in arbitrary units |
|---|---|
| frog | 150 |
| human | 200 |
| mouse | 1500 |

Explain why a mouse uses more oxygen per gram than a human.

**(3)**

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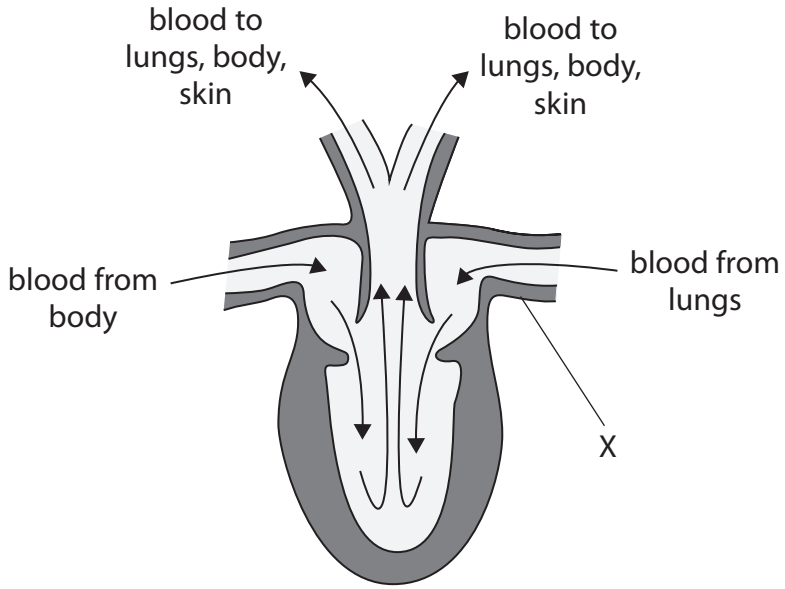
(c) The structure of a frog heart is different from the structure of a human heart.

The diagram shows a section of a frog heart with arrows showing the direction of blood flow.




(i) What is the name of the blood vessel labelled X?

**(1)**

- ☒ **A** aorta
- ☒ **B** pulmonary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

(ii) Give one difference between the structure of the frog heart and a human heart.

**(1)**

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(iii) Humans can run for long periods of time. Frogs can only move for short periods of time.

Explain how the structure of the heart of a frog means that it is unable to move for long periods of time.

**(5)**

**(Total for Question 9 = 12 marks)**

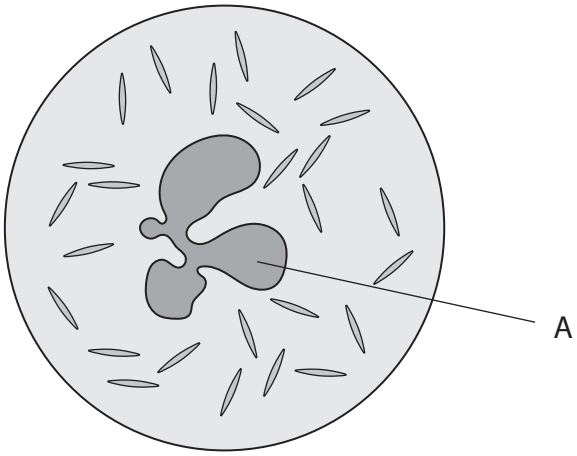
**10** Blood consists of cells and plasma.

(a) Plasma transports various substances to and from different parts of the body.

Describe the function of plasma in transporting named substances in the body.

**(4)**

(b) The diagram shows a white blood cell called a phagocyte.




(i) The magnification of the cell is calculated using this formula.

$$\text{magnification} = \frac{\text{diameter of cell in diagram}}{\text{actual diameter of cell}}$$

The actual diameter of the cell is 0.013 mm.

Calculate the magnification of the cell.

**(2)**

magnification = .....

(ii) Name the structure labelled A in the diagram.

**(1)**

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(iii) Describe the function of this cell in defending the body from infection.

**(2)**

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(c) Other white blood cells produce proteins called antibodies.

State how you could test a sample of plasma for protein.

**(1)**

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**(Total for Question 10 = 10 marks)**

**TOTAL FOR PAPER = 110 MARKS**

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