Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9-1)

Centre Number	Candidate Number

Biology

Paper 2

Higher Tier

Sample Assessment Materials for first teaching September 2016
Time: 1 hour 45 minutes

Paper Reference
1BI0/2H

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.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- 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 questions 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 on 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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S 5 0 0 4 4 A 0 1 3 2

PEARSON

Answer ALL questions. Write your answers in the spaces provided.

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 Figure 1 shows a diagram of the heart.

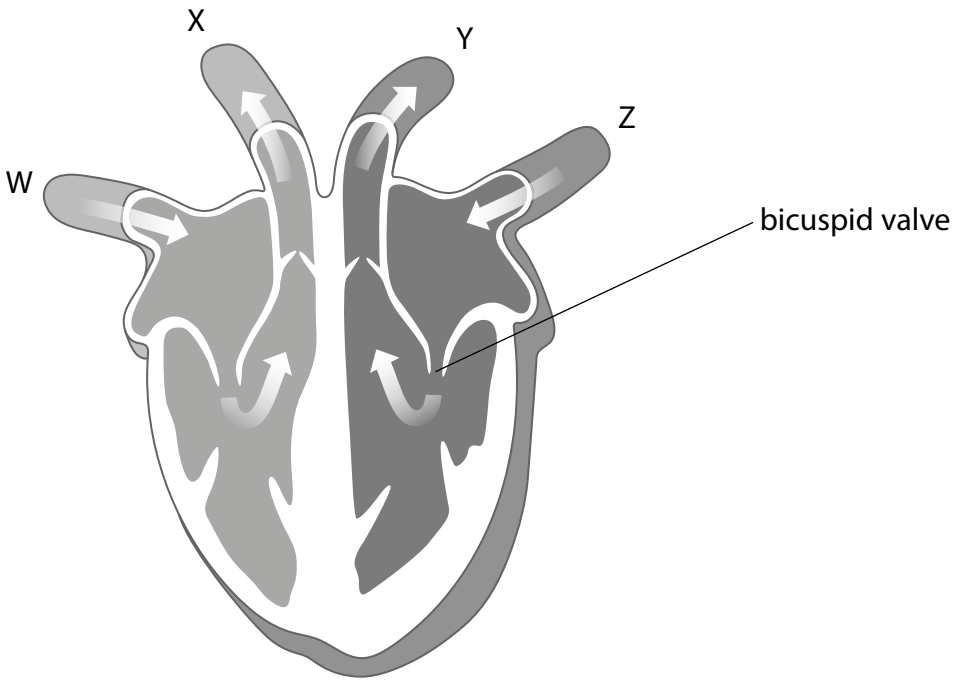

Figure 1

(a) (i) Vessel X takes

(1)

- ☒ **A** deoxygenated blood to the body
- ☒ **B** deoxygenated blood to the lungs
- ☒ **C** oxygenated blood to the body
- ☒ **D** oxygenated blood to the lungs

(ii) Give one reason why the wall of the left ventricle is thicker than the right.

(1)

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Valves in the human heart may become damaged and no longer function.

(iii) Describe what would happen to the flow of blood in the left side of the heart if the bicuspid valve did not function effectively.

(2)

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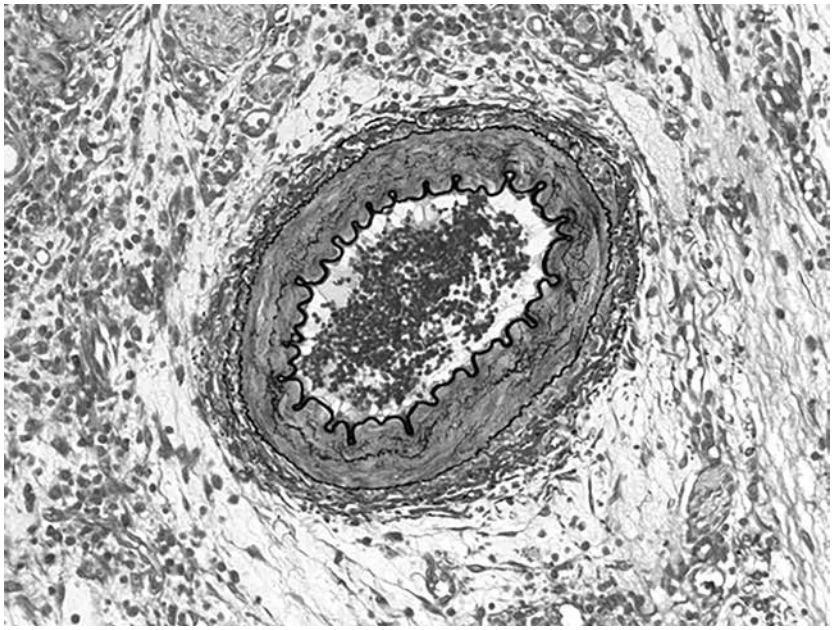
Figure 2 shows a photomicrograph of a blood vessel.



