Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel GCE

Thursday 22 May 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **8BI0/02**

Biology B

Advanced Subsidiary

PAPER 2: Core Physiology and Ecology

You must have:
Scientific calculator, HB pencil, 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.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In question(s) marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow from each other where appropriate.

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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P 7 8 6 9 0 A 0 1 3 2

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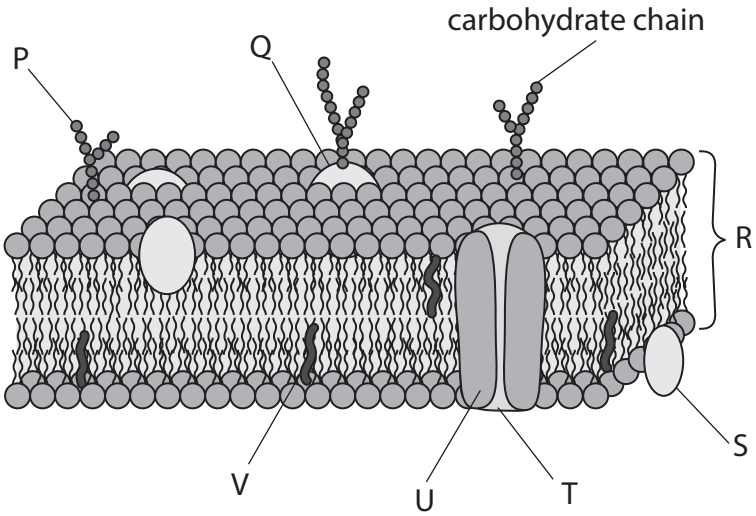
Answer ALL questions.

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 ☒.

1 The cell surface membrane controls transport into and out of the cell.

(a) The diagram shows a cell surface membrane with some structures labelled.



(i) Which of the following labelled structures is cholesterol?

(1)

☒ **A** P

☒ **B** Q

☒ **C** S

☒ **D** V

(ii) Which of the following labelled structures is an integral protein?

(1)

☒ **A** Q

☒ **B** R

☒ **C** S

☒ **D** U

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(iii) Which structure allows water molecules into the cell?

(1)

☒ **A** P

☒ **B** Q

☒ **C** T

☒ **D** V

(b) Explain how the properties of oxygen and of sodium ions determine how they enter a cell.

(4)

Oxygen

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Sodium ions

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(Total for Question 1 = 7 marks)

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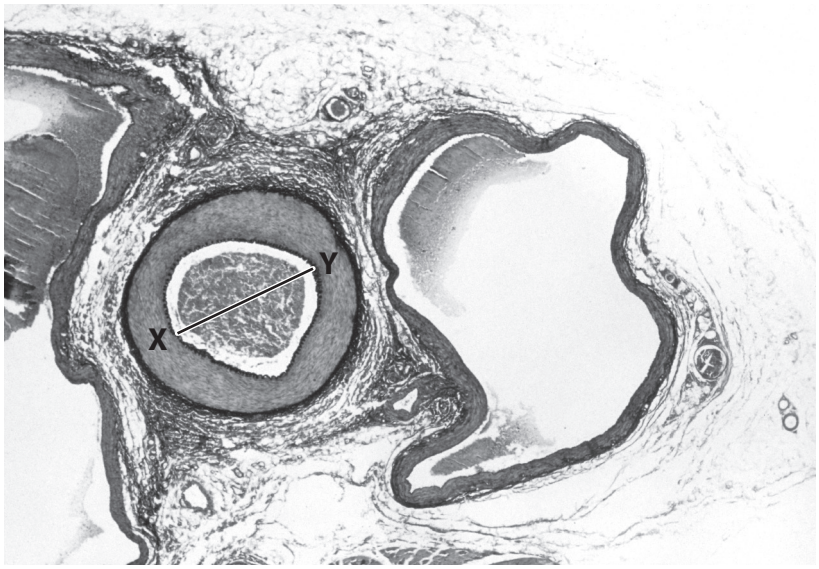
2 (a) The photograph shows a section through an artery and a vein, as seen using a light microscope.



(Source: © BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY)

(i) The actual diameter of the artery measured from X to Y is 1.2mm.

