Question Number	Answer	Additional guidance	Mark
1(a)(i)	B		**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	D		**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)	An explanation that makes reference to the following: • enzymes lower the activation energy of reactions in the clotting pathway therefore speeding it up (1) • enzymes are not destroyed by the reaction they catalyse therefore speeding it up (1)		**(2)**

(Total for Question 1 = 4 marks)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	correctly extracts values from graph 3.9 and 8.6 mm^3 (1) (8.6 – 3.9) ÷ 12 = 0.39 (1) $mm^3\ min^{-1}$ (1)	Correct answer gains full marks, with no working shown.	**(3)**

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to the following: • at a higher temperature water molecules have more kinetic energy (1) • therefore more water molecules evaporate (1) • therefore there is greater diffusion rate through stomata (1)		**(3)**

(Total for Question 2 = 6 marks)

Question Number	Answer	Additional guidance	Mark
3(a)(i)	A		**(1)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	D		**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)	An answer that makes reference to the following: • needs to {take more measurements in the range of 350 to 750 ppm / extend the range below 350 and above 750} to ensure the pattern is linear / to find out if other concentrations of carbon dioxide have a greater or lesser effect (1) • needs to use {more than one plant / measure more than one leaf} to improve reliability (1) • needs to ensure that {light intensity / water supply / temperature} are controlled to ensure validity (1) • needs to use leaves from the same height / measure number of stomata at the same place on the leaf because stomatal density may vary (1) • needs to use leaves from genetically identical / cloned plants because genes may affect stomatal density (1)		**(5)**

Question Number	Answer	Additional guidance	Mark
3(c)	An explanation that makes reference to the following: • plants will have different densities of stomata as a result of natural variation (1) • if concentration of carbon dioxide increases, plants will need fewer stomata (1) • plants with lower stomatal densities will have a selective advantage (1)	Accept converse argument for marking points 2 and 3	**(3)**

(Total for Question 3 = 10 marks)

Question Number	Answer	Additional guidance	Mark
4(a)	• spray soil with water as a control (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	An description that makes reference to the following: • absorbed by diffusion because insecticide concentration is higher in soil than in root hair (1) • may be transported through the {apoplast / cells walls} (1) • may be transported through the symplast when reaching the endodermis because of the Casparian strip (1) • transported in xylem by transpirational pull (1)		**(4)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	• more absorbed by root hair cells than by lenticels because surface area for absorption is greater (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
4(c)	• does not kill soil organisms / less disruptive to woodland food chains (1)		**(1)**

(Total for Question 4 = 7 marks)

Question Number	Answer	Additional guidance	Mark
5(a)(i)	A description that makes reference to the following: • hydrostatic pressure generated by the heart (1) • water and low molecular mass solutes forced out of capillaries (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	D		**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	An answer that makes reference to the following: • wider lumen and thin wall that has less {muscle / elastic} tissue (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation that makes reference to the following: • the concentration of plasma proteins in blood capillaries rises from 5 to 30 weeks (1) • therefore there is a higher solute potential in the blood than in tissue fluid (1) • therefore blood volume (progressively) increases because solute potential is greater than hydrostatic pressure (1) • after 30 weeks the concentration of plasma proteins levels off, so the blood volume remains constant and raised (1)		**(4)**

(Total marks for question 5 = 8 marks)

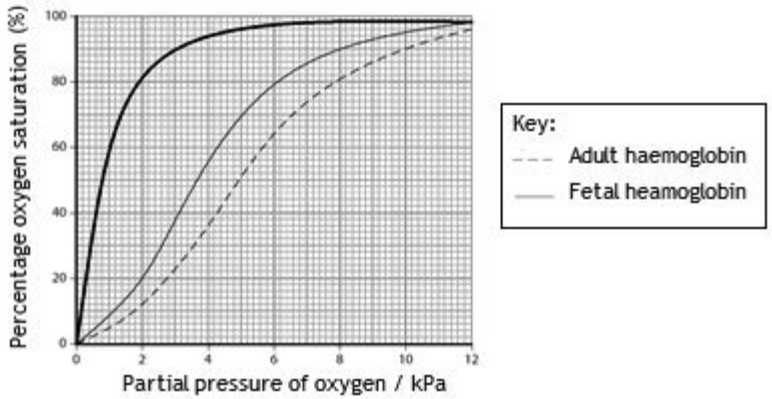
Question Number	Answer	Additional guidance	Mark
6(a)	An explanation that makes reference to the following: • to move molecules quickly between gas exchange surfaces and cells (1) • in organisms that have small surface area to volume ratio where diffusion would be inadequate (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
6(b)(i)	C		**(1)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	C		**(1)**