(Source: Microscape/Science Photo Library)

Figure 2

(b) Explain how the structure of this blood vessel is related to its function.

(2)

Figure 3 shows a diagram of the circulatory system of a fish.

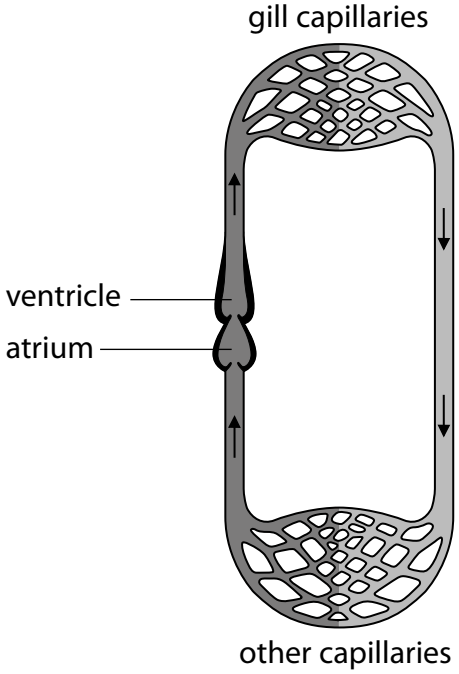


Figure 3

(c) Compare the differences between the structure of the circulatory system of a fish and the human circulatory system.

(4)

(Total for Question 1 = 10 marks)

2 Blood tests can be used to check a person's blood glucose and hormone levels.

Figure 4 shows the results of two blood tests carried out on three people to check their blood glucose levels. Person 1 is healthy.

	blood glucose level (mmols/l)	
	after fasting for 12 hours	**two hours after drinking 75 g glucose**
person 1	5.4	6.4
person 2	5.6	9.0
person 3	7.8	12.1

Figure 4

(a) (i) Compare the glucose levels of person 1 with the glucose levels of person 2 after fasting for 12 hours.

(1)

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.....

(ii) Compare the glucose levels of person 3 with the glucose levels of person 1, two hours after drinking 75 g glucose.

(1)

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Person 3 cannot produce the hormone that controls blood glucose levels.

(iii) State the hormone that person 3 cannot produce.

(1)

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(b) Figure 5 shows the level of progesterone for a female during five different stages of the menstrual cycle.

days in the menstrual cycle	progesterone level (nmol/l)
1–9	1.85
10–14	1.48
15–17	14.28
18–23	35.27
24–28	17.11

Figure 5

(i) Describe the changes in progesterone levels during the 28-day cycle.

(2)

(ii) Explain why progesterone levels changed following day 14.

(2)

(iii) Use Figure 5 to explain if the female is pregnant.

(2)

(Total for Question 2 = 9 marks)

3 A gardener investigated the ability of four types of compost to hold water.

50 cm^3 of water was added to each type of compost.

Figure 6 shows the volume of water retained by four different types of compost.

type of compost	A	B	C	D
mass of compost /g	500	500	1000	1000
volume of water retained / cm^3	15	29	45	34
total mass of compost after water was added /g cm^{-3}	515	529	1045	1034

Figure 6

(a) (i) Calculate the percentage change in mass for compost B.

(2)

.....%

(ii) Explain which compost would be best to use for a pot containing strawberry plants to be grown during a hot summer.

(2)

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(iii) State **one** way to improve this investigation in order to compare the results without having to calculate the percentage change in mass.

(1)

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(b) One method of preserving strawberries is by using them to make jam.

Figure 7 shows a method for making strawberry jam.

