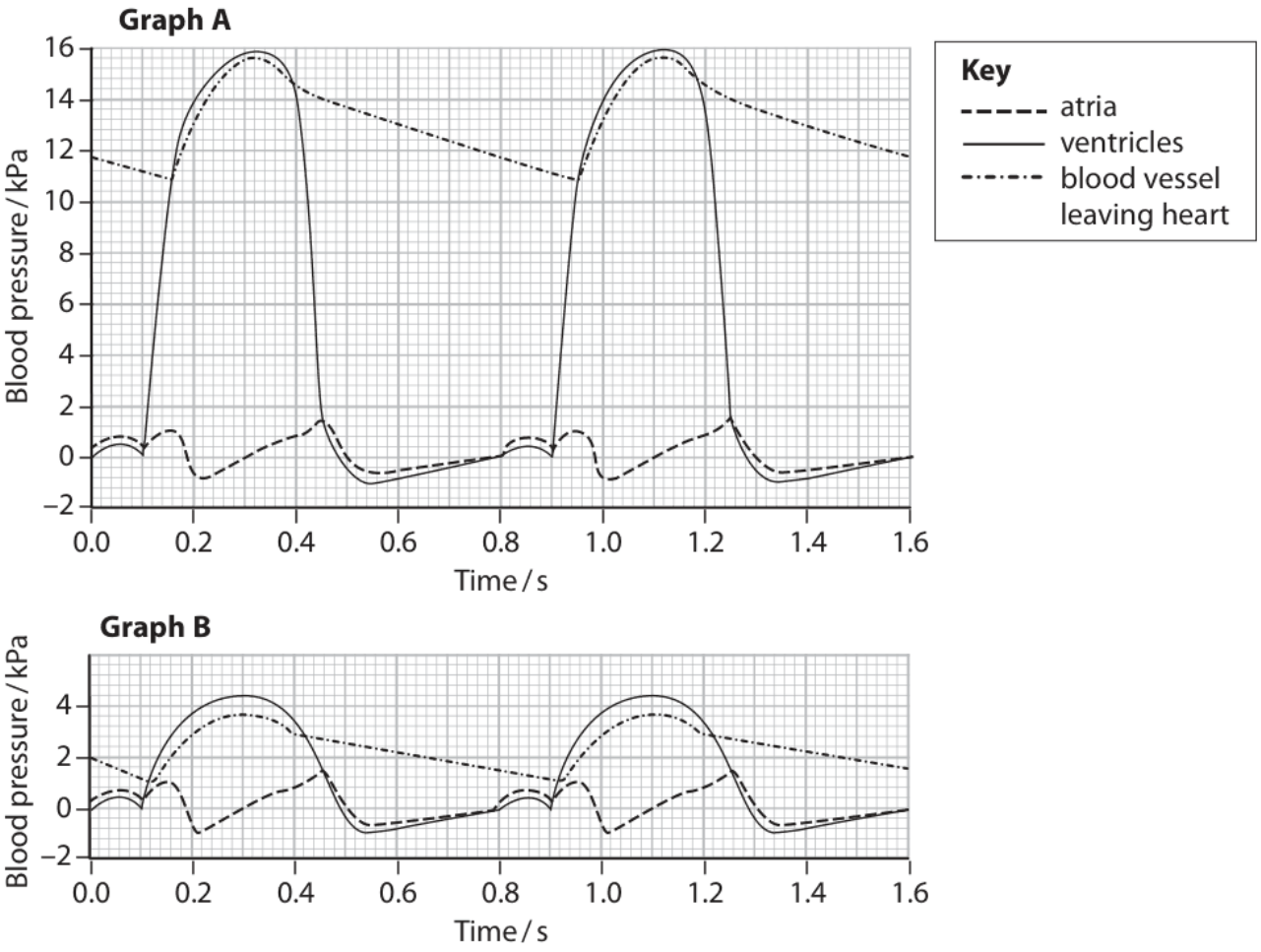
Graphs and Geometry (Maths Skills MS3 and MS4): Edexcel SNAB A Level Biology Exam Questions

19 questions · 43 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 1 · June 2018 · Q5(a)(i) · 2 marks

5 The pressure of the blood passing through the heart can vary.

Graph A shows the changes in blood pressure in one side of the heart. Graph B shows the changes in blood pressure in the other side of the heart over the same time period.



(a) (i) Calculate the heart rate.

(2)

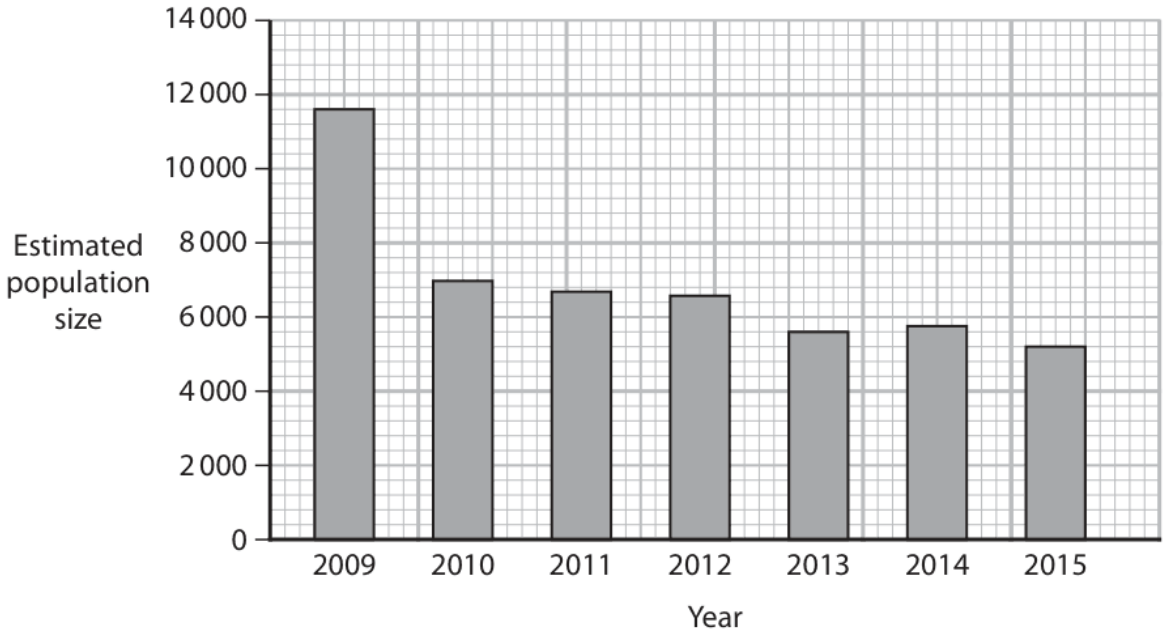
Answer .....

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Question 2 · AS Paper 2 · June 2023 · Q7(b)(ii) · 3 marks

(ii) Some of this habitat has been lost as the human population has grown and land has been developed.

The graph shows the estimated population size of the flamingos from 2009 to 2015 in one study.



Calculate the percentage decrease in the estimated size of the flamingo population from 2009 to 2015.