Calculate the magnification of this photograph.

(1)

Answer .....

(ii) Explain how **two** features of that artery distinguish it from the vein shown in the photograph.

(2)

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(b) The following are stages in blood clotting:

- M – platelets form a plug and release clotting factors
- N – fibrin network traps red blood cells and platelets
- P – prothrombin activator converts prothrombin into thrombin
- Q – thrombin converts fibrinogen into fibrin.

Which is the correct sequence of these stages in the formation of a blood clot?

(1)

☒ **A** M Q P N

☒ **B** M N Q P

☒ **C** N M Q P

☒ **D** M P Q N

(c) Blood clots can form in arteries and in veins.

(i) Give **one** reason why the development of blood clots in an artery is more dangerous than the development of blood clots in a vein.

(1)

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(ii) Explain how **three** lifestyle factors can lead to an increase in the risk of developing atherosclerosis.

(3)

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(Total for Question 2 = 8 marks)

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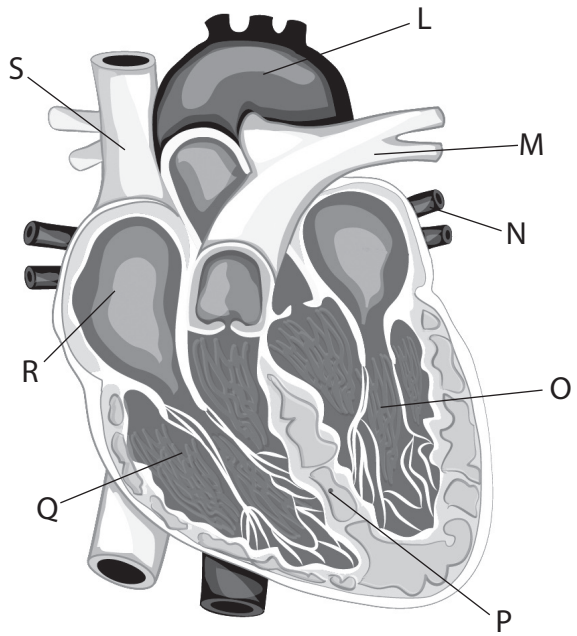
3 Diagram 1 shows a human heart with some structures labelled.



(Source: © okili77/Shutterstock)

Diagram 1

(a) (i) Which blood vessel carries oxygenated blood to the heart from the lungs?

(1)

☒ **A** L

☒ **B** M

☒ **C** N

☒ **D** S

(ii) Which labelled structure has the highest pressure during the cardiac cycle?

(1)

☒ **A** M

☒ **B** O

☒ **C** Q

☒ **D** R

(iii) Which labelled structure is the septum?

(1)

☒ **A** O

☒ **B** P

☒ **C** Q

☒ **D** R

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(b) Bony fish have a heart with one atrium and one ventricle.

Diagram 2 shows the structure of a heart from a bony fish with some structures labelled.

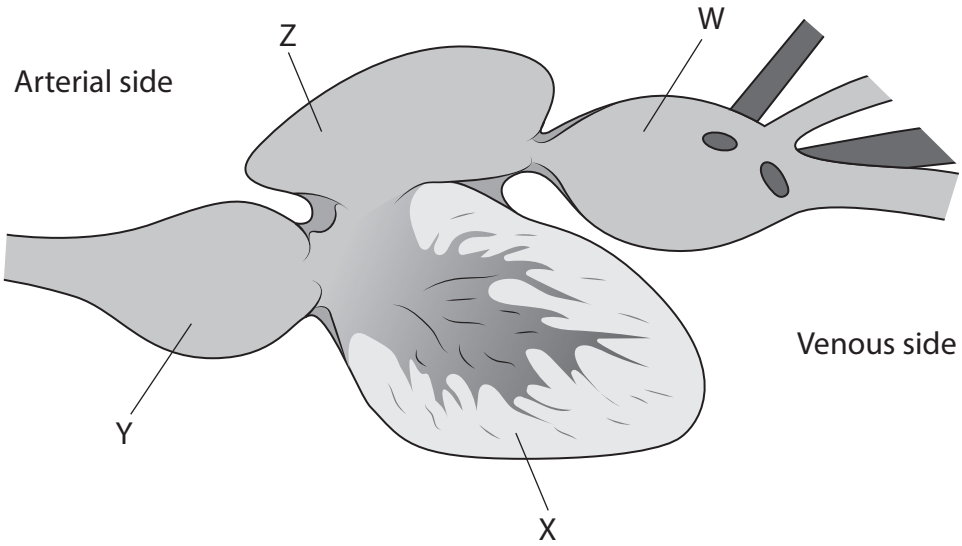

Diagram 2

(i) Which of the following structures is the atrium?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Draw arrows on diagram 2 to show the direction of blood flow through this heart.