Procedure:

Measure 2 kg of crushed strawberries. Place in a bowl.
Add sugar, mix well, and allow to stand for 10 minutes.
Transfer to a saucepan and heat until boiling.
Stir apple pectin into fruit and continue stirring over a high temperature until the gel point is reached and there is a reduction in the water content.
Pour jam into sterilised jars, leaving 1 cm of space at the top and cover.

Figure 7

(i) Explain why reducing the water content of the strawberries will help to preserve them.

(2)

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(ii) Give a reason for sterilising the jars before adding the jam.

(1)

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(Total for Question 3 = 8 marks)

4 A student wanted to investigate the effect of light on the growth of cress seedlings.

The student had three pots of seedlings grown in different conditions.

Pot A was placed in a window with light from one direction only.

Pot B was placed in a cupboard with no light.

Pot C was placed with light from above.

Figure 8 shows the seedlings at the end of the investigation.

(a) (i) Label the pots of cress seedlings A, B and C.

(2)

(Source: Nigel Cattlin/Science Photo Library)

Figure 8

(ii) What is the response shown by the cress seedlings in Pot A?

(1)

- ☒ **A** negative gravitropism
- ☒ **B** negative phototropism
- ☒ **C** positive gravitropism
- ☒ **D** positive phototropism

(iii) State the plant hormone that causes the cress seedlings to grow towards the light.

(1)

.....

.....

(b) The student wanted to find out where the hormone that caused the response to directional light was found.

The student had two growing plant shoots and placed them both in a window with light coming from one direction.

Describe a method the student could use to show that the hormone was found in the tip of the plant shoot.

(2)

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(c) Figure 9 shows a cross section through a pine leaf.

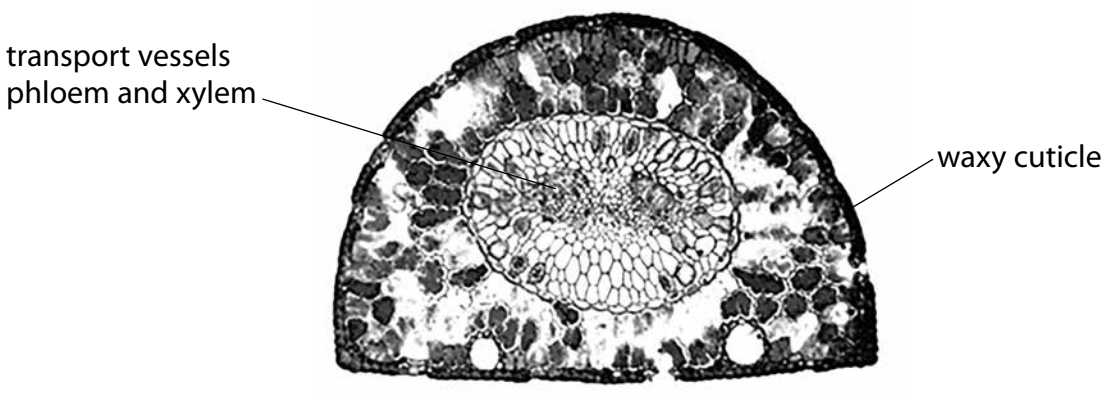

Figure 9

(i) Explain why the waxy cuticle is important for this pine leaf.

(2)

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(ii) The transport vessels are labelled on Figure 9.

Which row of the table is correct for the movement of sucrose through the plant?

(1)

		method of transport of sucrose through the plant	structure through which sucrose is transported
☒	**A**	transpiration	xylem
☒	**B**	transpiration	phloem
☒	**C**	translocation	xylem
☒	**D**	translocation	phloem

(Total for Question 4 = 9 marks)

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5 A scientist investigated the effect of light intensity on the rate of photosynthesis of the aquatic *Cabomba* plant.

A lamp was used as a source of light. The lamp was placed at different distances (*d*) from the *Cabomba* plant, and the number of bubbles produced in 60 seconds was counted.

The number of bubbles produced in 60 seconds was used to calculate the rate of photosynthesis.

The light intensity was then calculated using the inverse square law $\left(\frac{1}{d^2}\right)$.

Figure 10 shows the scientist's results.

distance (*d*) of lamp from *Cabomba* (cm)	light intensity (arbitrary units)	bubbles produced in 60 seconds
5	0.0400	79
10	0.0100	21
15	0.0044	12
20	0.0025	7
25		5
30	0.0011	4

Figure 10

(a) (i) Calculate the light intensity when the lamp is 25 cm from the *Cabomba* plant.