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

(3)

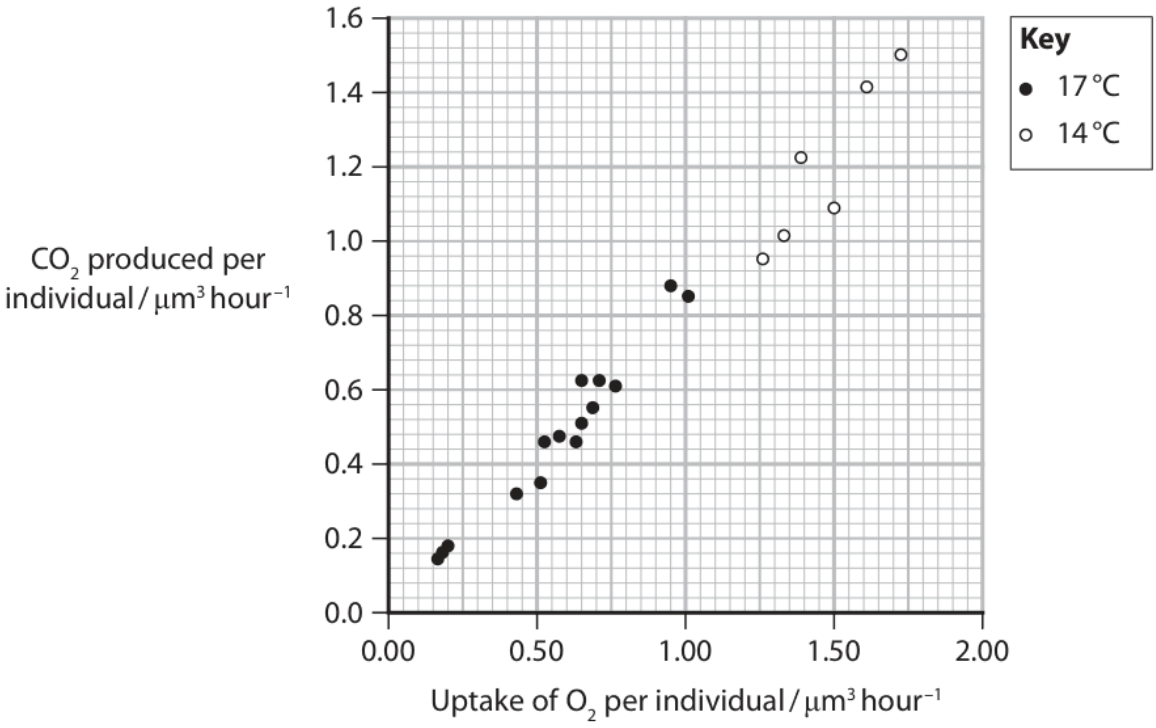
.....

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(c) Copepods are a group of zooplankton, small animals that feed on phytoplankton.

In an experiment, the production of carbon dioxide and the uptake of oxygen by copepods was measured at 14 °C and at 17 °C.

The results of the experiment are shown in the graph.



(i) Determine the mean ratio of carbon dioxide produced to oxygen consumed at 17 °C.

(1)

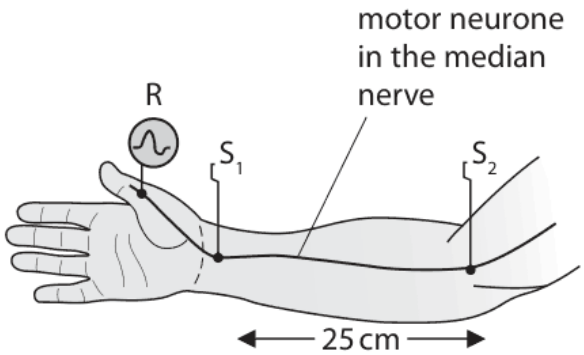
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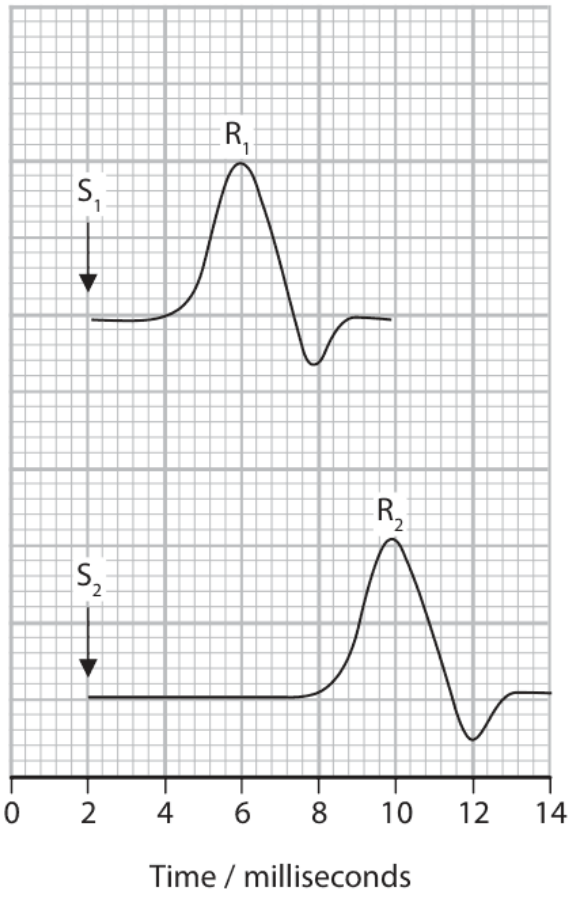
Question 4 · A level Paper 2 · June 2018 · Q8(b) · 2 marks

(b) The speed of conduction along a motor neurone can be calculated.

The time taken for a stimulus (S) to produce a response (R) further along the neurone is recorded.

Using two stimuli, a known distance apart, allows the speed of conduction to be calculated.





Calculate the speed of conduction for the neurone shown.

(2)

..... cm s^{-1}

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

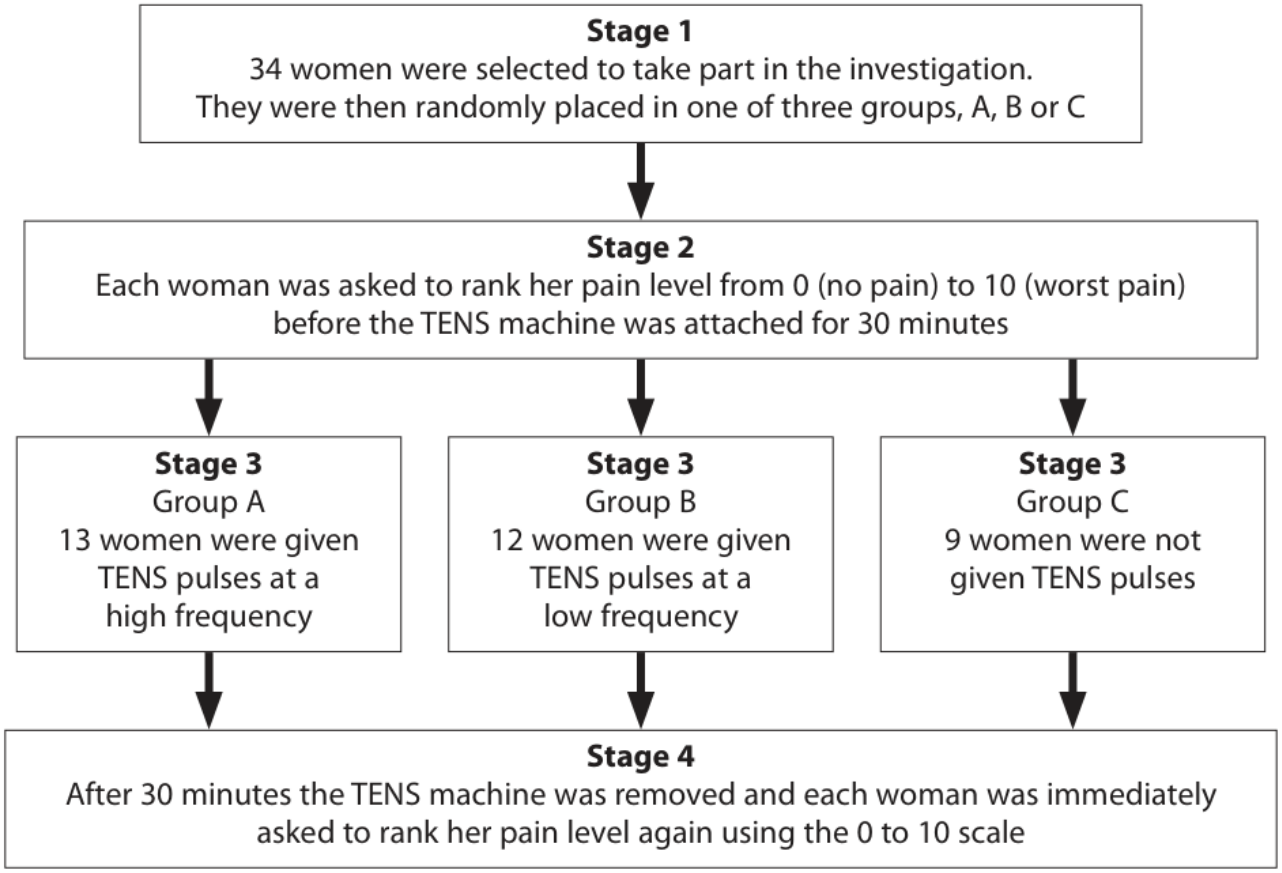
Question 5 · information from earlier in the question