(1)

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(iii) Explain how the heart and circulatory system of a bony fish differ from those of a mammal.

(3)

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(Total for Question 3 = 8 marks)

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4 Crickets are medium-sized insects, similar to grasshoppers. They are found in many parts of the world.

Scientists studied the factors that are associated with mating behaviour in two related species of cricket, *Gryllus rubens* and *Gryllus texensis*.

These species can exist as allopatric and sympatric populations.

The male crickets produce a courtship 'song' to attract females.

This song is different for each species.

The scientists compared mating behaviour of male crickets.

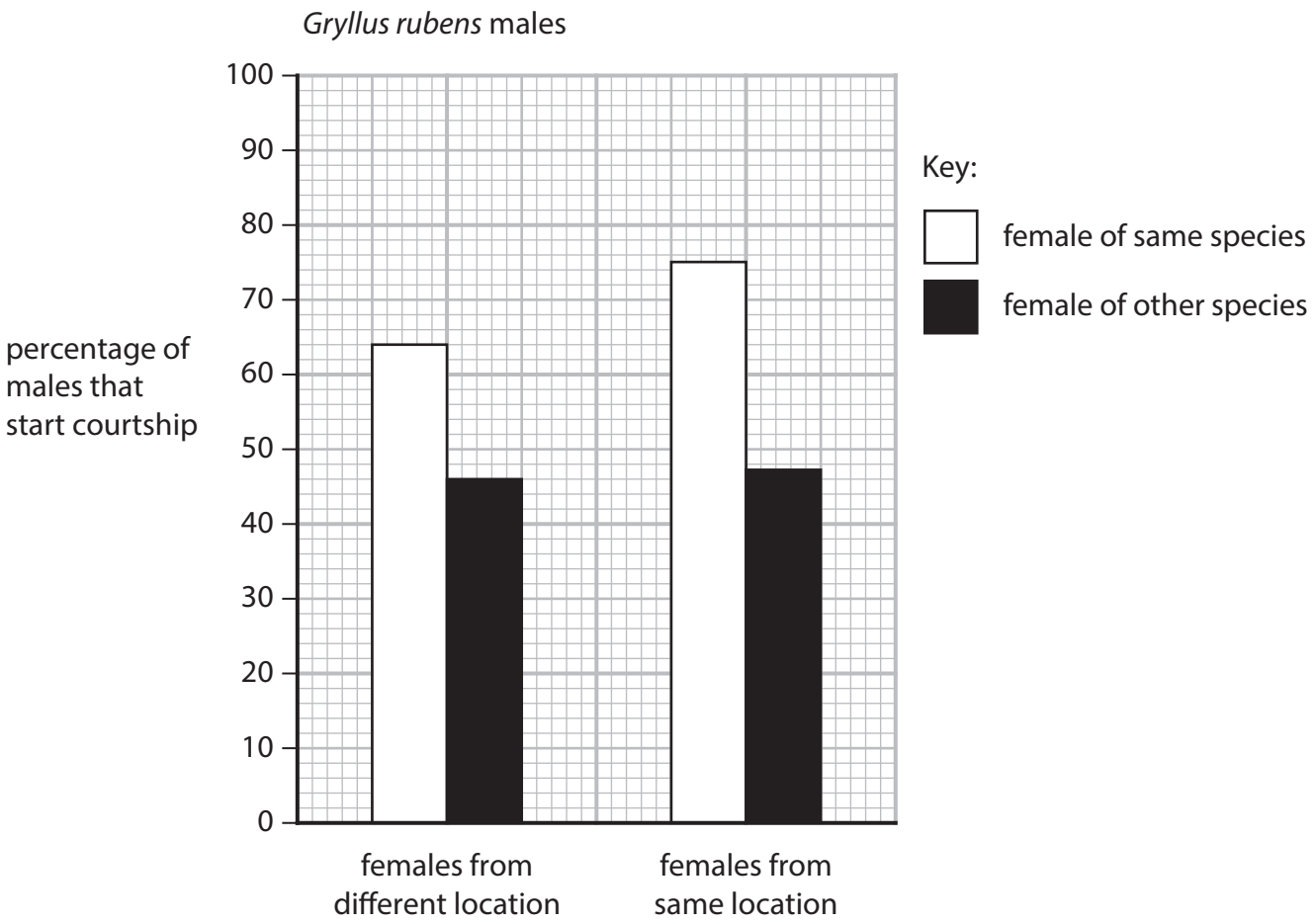
They did this for sympatric and allopatric populations.