(2)

light intensity = ... arbitrary units

(ii) Use information from Figure 10 to describe the effect of light intensity on the rate of photosynthesis.

(2)

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(iii) Give another method of measuring light intensity rather than calculating it.

(1)

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.....

(iv) The scientist counted the number of bubbles produced by the *Cabomba* plant.

Another scientist stated that this was not the best method of measuring the volume of gas produced.

Explain how you could improve the method to measure the volume of gas released more accurately.

(2)

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(b) Explain what would happen to the levels of gas produced if the light intensity decreased to 0.0001 arbitrary units.

(2)

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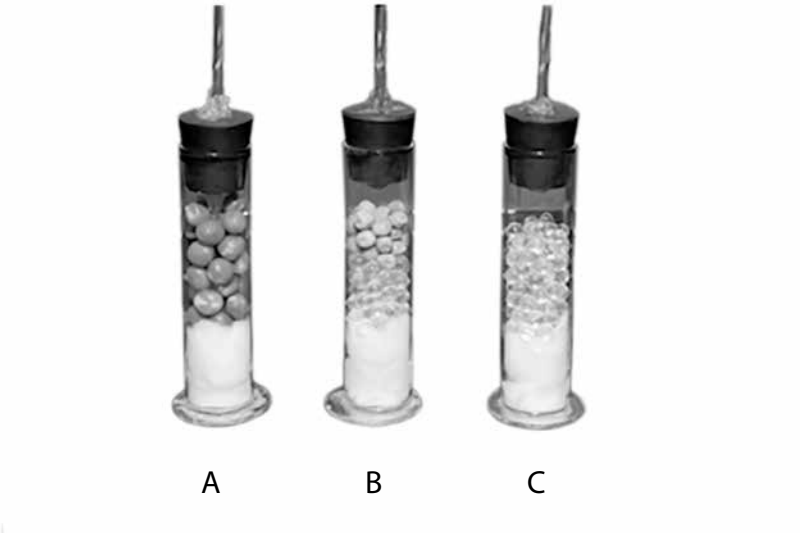
(Total for Question 5 = 9 marks)

6 Figure 11 shows the equipment used for measuring respiration in peas.



(Source: Martin Shields/Science Photo Library)

Figure 11

- Respirometer A contains germinating peas.
- Respirometer B contains peas that are not germinating.
- Respirometer C contains glass beads.

All three respirometers are placed in a water bath at 25 °C for 30 minutes.
The reduction in oxygen levels in each respirometer is measured using a data logger.

(a) Explain why the respirometers are placed in a water bath at 25 °C.

(2)

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(b) A student recorded the change in oxygen levels in the germinating peas over a 30-minute period.

The results are shown below.

A 10 mins (–0.8) ml, 20 mins (–1.6) ml, 30 mins (–2.4) ml

B 10 mins (–0.1) ml, 20 mins (–0.1) ml, 30 mins (–0.1) ml

C No change

(i) Complete the table for these results.

(2)

(ii) Calculate the rate of oxygen consumption per second for the results in respirometer A.

(2)

..... ml/second

(iii) Explain why respirometer A has the highest rate of oxygen consumption.

(2)

.....

.....

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.....

(c) Some respirometers read the movement of a bubble along capillary tubing.

Carbon dioxide can affect the measuring of oxygen used in this type of respirometer.

State a chemical that could be placed in the respirometer that would stop carbon dioxide affecting the experiment.

(1)

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(Total for Question 6 = 9 marks)

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7 A diabetic athlete is advised to estimate the number of grams of carbohydrate in his meals in order to calculate the number of units of insulin he will need to inject to lower his blood glucose concentration.

Each unit of insulin he injects reduces his blood glucose concentration by 1.5 mmol dm^{-3}.

He needs to inject 1 unit for every 10 grams of carbohydrate he consumes.

Figure 12 shows the estimated carbohydrates in the breakfast eaten by the athlete.

food consumed	estimated carbohydrate /grams
orange juice	25
2 slices brown toast	68
350 grams baked beans	38
tea with sugar	25

Figure 12

(a) (i) Calculate how many units of insulin the athlete would need to inject to control the rise in blood glucose levels.

Give your answer to two significant figures.