2 Some women need to have surgery to aid childbirth. This can lead to pain after surgery.

A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

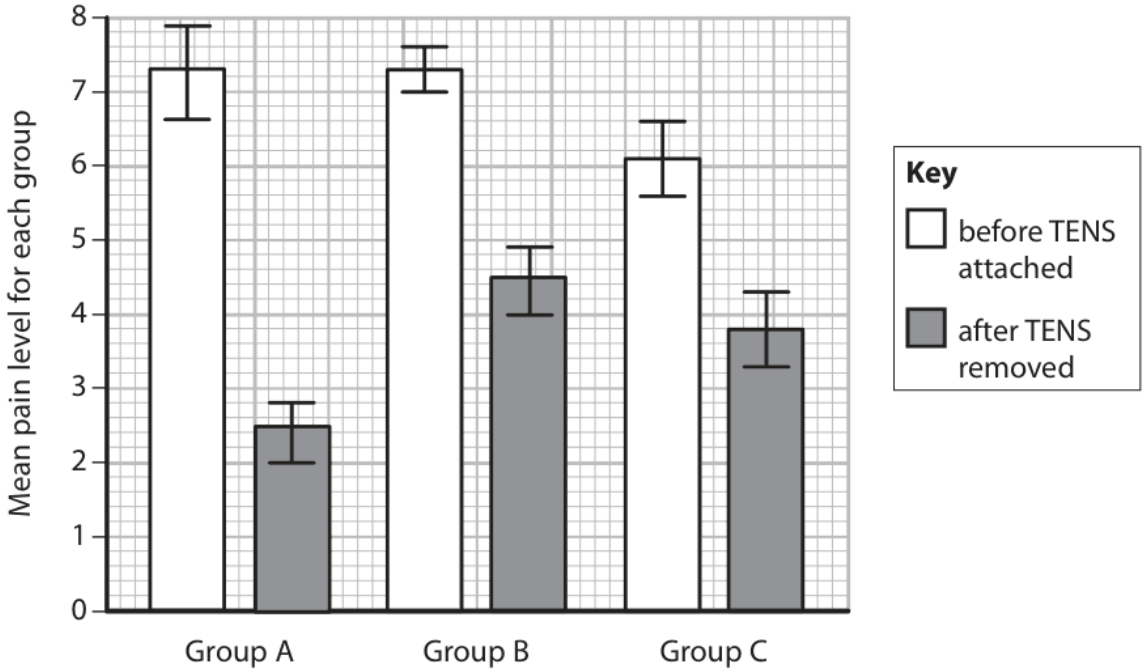
An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



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(c) The results and range of data for the investigation are shown in the graph.



Determine the effectiveness of the use of a TENS machine in relieving pain following surgery.

(4)

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(c) In an investigation, the velocity of the sperm cells was measured from 0 to 90 minutes after being treated with sildenafil.

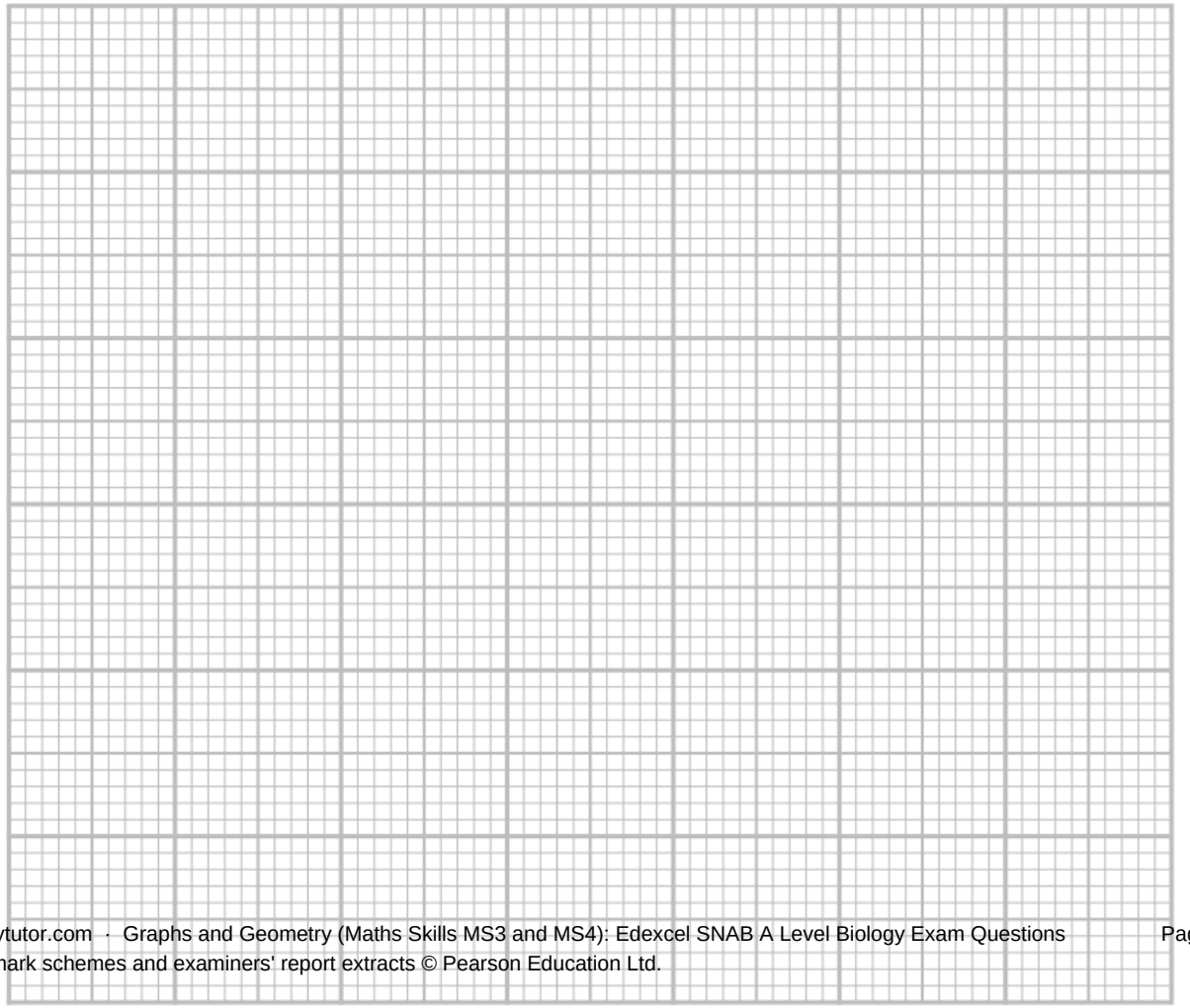
A control group was not given sildenafil.

The table shows the results of this investigation.

Time / minutes	Velocity of sperm cells / $\mu m\ s^{-1}$	
	Control	Treated with sildenafil
0	33	33
15	32	38
30	31	39
60	30	38
90	29	33

(i) Plot the data to show the results of this investigation in a suitable graphical form.