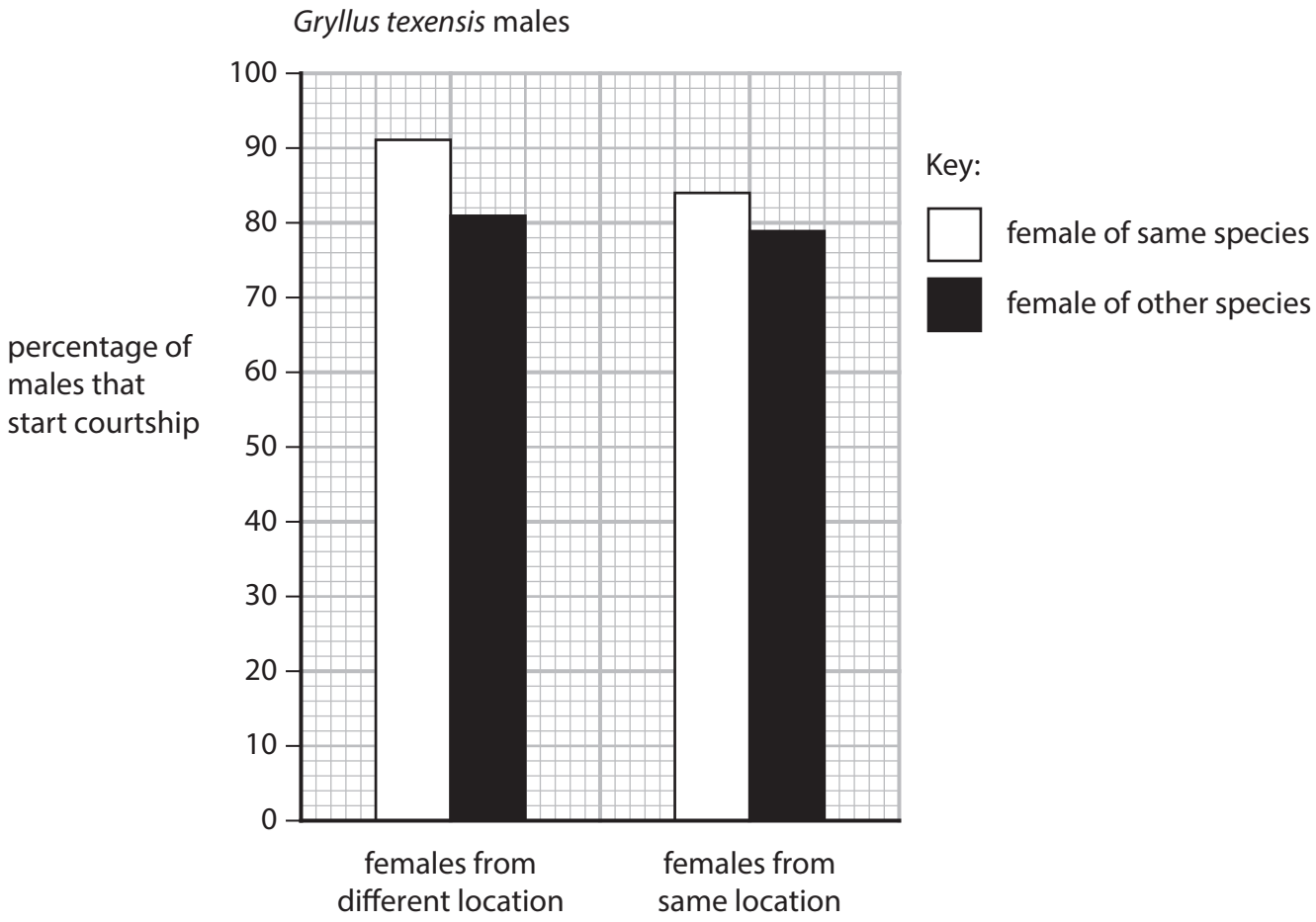
Male crickets of each species were placed with:

- Females of the same species that were from different locations
- Females of the same species that were from the same location
- Females of the other species that were from different locations
- Females of the other species that were from the same location.

The percentage of males that began mating behaviour was calculated.

The results are shown in the graphs.





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(a) Give the difference between allopatric and sympatric populations.

(1)

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(b) Explain how the courtship songs of male crickets may have evolved by natural selection.

(3)

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*(c) Analyse the information and data to comment on how male courtship behaviour could affect speciation in these crickets.

(6)

(Total for Question 4 = 10 marks)

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5 The photograph shows a vicuna, *Lama vicugna*.

(Source: © Stefano Buttafoco/Shutterstock)

Vicunas live in high mountainous regions of South America. At high altitudes, the atmospheric pressure is low.

(a) State the genus to which this animal belongs.

(1)

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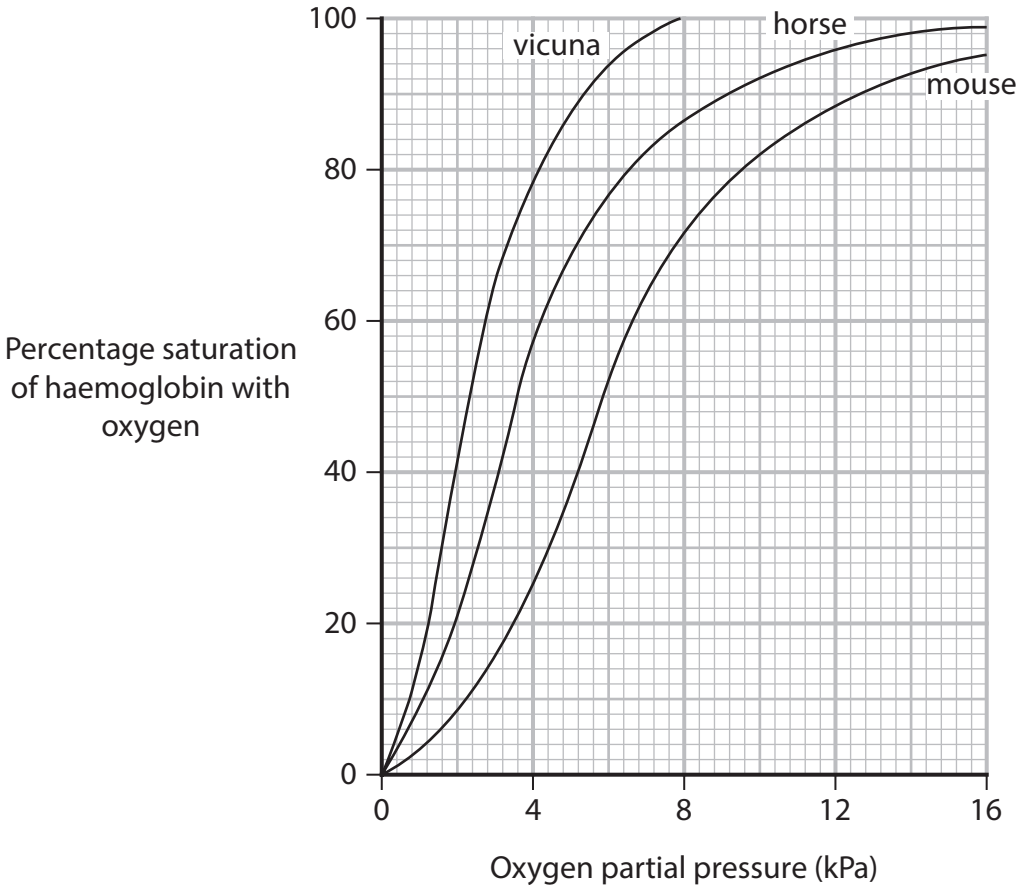
(b) The graph shows the oxygen dissociation curve of haemoglobin from this animal, from a horse and from a mouse.