(2)

..... units of insulin

(ii) The athlete miscalculated his carbohydrate intake to be greater than his actual intake.

Explain how the increase in the number of units injected would affect his blood glucose concentrations.

(2)

.....

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.....

.....

(b) (i) A patient visits his doctor because he is putting on weight but does not think he is increasing his calorie intake.

The patient has a height of 1.9 m and a body mass of 120 kg.

What is his BMI?

(1)

- ☒ **A** 0.0083
- ☒ **B** 33.2
- ☒ **C** 0.016
- ☒ **D** 66.4

The doctor diagnosed this person with an underactive thyroid gland.

*(ii) Explain why an underactive thyroid could cause this patient to have an increased body mass.

(6)

(Total for Question 7 = 11 marks)

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8 (a) Figure 13 shows a food chain for organisms in a stream.

algae ⟶ stonefly larvae ⟶ water beetles ⟶ birds

Figure 13

(i) In the food chain there is 2.1×10^4 J of energy in the biomass of stonefly larvae. 90% of the energy is lost between each trophic level of the food chain.

Calculate the energy value that enters the birds.

(2)

..... J

(ii) State the impact of this energy loss on the length of the food chain.

(1)

.....

.....

(b) A group of students investigated the level of pollution in two different streams, A and B.

Figure 14 shows the student's results.

indicator species	total number in	
	stream A	stream B
Mayfly nymph	4	0
Caddis fly larva	29	0
Stonefly larvae	74	1
Water louse	34	4
Bloodworm	10	45
Sludge worm	2	100

Figure 14

Mayfly nymphs, caddis fly lavae and stonefly larvae are indicators of clean water.

(i) Calculate the percentage of organisms in stream A that are clean water indicators.

Give your answer to two significant figures.

(2)

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(ii) Use the results to explain which stream is more polluted.

(2)

The student investigated a third stream, which is very slow flowing and runs through an area where intensive farming methods are used.

Figure 15 shows the thick layer of algae formed on top of this stream.

Figure 15

(c) Explain the effect of this algal growth on the organisms in the stream.

(4)

(Total for Question 8 = 11 marks)

9 The kangaroo rat is a mammal that can survive in desert environments and can tolerate much higher concentrations of sodium ions in their bloodstream than humans.

Figure 16 shows an image of the kangaroo rat.

(Source: Richard R. Hansen/Science Photo Library)

Figure 16

(a) The name of the process that controls water levels in the body is

(1)

☒ **A** diffusion

☒ **B** osmosis

☒ **C** osmoregulation

☒ **D** thermoregulation

(b) (i) Explain how the blood entering the nephron of the kangaroo rat is filtered to remove excess sodium ions and water.

(3)

The kangaroo rat has a longer loop of Henle than most mammals.

(ii) Explain why this adaptation is beneficial to the kangaroo rat.

(2)

The volume of ADH stored in the pituitary gland of the kangaroo rat was measured.

Figure 17 shows the average results for 500 kangaroo rats.

concentration of sodium chloride fed to kangaroo rats (mol dm^{-3})	volume of ADH stored in the pituitary gland (arbitrary units)
0.00	45
0.25	40
0.50	10
0.75	8
1.00	8

Figure 17

*(iii) Explain how ADH helps to control the levels of water and sodium ions in the bloodstream.

(6)

(Total for Question 9 = 12 marks)

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10 Tropical fish excrete ammonia, which is an alkali.

The pH level of water in a tropical fish tank needs to be maintained between 6.6 and 7.4 for the fish to survive.

This is the optimum pH range for the bacteria that are responsible for the conversion of ammonia into nitrites and then nitrates.

Nitrosomonas bacteria convert ammonia into nitrites.

Nitrobacter bacteria convert nitrites into nitrates.

(a) (i) *Nitrosomonas* bacteria are an example of

(1)

- ☒ **A** nitrogen fixing bacteria
- ☒ **B** nitrifying bacteria
- ☒ **C** denitrifying bacteria
- ☒ **D** *Helicobacter* bacteria

(ii) Explain why *Nitrosomonas* and *Nitrobacter* bacteria are needed in tropical fish tanks.

(2)

An aquatic plant in the fish tank had a concentration of nitrates higher than the water in the fish tank.

(iii) Explain how this aquatic plant can uptake nitrates from the water in the fish tank.