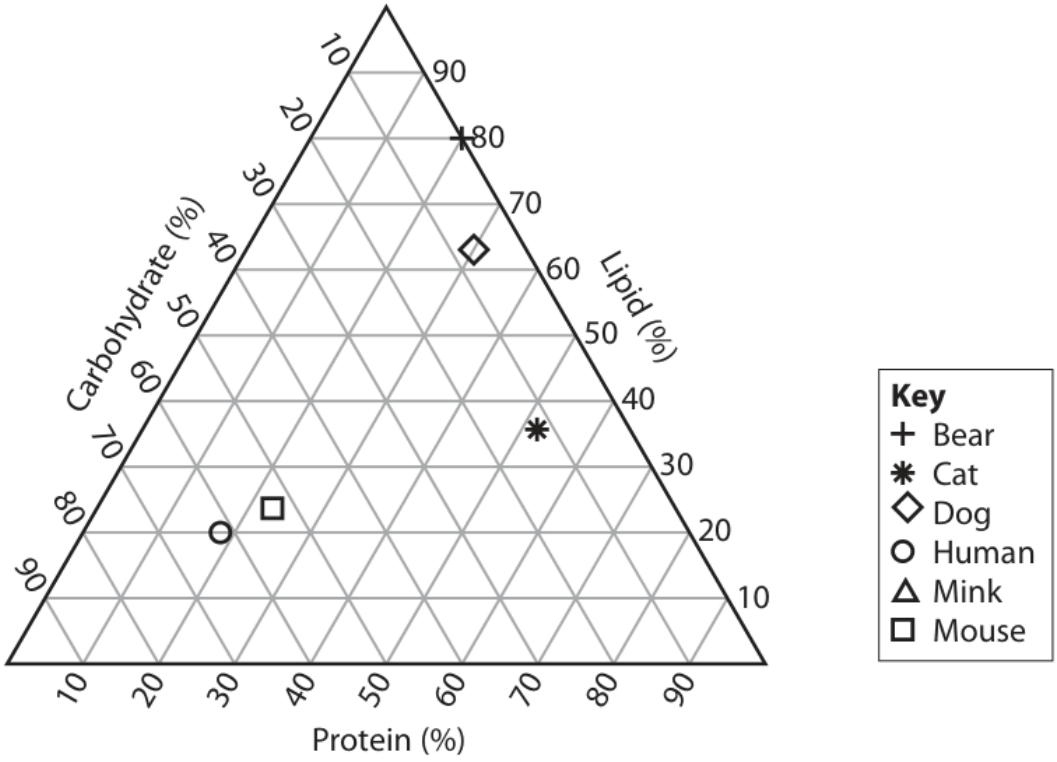
(4)



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(b) Mammals have diets containing different proportions of carbohydrates, lipids and proteins.

The diagram shows the composition of the average diet of some mammals.



(i) The diet of a dog contains 6% carbohydrate, 64% lipid and 30% protein. This is shown on the diagram as a diamond.

The diet of a mink contains 15% carbohydrate, 50% lipid and 35% protein.

Plot this on the diagram.

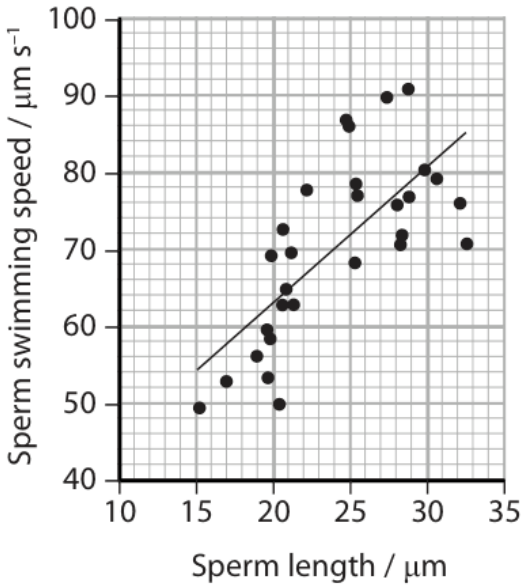
(1)

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Question 8 · AS Paper 2 · June 2016 · Q1(c)(i) · 2 marks

(c) The relationship between the length of a sperm cell and the speed at which it can swim was investigated.

The data collected are shown in the graph.



(i) Calculate the swimming speed of a sperm cell that is 40 μm long, as predicted by the line shown on the graph.

(2)

Answer .....

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Question 9 · AS Paper 2 · June 2016 · Q1(c)(ii) · 2 marks

(ii) Explain the limitations of using the line on the graph to predict the swimming speed of sperm cells.

(2)

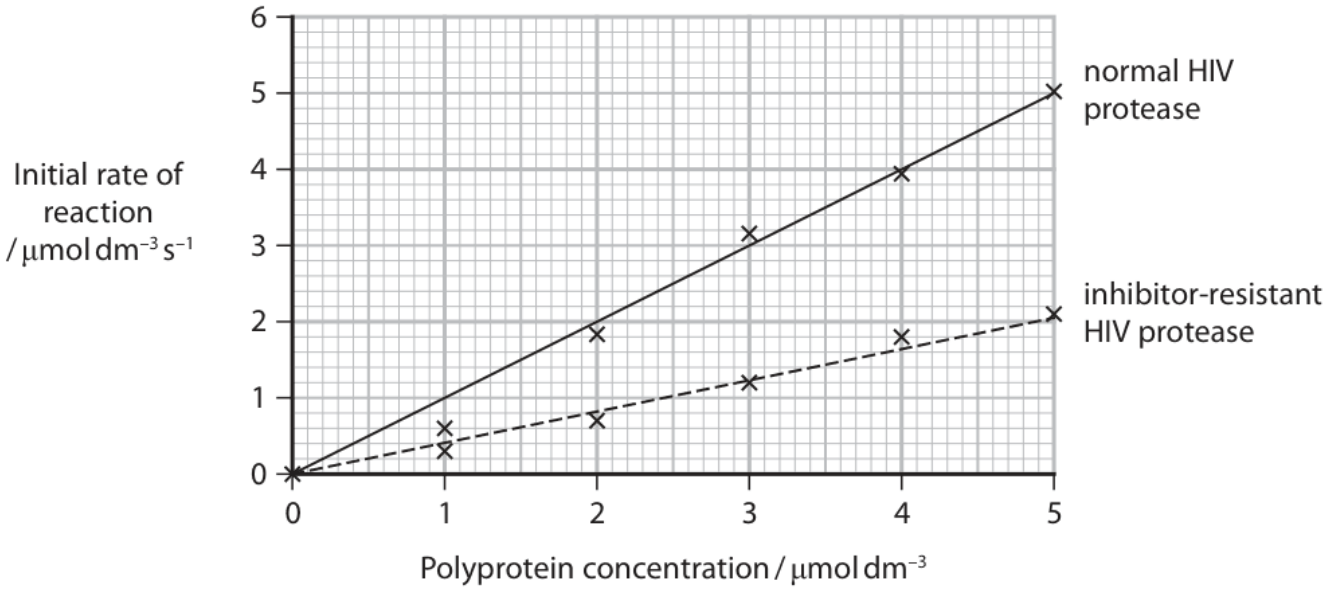
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Question 10 · A level Paper 3 · June 2024 · Q5(c)(i) · 2 marks

(c) HIV protease inhibitors are used in drugs to treat HIV infection.

In some individuals, the HIV has developed resistance to protease inhibitors.

The graph shows the effect of polyprotein concentration on the initial rate of reaction of normal HIV protease and inhibitor-resistant HIV protease.



(i) Calculate the initial rate of reaction in the inhibitor-resistant HIV protease for a polyprotein concentration of 7 μmol dm⁻³.

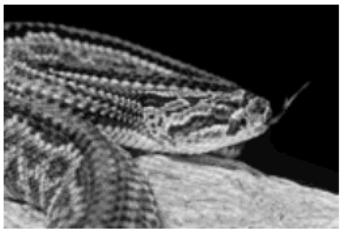
(2)

Answer .....