P 7 8 6 9 0 A 0 1 6 3 2

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(i) Explain why the dissociation curves for all three animals are S-shaped.

(2)

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(ii) Calculate the difference in the percentage saturation of haemoglobin for the vicuna at a partial pressure of 6 kPa and a partial pressure of 2 kPa.

(1)

Answer .....

(iii) Explain the differences in the dissociation curves of the vicuna and the horse.

(2)

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(c) Llamas are closely related to vicunas but are larger and are used as pack animals to transport materials. They have an oxygen dissociation curve that is similar to that of a vicuna.

Explain the advantage of using llamas to transport heavy loads at high altitude rather than using horses.

(3)

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(d) Give a reason why the dissociation curve for the mouse is located to the right of the dissociation curve for the horse.

(1)

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(Total for Question 5 = 10 marks)

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6 Osmosis is affected by a number of factors, including temperature.

(a) State what is meant by the term **osmosis**.

(2)

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(b) The effect of temperature on the rate of osmosis in potato cylinders was investigated.

- Potato cylinders were cut from the same type of potato using a cork borer.
- Each cylinder was 5 cm long and had a diameter of 1 cm.
- Five cylinders were used at each temperature.
- The cylinders were first blotted dry, weighed and the masses recorded.
- The cylinders were immersed in distilled water at 10 °C for 10 minutes then removed, blotted dry, reweighed and the new masses were recorded.
- This was repeated at temperatures of 15 °C and 20 °C.

(i) The surface area of each potato cylinder is 17.3 cm^2.

Determine the surface area to volume ratio of one of these cylinders.

Use the formula:

$$\text{Volume} = \pi r^2 l$$

Give your answer to **one decimal place**.

(3)

Answer .....

(ii) The table shows the results of this investigation.

Temperature / °C	Initial mass of potato cylinder / g	Final mass of potato cylinder / g	Change in mass / g	Percentage change in mass (%)	Mean percentage change in mass (%)	Standard deviation
10	5.1	5.2	0.1	2.0	2.0	1.4
	5.0	5.0	0.0	0.0		
	5.2	5.3	0.1	1.9		
	5.0	5.2	0.2	4.0		
	4.9	5.0	0.1	2.0		
15	5.1	5.2	0.1	2.0	2.8	
	5.1	5.3	0.2	3.9		
	5.2	5.3	0.1	1.9		
	4.9	5.1	0.2	4.1		
	5.1	5.2	0.1	2.0		
20	4.9	5.1	0.2	4.1	3.6	0.94
	5.0	5.2	0.2	4.0		
	5.2	5.3	0.1	1.9		
	5.1	5.3	0.2	3.9		
	5.0	5.2	0.2	4.0		

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Calculate the standard deviation for percentage change in mass for the cylinders at 15 °C.

Use the formula:

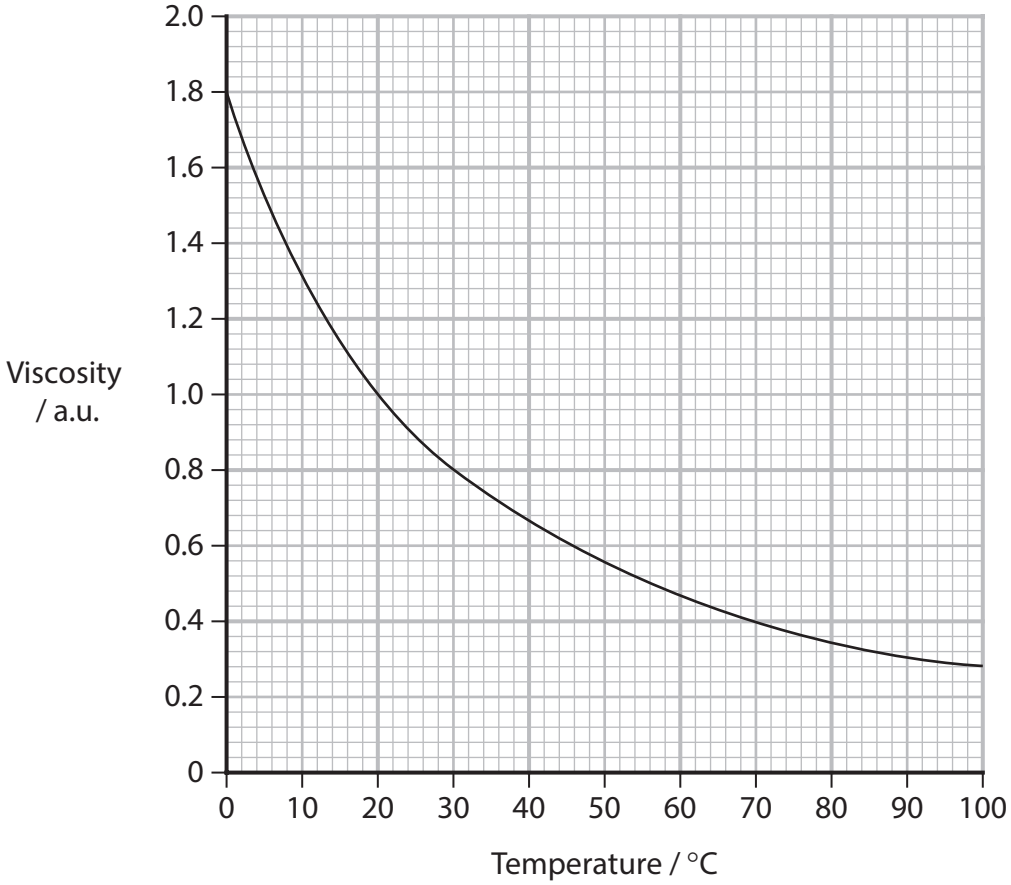
$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Give your answer to **two significant figures**.

(3)

Answer .....

(iii) The graph shows the effect of increasing temperature on the viscosity of water. Viscosity is a measure of how quickly liquids flow. A liquid with low viscosity flows more quickly than a liquid with high viscosity.



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Analyse the data in the table of results and the graph to explain the effect of temperature on the movement of water into the potato cylinders.

(5)

(Total for Question 6 = 13 marks)

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7 Scientists measured the transpiration rate of alfalfa plants.

(a) State what is meant by the term **transpiration**.

(1)

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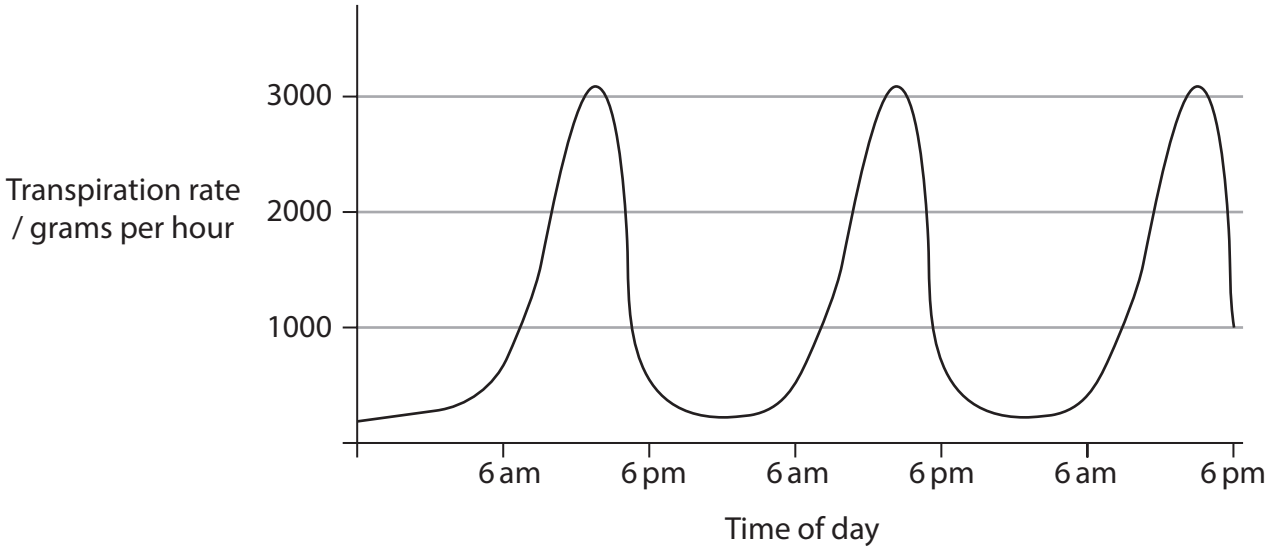
(b) The graph shows the change in transpiration rate, measured in grams per hour, for three successive days.