(2)

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Leguminous plants have nodules on their roots that have colonies of nitrogen-fixing bacteria.

Clover is a leguminous plant.

(b) Describe how a quadrat could be used to sample the population of clover in a 500 m^2 field.

(3)

The nitrogen-fixing bacteria provide nitrates for the plants and release any excess into the soil.

(c) Explain how leguminous plants such as clover could be used to reduce the amount of artificial fertilisers.

(4)

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS

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Paper 2 Higher

Question number	Answer	Mark
1(a)(i)	B	**(1)**

Question number	Answer	Mark
1(a)(ii)	to pump blood around the body under higher pressure	**(1)**

Question number	Answer	Mark
1(a)(iii)	An answer that combines the following points of understanding to provide a logical description: • blood would flow backwards from the ventricle to the atrium/blood will leak through (1) • less (oxygenated) blood would be pumped to the body (1)	**(2)**

Question number	Answer	Mark
1(b)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the blood vessel has thick walls/small lumen (1) • to carry oxygenated blood/to carry blood under higher pressure (1)	**(2)**

Question number	Answer	Mark
1(c)	• the fish heart has two chambers rather than four chambers (1) • the fish heart only has one ventricle and one atrium rather than two ventricles and two atria (1) • only deoxygenated blood flows through the fish heart (1) • the fish heart shows a single circulatory system rather than a double circulatory system (1)	**(4)**

Question number	Answer	Mark
2(a)(i)	• person 2 had a slightly higher blood glucose level than person 1 after fasting (by up to 0.2 mmols/l) (1)	**(1)**

Question number	Answer	Mark
2(a)(ii)	• person 3 had a much higher blood glucose level than person 1 two hours after taking glucose (up by up to 5.6 mmols/l) (1)	**(1)**

Question number	Answer	Mark
2(a)(iii)	Insulin	**(1)**

Question number	Answer	Mark
2(b)(i)	An answer that combines points of interpretation/evaluation to provide a logical description: • levels remain low up until day 14 then rise (1) • they continue to rise to day 23 and drop at day 24 (1)	**(2)**

Question number	Answer	Mark
2(b)(ii)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • as ovulation occurs (1) • the levels of progesterone released from the corpus luteum increases to maintain the lining of the uterus (1)	**(2)**

Question number	Answer	Mark
2(b) (iii)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark): • progesterone levels fall after day 23 to 17.11 (1) • so uterus wall thickness is not maintained and therefore pregnancy has not occurred (1)	**(2)**

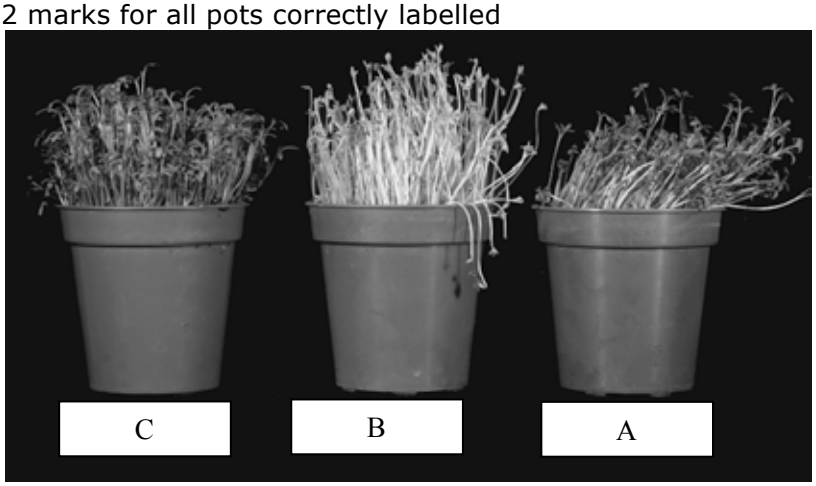
Question number	Answer	Additional guidance	Mark
3(a)(i)	29 ÷ 500 = 0.058 (1) 0.058 × 100 = 5.8 (1)	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Mark
3(a)(ii)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark): • compost B (1) as it has the highest percentage water retained • and there is a higher amount of water loss in the plants due to higher temperatures causing a {larger rate of evaporation of water/higher transpiration rates} (1)	**(2)**