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Question 11 · AS Paper 1 · June 2016 · Q2(a)(i) · 2 marks

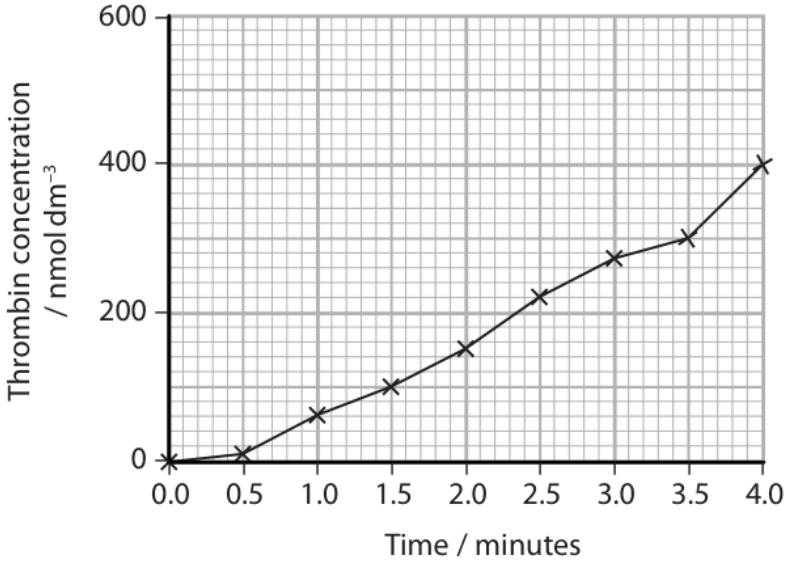
2 The photograph shows the tropical rattlesnake, *Crotalus durissus terrificus*.



This snake produces a toxin called convulxin (CVX), which activates platelets leading to blood clotting.

(a) The effect of CVX on the rate of thrombin production was investigated.

The graph shows the concentration of thrombin in a sample of blood treated with CVX.



(i) Calculate the rate of thrombin production during the last two minutes of this investigation.

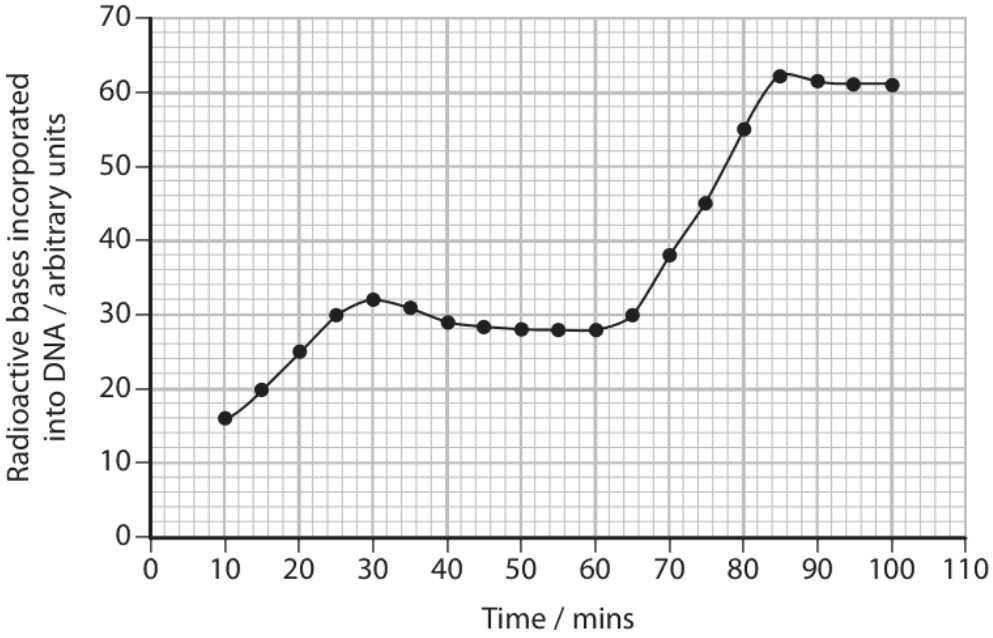
(2)

Answer .....

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(b) In an experiment, a mixture of radioactive bases was added to a culture of dividing bacteria.

The results are shown in the graph.



(i) Calculate the fastest rate of uptake of bases by these bacteria.

(2)

Answer .....

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Question 13 · information from earlier in the question

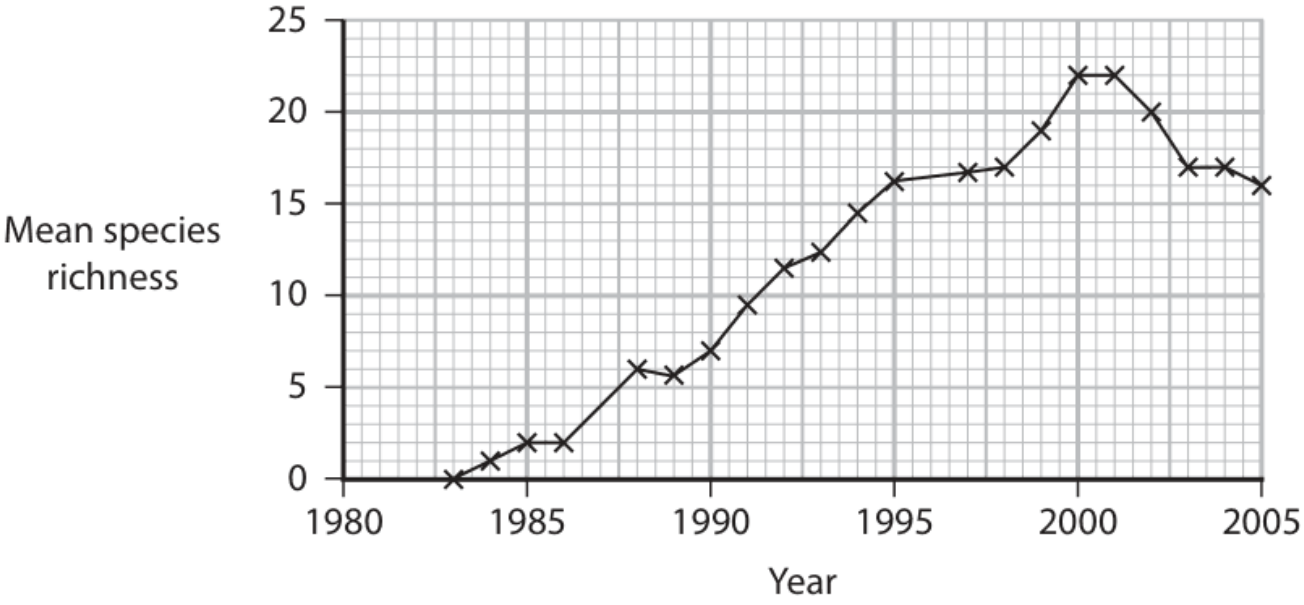
1 In 1980, a volcano erupted in Washington State, USA.

Ash from the volcano covered surrounding vegetation, killing all the plants.

Succession has been investigated on one of the sides of the volcano.

(a) In one study, species richness on the side of the volcano was measured.

The graph shows the change in mean species richness from 1983 to 2005.



Question 13 · A level Paper 3 · June 2025 · Q1(a)(ii) · 2 marks

(ii) Calculate the rate of increase in the mean number of species from 1986 to 1995.

Give your answer to two significant figures and include units.