(i) Explain the changes in transpiration rate from 6 am to 6 pm.

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(ii) The scientists also examined the effects of soil temperature, relative humidity and air temperature on transpiration rate.

Soil temperature / °C	Relative humidity	Transpiration rate at different air temperatures / grams per hour			
		22 °C	**27 °C**	**32 °C**	**Mean**
10	35%	13.7	13.3	12.3	**13.1**
	53%	10.5	13.5	13.5	**12.5**
	65%	13.2	13.3	19.2	**15.2**
	Mean	**12.5**	**13.4**	**15.0**	**13.6**
25	**Relative humidity**	**Transpiration rate at different air temperatures / grams per hour**			
		22 °C	**27 °C**	**32 °C**	**Mean**
	35%	19.7	27.5	31.2	**26.1**
	53%	23.0	27.5	28.5	**26.3**
	65%	22.5	24.7	29.5	**25.6**
	Mean	**21.7**	**26.6**	**29.7**	**26.0**

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Analyse the data in the table to comment on the factors that influence transpiration rate.

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(c) Transpiration can be measured in the laboratory using a cut leafy shoot.

Describe how you could accurately measure the effect of changing light intensity on the rate of transpiration of a cut leafy shoot in the laboratory.

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(Total for Question 7 = 11 marks)

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8 Gas exchange systems in a mammal and in an insect are different.

(a) Explain why larger species of animal need specialised gas exchange surfaces.

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(b) Compare and contrast the gas exchange systems in insects and in mammals.

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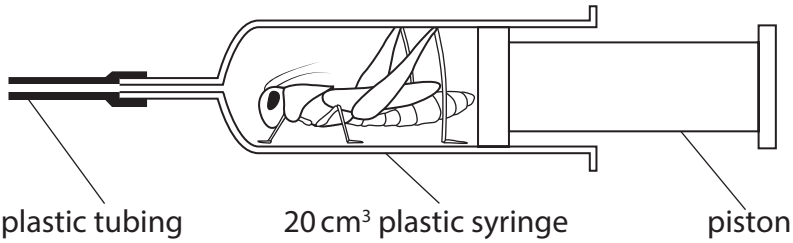
(c) The effect of gas composition on the ventilation rate of a locust was investigated using the following method.

Step 1 A locust was placed in a 20 cm^3 clear plastic syringe, as shown in the diagram. The piston was inserted gently to hold the locust in place.



Step 2 Different mixtures of gases were added to the syringe through the plastic tubing.

Step 3 For each mixture of gases, the number of pumping movements of the locust's abdomen was counted for one minute. This was repeated two more times.

Step 4 Between each mixture of gases used, the piston was moved in and out ten times to replace the mixture with laboratory air.

Step 5 The locust was then left for five minutes before the next mixture of gases was added.

(i) State the independent variable in this investigation.

(1)

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(ii) The table shows the results of this investigation.

Gas mixture		Ventilation rate / movements per minute			Mean ventilation rate / movements per minute
Oxygen (%)	Carbon dioxide (%)				
100.0	0.0	10	24	12	15.3
21.0	0.1	52	44	62	52.7
16.4	4.1	106	98	102	102.0
94.0	6.0	96	84	92	90.7
88.0	12.0	82	92	102	92.0
83.0	17.0	108	98	99	101.7

Analyse the data to comment on the effect of the different gas mixtures on the ventilation rate of the locust.

(4)

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(iii) Describe how the method could be modified to investigate the effect of temperature on the ventilation rate of a locust.

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(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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