Question number	Answer	Additional Guidance	Mark
3(a)(iii)	Use the same starting mass of compost (1)	accept any other relevant improvement	**(1)**

Question number	Answer	Additional guidance	Mark
3(b)(i)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • by reducing the water content it reduces the number of microorganisms that can reproduce (1) • because there is a reduction of microorganisms this reduces the decay process/preserves the food (1)	accept bacteria/pathogens for microorganisms	**(2)**

Question number	Answer	Mark
3(b)(ii)	to kill unwanted micro-organisms	**(1)**

Question number	Answer	Mark
4(a)(i)	1 mark for 1 or 2 correctly labelled pots 2 marks for all pots correctly labelled  	(2)

Question number	Answer	Mark
4(a)(ii)	D	(1)

Question number	Answer	Mark
4(a)(iii)	Auxin	(1)

Question number	Answer	Mark
4(b)	An answer that combines the following points to provide a logical description of the method: • remove the tip from one of the plant shoots and leave the other (1) • measure the changes in growth and direction of movement (1)	(2)

Question number	Answer	Mark
4(c)(i)	An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark): • it surrounds the pine leaf (1) • so prevents water loss from the pine leaf/prevents dehydration (1)	(2)

Question number	Answer	Mark
4(c)(ii)	D	(1)

Question number	Answer	Additional guidance	Mark
5(a)(i)	25 × 25 = 625 (1) 1 ÷ 625 = 0.0016 (1)	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Mark
5(a)(ii)	An answer that combines points of interpretation/evaluation to provide a logical description: • as light intensity decreases the rate of photosynthesis also decreases (1) • after 20 cm away when light intensity appears to have little effect on the rate of photosynthesis (1)	**(2)**

Question number	Answer	Mark
5(a)(iii)	use a light meter/lux meter	**(1)**

Question number	Answer	Additional guidance	Mark
5(a)(iv)	An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark): • collect the gas/oxygen produced in a graduated gas syringe (1) • to reduce the errors generated when counting bubbles which maybe of different sizes (1)	accept alternative gas collection method with measuring cylinder and beehive shelf accept leave the apparatus for a longer amount of time	**(2)**

Question number	Answer	Mark
5(b)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark): • the volume of gas produced would decrease to below four bubbles (1) • because light is needed for photosynthesis (1)	**(2)**

Question number	Answer	Mark
6(a)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • same temperature to act as control (1) • to provide the optimum temperature for enzyme action in the peas (1)	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	• headed table with units (1) • accurately completed table (1)	negative values do not need to be shown if table heading states oxygen used/lost accept time in row 1 as an alternative	**(2)**

	A	B	C
O_2 used /ml at 10 mins	0.8	0.1	0.0
O_2 used /ml at 20 mins	1.6	0.1	0.0
O_2 used /ml at 30 mins	2.4	0.1	0.0

Question number	Answer	Additional guidance	Mark
6(b)(ii)	2.4 ÷ (30 × 60) (1) = 0.0013 (ml/second) (1)	accept 1.6 ÷ (20 × 60) accept 0.8 ÷ (10 × 60) award full marks for correct numerical answer without working maximum one mark if no unit conversion	**(2)**

Question number	Answer	Mark
6(b)(iii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the peas in respirometer A are germinating so using up oxygen (1) • during the process of respiration to release energy for growth (1)	**(2)**

Question number	Answer	Additional guidance	Mark
6(c)	Any one improvement from: soda lime (1) • cotton wool soaked with potassium hydroxide (1)	accept other relevant chemical that would remove carbon dioxide	**(1)**

Question number	Answer	Additional guidance	Mark
7(a)(i)	• 156 ÷ 10 (1) • 16 units (1) Answer to two significant figures	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Mark
7(a)(ii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • an increase in the units of insulin injected would cause more blood glucose to be converted to glycogen and stored in the liver/muscles (1) • leading to blood glucose levels becoming critically low/person would become hypoglycemic (1)	**(2)**

Question number	Answer	Mark
7(b)(i)	B	**(1)**

Question Number	Indicative content	Mark
***7(b)(ii)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • the thyroid gland produces thyroxine • thyroxine helps to regulate metabolic rate • low levels of thyroxine should stimulate the production of TRH • TSH being produced and more thyroxine being released • an underactive thyroid would cause less thyroxine to be produced • metabolic rate to drops • less energy (calories) are available for tasks • more fat storage so the person gains body mass	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Question number	Answer	Additional guidance	Mark
8(a)(i)	• $2.1 \times 10^4 = 21\,000 \times 0.1 =$ 2 100 in the water beetle (1) • 210 J in the bird (1)	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Mark
8(a)(ii)	it limits the length of the food chain	**(1)**