(2)

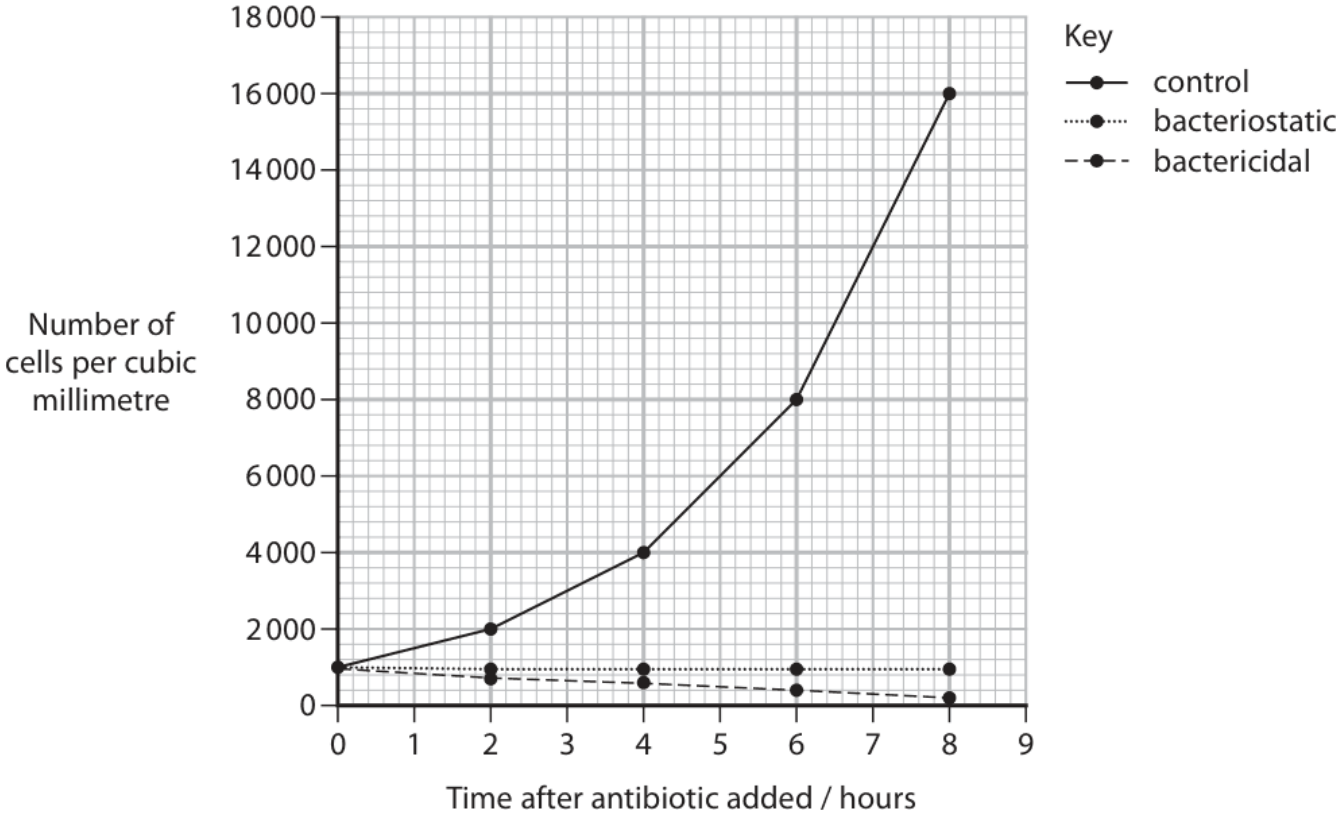
Answer .....

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Question 14 · information from earlier in the question

(b) Some bacteria are pathogenic. Bacteriostatic and bactericidal antibiotics are drugs used to treat diseases caused by bacteria.

The graph shows the effects of two types of antibiotic on the growth of bacteria. The control line shows the growth of bacteria with no antibiotic present.



Question 14 · A level Paper 1 · June 2023 · Q7(b)(ii) · 2 marks

(ii) Calculate the mean rate of increase in the number of bacteria in the control from 6 to 8 hours.

Give your answer in **standard form**.

(2)

Answer .....

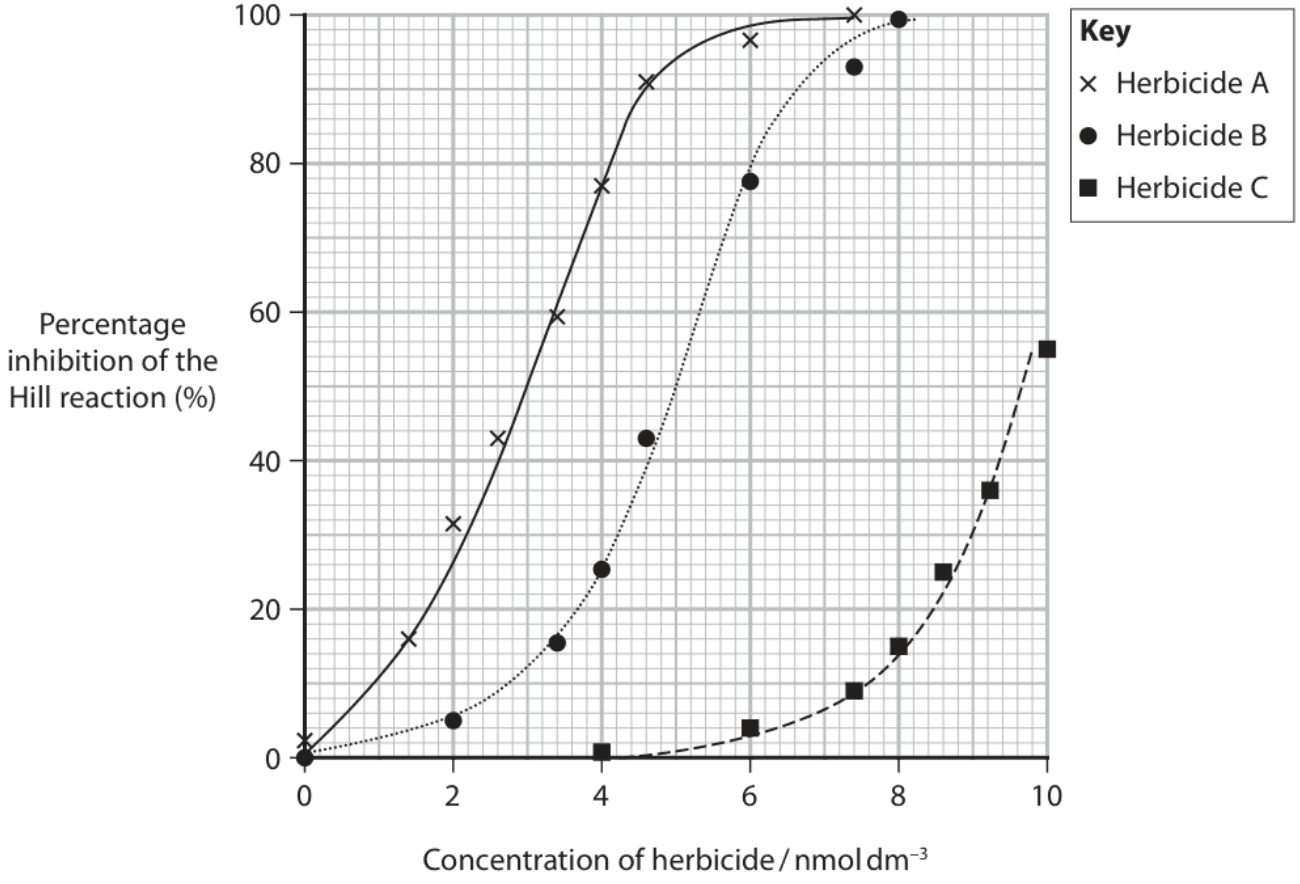
Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 15 · information from earlier in the question

3 Photosynthesis takes place in chloroplasts.

(a) The light-dependent processes in photosynthesis can be investigated using the Hill reaction.

The graph shows the effect of three different herbicides, A, B and C, on inhibition of the Hill reaction in isolated chloroplasts.



Question 15 · A level Paper 3 · June 2024 · Q3(a)(ii) · 2 marks

(ii) Calculate the gradient of the slope for herbicide A at 50% inhibition of the Hill reaction.

Give your answer to two significant figures.

(2)

Answer .....

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6 Plants have been used as sources of medicine for thousands of years.

(a) The antimicrobial properties of a range of plant extracts were studied.

Extracts were produced by grinding plant material in water or ethanol.

The effectiveness of these extracts was tested against the bacteria *Staphylococcus aureus* grown in agar jelly in Petri dishes.

The table shows the results of this investigation.

Plant extract	Diameter of zone of inhibition / mm	
	Extract made with water	Extract made with ethanol
Cardamom	8.0	12.0
Cinnamon	6.0	10.0
Cloves	6.0	14.0
Cumin	6.0	11.5
Lemongrass	8.0	12.5

(i) The area of the zone of inhibition for lemongrass extract made with water was 50.3 mm^2.