Question Number	Answer	Additional guidance	Mark
6(c)(i)	correctly extracts values from graph 55 and 35 (1) [(55-35) ÷ 35] x 100 = 57 % (1)	Correct answer gains full marks, with no working shown.	**(2)**

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that makes reference to the following: • fetal haemoglobin has a higher affinity for oxygen (1) • therefore at lower oxygen partial pressures oxygen will transfer from adult to fetal haemoglobin more readily (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
6(c)(iii)	 • non-sigmoid line drawn to left of fetal haemoglobin (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
6(c)(iv)	An explanation that makes reference to the following: • myoglobin stores oxygen (1) • greater concentration in whale means more oxygen can be stored so can remain underwater for longer (1) • because cells having to respire anaerobically (1)		**(3)**

(Total for Question 6 = 12 marks)

Question Number	Answer	Additional guidance	Mark
7(a)	An explanation that makes a reference to the following: • greater species diversity in rain forest than in the desert (1) • because abiotic factors { more food / water / eq} are more favourable in rainforests than in a desert (1) • this leads to greater survival of number and diversity of species in rainforests compared to desert(1)		**(3)**

Question Number	Answer	Additional guidance	Mark
7(b)	An explanation that makes reference to the following: • mutations occur in fish populations that enable individuals to survive in different niches (1) • isolation prevents sharing of {mutations / genetic material} leading to sympatric speciation (1) • likely to be more potential niches in bigger lakes (1)		**(3)**

Question Number	Answer	Additional guidance	Mark
7(c)(i)	N(N-1) = 17030 (1) ∑n(n-1) = 4120 (1) D = 4.13 (1)	Correct answer gains full marks, with no working shown.	**(3)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	A comparison and contrast that must include one similarity and one difference from four of the following: • both areas have the same number of lizard species (1) • both areas have a similar total number of lizards (1) • the number of lizards is more evenly spread across the different species in area A (1) • area A has a larger index of diversity than area B (1) • area A is the more biodiverse (for lizards) (1)		**(4)**

(Total for Question 7 = 13 marks)

Question Number	Answer	Additional guidance	Mark
8(a)	• lowers water potential (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
8(b)	An explanation that makes reference to the following: • water had moved from the solution into the potato by osmosis (1) • increasing the sucrose concentration of the solution (1) • making the solution more dense (1)		**(3)**

Question Number	Answer	Additional guidance	Mark
8(c)	An explanation that makes reference to the following: • no readings between 0.4 and 0.5 mol dm^{-3} (1) • other physical variable not controlled and its effect on osmosis (e.g. temperature, surface area) (1) • other tissue variable not controlled and its effect on water potential (e.g. age, source, pre-treatment of potato) (1)		**(3)**

(Total for Question 8 = 7 marks)

Question Number	Answer	Additional guidance	Mark
9(a)(i)	B		**(1)**

Question Number	Indicative content	
***9(a)(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 which is indicated as relevant. Additional content included in the response must be scientific and relevant. • reference to membrane being a phospholipid bilayer with channel and carrier proteins • damage to phospholipids affects transport of {oxygen / carbon dioxide / non-polar molecules} • damage to phospholipids affects the processes of endocytosis and exocytosis • damage to channel and carrier proteins alters their shape and affects facilitated diffusion • damage to channel proteins affects transport of {charged ions / large molecules / polar molecules} • damage to carrier proteins affects active transport • damage to cell membrane allows lysosomes to escape and release digestive enzymes onto other cells	
Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.

Level	Mark	Descriptor
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

Question Number	Answer	Additional guidance	Mark
9(b)	change = 94.0 – 65.0 ÷ 29 (1) % change = [(94.0 – 65) ÷ 94.0] x 100 = 31% (1)	Correct answer gains full marks, with no working shown.	**(2)**

Question Number	Answer	Additional guidance	Mark
9(c)	An explanation that makes reference to four of the following: • in sample A, after 12 hours diffusion out faster than uptake (1) • in sample B, the glucose is used to produce ATP, therefore rate of uptake is faster (1) • the rate in sample B slows after 8 hours due to lowering of concentration of potassium ions outside the cell (1) • increase in uptake in both samples must be due to active transport (1) • in sample A there must be some ATP available to supply the energy (1)		**(4)**

(Total for Question 9 = 13 marks)