Question number	Answer	Additional guidance	Mark
8(b)(i)	• 107 ÷ 153 (1) • 0.699 3464 × 100 = 70% (1) Answer to 2 significant figures	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark): • stream B is more polluted that stream A (1) Plus one from: • (because) stream A contains stonefly larvae/mayfly larvae/caddis fly larvae (which are indicators of clean water) (1) • (because) stream B contains larger numbers of blood worm and sludge worm (which are indicators of polluted water) (1)	accept other correct indicators from the table. accept higher oxygen levels in place of clean water accept lower oxygen levels in place of polluted water	**(2)**

Question number	Answer	Mark
8(c)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks): • plants growing on the bottom of the stream will be unable to receive sunlight due to the thick layer of algae (1) • these plants will not be able to photosynthesise and will die and start to decompose (1) • the microorganisms decomposing the plants will respire, removing oxygen from the water (1) • the stream will become anoxic/oxygen depleted and other respiring organisms (plants and animals) will not be able to survive so biodiversity will be reduced (1)	**(4)**

Question number	Answer	Mark
9(a)	C	(1)

Question number	Answer	Mark
9(b)(i)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks): • ultrafiltration occurs in the glomerulus where the liquid part of the blood passes into the Bowman's capsule (1) • reabsorption takes place as it travels through the proximal convoluted tubule into the loop of Henle (1) • finally urine production occurs in the collecting duct and excess fluid and sodium ions are removed (1)	(3)

Question number	Answer	Mark
9(b)(ii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the kangaroo rat lives in the desert so it needs to retain as much water as possible (1) • as most water is reabsorbed in the loop of Henle, a longer loop gives more surface area for water reabsorption (1)	(2)

Question Number	Indicative content	Mark
*9(b)(iii)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2 (6 marks)** water content • increased ADH causes more water to be reabsorbed into the bloodstream • prevents dehydration • decreased concentrations of ADH cause less water reabsorption • greater volume of urine produced • at 0.0 mol/dm^{-3} of sodium ions the volume of ADH stored is at its highest • so the lowest amount of ADH is released • water levels in the body are regulated sodium ions • as sodium ion concentration increases the levels of ADH stored decrease • at 0.25 mol/dm^{-3} ADH stored reduced by 5 au • so a small amount of water is reabsorbed • at 0.50 mol/dm^{-3} ADH stored reduced by a further 30 au • a greater amount of water is reabsorbed • the volume of ADH stored remains stable at 8 au • causing the maximum amount of water to be reabsorbed • preventing dehydration when sodium levels are high	**(6)**

Level	Mark	Descriptor
	0	No awardable content
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the

		context of the question. • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Question number	Answer	Mark
10(a)(i)	B	**(1)**

Question number	Answer		Mark
10(a)(ii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the bacteria convert the ammonia into nitrites then nitrates maintaining the pH (1) • (this prevents an increase in pH) which would cause enzymes to denature and kill the fish (1)		**(2)**

Question number	Answer	Mark
10(a)(iii)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the aquatic plant will take up nitrates by active transport (1) • against the concentration gradient/from where there is a low concentration to where there is a high concentration of nitrates (1)	**(2)**

Question number	Answer	Additional guidance	Marks
10(b)	An answer that combines the following points of application of knowledge and understanding to provide a logical description: • a description of the use of a quadrat either by random sampling or using a belt transect (1) • a sample size 10–100 and count the number of clover plants in each quadrat (1) • multiplication factor dependent on the number of quadrats sampled (1)	to gain maximum marks steps must be in a logical sequence	**(3)**

Question number	Answer	Mark
10(c)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks): • clover/leguminous plants could be used in crop rotation (1) • where at intervals (2–3 years) a field is planted with clover/leguminous plants and left fallow (1) • the clover/leguminous plants will have colonies of nitrogen fixing bacteria which will produce nitrates (1) • the nitrates will increase the fertility of the soil and negate the need for artificial fertilisers (1)	**(4)**