Calculate the difference in the areas of the zones of inhibition for the lemongrass extract made with water and the lemongrass extract made with ethanol.

Give your answer to one decimal place.

(2)

..... mm^-

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 17 · AS Paper 2 · June 2019 · Q7(c)(i) · 3 marks

(c) Extracts from four different plants were added on separate small paper discs to agar plates containing *E. coli* bacteria.

After 48 hours, the zone of inhibition around each extract was measured.

Extract	Mean diameter of zone of inhibition / mm	Range
P	18.5	± 1.07
Q	23.5	± 0.97
R	22.2	± 0.58
S	22.9	± 1.28

(i) Calculate the area of the largest zone of inhibition for extract S.

(3)

..... mm^2

Question 18 · A level Paper 3 · June 2019 · Q2(a) · 2 marks

2 The largest blood vessels in the body are the aorta and the vena cava.

(a) For one person, the cross-sectional area of the lumen of the aorta is 193.6 mm^2.

The diameter of the lumen of the vena cava is 22.0 mm. Calculate the percentage increase in the cross-sectional area of the lumen of the vena cava compared with that of the aorta.

(2)

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Question 19 · A level Paper 2 · June 2025 · Q4(b) · 3 marks

(b) The fovea is part of the retina.

In one study, the mean density of photosensitive cells in the fovea was found to be 164 000 ± 24 000 per mm^2.

The mean radius of the fovea is 0.8 mm.

Calculate the maximum number of photosensitive cells present in the fovea.

Give your answer to 3 significant figures.

(3)

Answer .....

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Mark schemes

Question 1 · AS Paper 1 · June 2018 · Q5(a)(i) · 2 marks

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	• correct figures from graph • correct answer with unit	Example of calculation e.g. 120 and 1.6 or 60 and 0.8 120 ÷ 1.6 / 60 ÷ 0.8 75 bpm	(2)

Question 2 · AS Paper 2 · June 2023 · Q7(b)(ii) · 3 marks

Question Number	Answer
7(b)(ii)	An description that makes reference to the following: • correct values read from graph and difference calculated (1) • decrease from original calculated (1) • answer expressed as a percentage correct to 3sf (1)

Additional guidance	Mark
Example of calculation 11600 - 5200 = 6400 6400 ÷ 11600 = 0.55172 55.2 (%) ECF max 2 marks if incorrect values used from graph in working. Correct answer with no working gains full marks.	(3)

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Question 3 · A level Paper 3 · June 2024 · Q4(c)(i) · 1 mark

Question number	Answer	Additional guidance	Mark
4(c)(i)	Choose an item. • 0.86 : 1	ALLOW value between 0.8 : 1 and 0.92 : 1 ALLOW values between 1 : 1.09 and 1 : 1.25	Choose an item. (1)

Question 4 · A level Paper 2 · June 2018 · Q8(b) · 2 marks

Question Number	Answer
8(b)	• appropriate figures in formula for calculating speed distance divided by time (1) • correct conversion of units (1)

Additional Guidance	Mark
<u>Example of calculation</u> 25 ÷ time (ALLOW any time from 3.7 to 4.3 milliseconds) The answer multiplied by 1000 to give answer in cm s^{-1} Examples of acceptable answers: 3.7ms gives 6757 cm s^{-1} 3.8 6579 3.9 6410 4.0 6250 4.1 6098 4.2 5952 4.3 5814 Correct answer without working gains full marks	**(2)**

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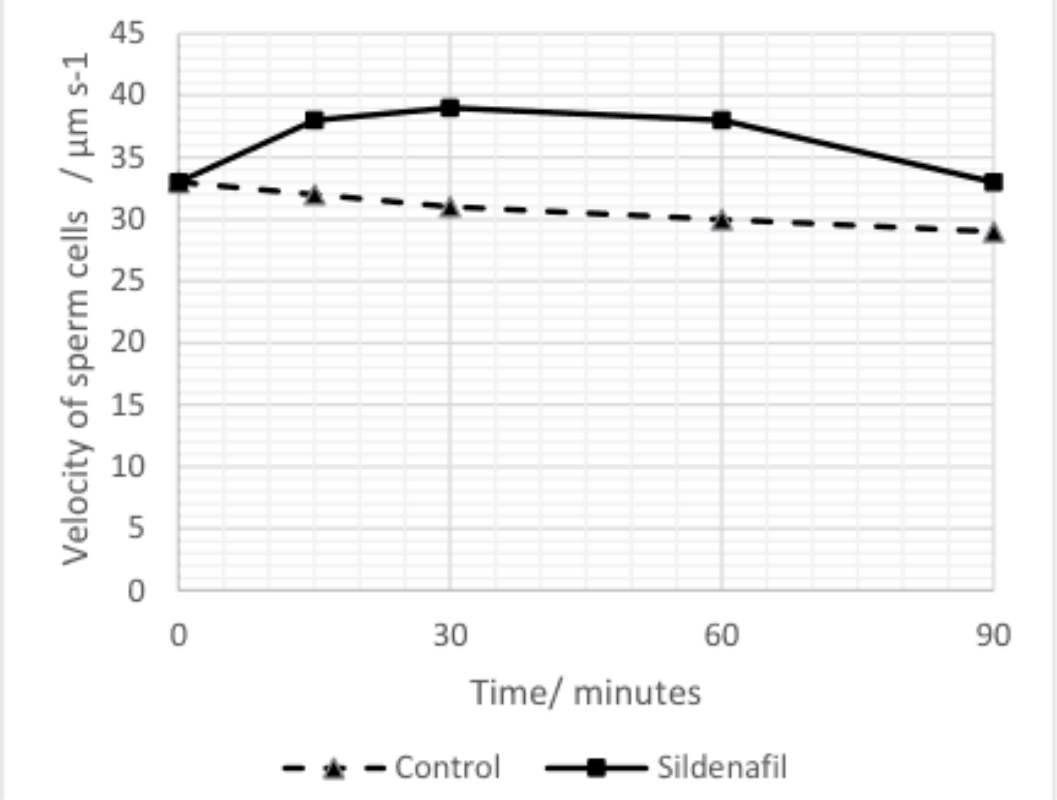
Question 5 · A level Paper 3 · June 2017 · Q2(c) · 4 marks

Question Number	Answer
2(c)	An answer that makes reference to the following: • TENS provides pain relief **(1)** • high frequency {most effective / more effective than low frequency} **(1)** • quantified difference between before TENS and after TENS to show that A was the largest **(1)** • there was overlap between the {low frequency TENS / B} and {TENS with no pulses / placebo / control / C} **(1)**

Additional Guidance	Mark
ALLOW TENS is effective {4.8 / 65.8%} pain relief reduction for group A but only {2.8 /38.4% for group B} / {2.3 / 37.7% for group C}	**(4)**

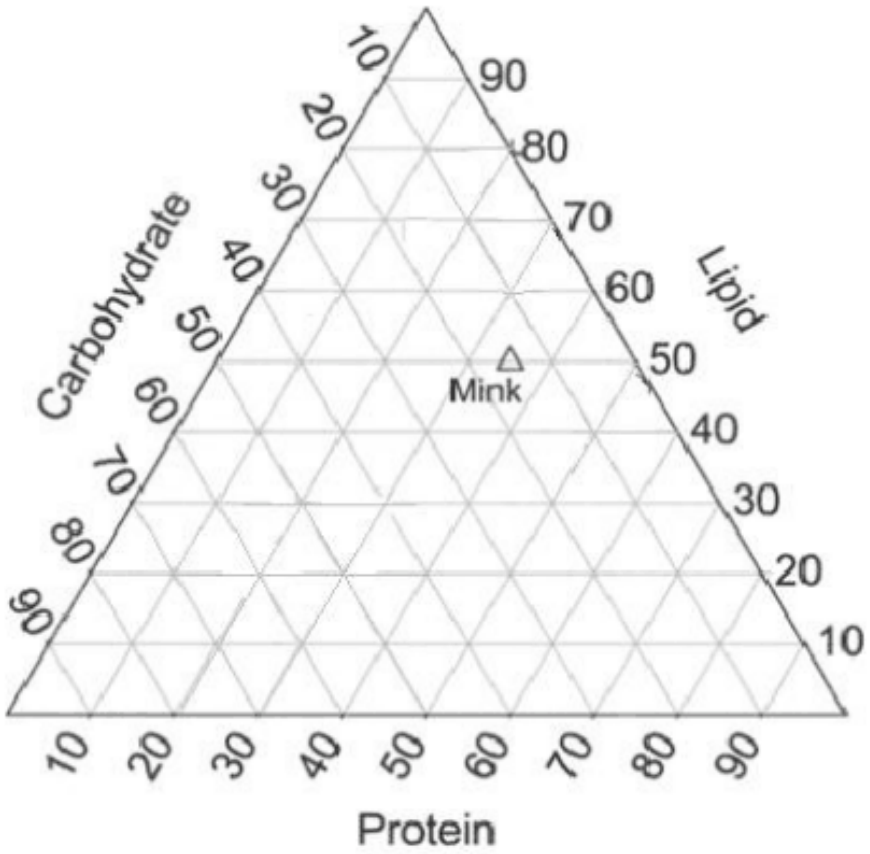
Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question number	Answer
7(c)(i)	An answer that makes reference to the following: • A – Axes the right way around and labelled including units (1) • S – Scales on axes linear, y axis to at least 40 and x axis to at least 90 (1) • P – Plotting accurate (1) • L - Lines drawn accurately with key (1)

Additional guidance	Mark
Example of graph  ALLOW marks for A, P and L if a bar chart is drawn instead of a line graph ALLOW scatter graph if there is a key for points ALLOW y axis not starting at zero ALLOW correct labelling of lines for key ALLOW L mark for bar chart if columns drawn	

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Question 7 · AS Paper 1 · June 2017 · Q5(b)(i) · 1 mark

Question Number	Answer
5 (b)(i)	Correct Plot 

Additional Guidance	Mark
ALLOW any shape in the correct plot area Labelling not required	**(1)**

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Question 8 · AS Paper 2 · June 2016 · Q1(c)(i) · 2 marks

Question Number	Answer
1(c)(i)	• correct extrapolation to find the speed for 40µm (1) • correct units (1)

Additional Guidance	Mark
Example of calculation 18 ÷ 10 = 1.8 (ALLOW 1.75 to 1.85) 84 + (1.8 x 8) = 98.4 µm/s ALLOW **98 to 99 µm/s** µm/s OR µm s^{-1} NOT $µm^{s-1}$	**(2)**

Question 9 · AS Paper 2 · June 2016 · Q1(c)(ii) · 2 marks

Question Number	Answer
1(c)(ii)	An explanation making reference to the following points: • there is variation about the line / few data points lie exactly on the line (therefore the prediction will not be exact) (1) • the gradient of the line may not remain the same (1)

Additional Guidance	Mark
ALLOW a suggested reason for variation about the line e.g. different numbers of mitochondria in the sperm	**(2)**

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Question 10 · A level Paper 3 · June 2024 · Q5(c)(i) · 2 marks

Question number	Answer
5(c)(i)	An answer that makes reference to the following: • correct slope calculated for the graph (1) • correct value calculated from y = mx + c (1)

Additional guidance	Mark
Example of calculation e.g. 2 ÷ 5 = 0.4 2.1 ÷ 5 = 0.42 2 ÷ 4.9 = 0.408 ALLOW correct fractions 2.8 / 2.86 / 2.9 / 2.94 / 3 IGNORE units Correct answer without working gains both marks	Choose an item. (2)

Question 11 · AS Paper 1 · June 2016 · Q2(a)(i) · 2 marks

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	• correct answer (1) • correct unit (1)	Example of calculation (400 – 150) ÷ 2 = **125** nmol dm^{-3} min^{-1} Allow per min Allow 2.083 (nmol dm^{-3} s^{-1})	**(2)**

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Question 12 · A level Paper 1 · June 2017 · Q3(b)(i) · 2 marks

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• correct values taken from the graph (1) • correct answer with units (1)	Example of calculation 55 – 45 (= 10) = 2 au min^{-1} ALLOW an answer between 1.6 au and 2 au per minute or 0.0267 to 0.0333 au per second Correct answer with units, with no working gains full marks Correct answer with no units, gains one mark only	2

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Question 13 · A level Paper 3 · June 2025 · Q1(a)(ii) · 2 marks

Question number	Answer
1(a)(ii)	An answer that makes reference to the following: • correct values taken from the graph (1) • correct answer given to two significant figures with an appropriate unit (1)

Additional guidance	Mark
<u>Example of calculation</u> 16 - 2 = 14 1995 – 1986 = 9 (ALLOW 14.2 and 9) $14 \div 9 = 1.6$ (species) $year^{-1}$ e.g. of acceptable unit (species) per year / (species) per y One mark can be given for 1.6 with no units Correct answer with no working gains full marks	(2)

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Question 14 · A level Paper 1 · June 2023 · Q7(b)(ii) · 2 marks

Question Number	Answer
7(b)(ii)	• calculation of increase in cell number (per hour) (1) • answer expressed in standard form (1)

Additional guidance	Mark
Example of calculation (16000 – 8000) ÷2 = 4000 (per hour) 4.0 x 10^3 hour $^{-1}$ / 4.0 x 10^3 hr $^{-1}$ ALLOW 4 x 10^3 hour $^{-1}$ ALLOW per hour or /hour IGNORE mm or mm^3 4.0 x 10^3 gains one mark Correct answer with no working gains full marks	(2)

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Question 15 · A level Paper 3 · June 2024 · Q3(a)(ii) · 2 marks

Question number	Answer
3(a)(ii)	• correct calculation of gradient (1) • correct answer to two significant figures (1)

Additional guidance	Mark
Answer between 25 and 28 to any number of significant figures 25 / 26 / 27 / 28 Correct answer without working gains both marks	Choose an item. (2)

Question 16 · AS Paper 2 · June 2023 · Q6(a)(i) · 2 marks

Question Number	Answer
6(a)(i)	• calculation of area for ethanol extract (1) • difference between the areas to one decimal place (1)

Additional guidance	Mark
Example of calculation Π x $(12.5 \div 2)^2 = 122.718$ $122.718 - 50.3 = 72.4$ (mm^2) ALLOW 72.5 Correct answer with no working gains full marks	Exp (2)

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Question 17 · AS Paper 2 · June 2019 · Q7(c)(i) · 3 marks

Question Number	Answer
7(c)(i)	• maximum diameter for S calculated (1) • calculation of r^2 for S (1) • calculation of maximum area for S (1)

Additional Guidance	Mark
<u>Example of calculation</u> 22.9 + 1.28 = 24.18 $12.09^2 = 146.17$ $\prod \times 12.09^2 = 459.2 / 459 (mm^2)$ ECF if maximum diameter not calculated - 2 marks for 412 / 411.9 / 411.87 ALLOW answers where value of $\prod$ is 3.14{ Correct answer without working gains full marks	**(3)**

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Question 18 · A level Paper 3 · June 2019 · Q2(a) · 2 marks

Question Number	Answer
2(a)	• calculation of cross sectional area (1) • percentage difference in area (1)

Additional guidance	Mark
<u>Example of calculation</u> $\pi \times 11^2 = 380.1\ (mm^2)$ ALLOW 379.94 to 380.133 [(380.1 — 193.6) ÷ 193.6] x 100 = 96.3 (%) ALLOW answers between 96.25 and 96.40 Correct answer with no working gains full marks	**(2)**

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Question 19 · A level Paper 2 · June 2025 · Q4(b) · 3 marks

Question Number	Answer
4 (b)	• maximum density (1) • area of fovea (1) • maximum number of photosensitive cells to three significant figures (1)

Additional Guidance	Mark
<u>Example of calculation</u> 188 000 (mm^{-2}) 2.01 (mm^2) ALLOW 2.0106 (mm^2) 378 000 ALLOW 2 marks for values from 377 804 to 377 996 Correct answer with no working gains full marks	**(3)**

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