PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 4: EXCHANGE AND TRANSPORT

TRANSPORT IN PLANTS

SCORE	PERCENTAGE
/64	%

STEMUP

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Mark Scheme

Q1.

Question Number	Correct Answer	Additional guidance	Mark
	An answer that makes reference to three of the following: • wide/large cross-sectional area to transport large volume of water (1) • empty cells/no cytoplasm so low resistance to flow (1) • thickening of the wall / lignification that strengthens the wall to prevent collapse (1) • annular/spiral thickening to allow xylem tissue to stretch during growth (1)		**(3)**

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	A calculation that shows the following stages • use manipulation of units to mm (1) • calculation of volume of cylinder (1) • rate per minute calculated to 2sf (1)	Example of calculation: eg mean is 64 (mm) 4.522 / 4.524 (this gets mp1 and 2 if 64 not seen) 45.2 is correct value if 6.4 is used 0.90 Correct answer with no working gains 3 marks 0.9 gets 2 marks (not 2sf) 0.09 gets 2 marks (if 6.4 is used for distance) 18 gets 2 marks (if diameter is used) 4.5 gets 2 marks (2sf if they do not divide by 5)	**Exp (3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that includes three of the following • {water uptake / transpiration} is fastest in moving air in the light (1) • {water uptake / transpiration} {is very slow / stops / decreases} in the dark as stomata close (1) • {water uptake / transpiration} is faster in moving air (than still air) as the diffusion gradient is {maintained / steeper} (1) • comment on decline in rate (of transpiration / water uptake) as trials continue in darkness with explanation (1) • effect of light is greater than effect of moving air (1)	Accept {water uptake / transpiration} is slowest in still air in the dark Not converse Accept concentration gradient / water potential gradient / diffusion shells around stomata or leaf Accept converse Accept stomata do not close completely until trial 3	**Exp (3)**

Question Number	Answer	Additional Guidance	Mark
(iv)	A description that includes four of the following: • cover one surface of leaves with vaseline / petroleum jelly / clear tape (to prevent transpiration) • measure {rate / distance moved in 5 mins / volume of water taken up in 5 mins} (1) • ensure that covering is fully removed or use another shoot with same surface area (1) • repeat for other surface of leaves (and compare results) (1) • **method of control of** one named variable / monitoring named variable which cannot be controlled (1) • repeats for each set up and calculate standarc deviation (1)	Accept clear nail varnish / clingfilm Accept other times Accept time how long it takes to move a set distance Accept same number of leaves / similar surface area Accept calculate rate of water loss per unit area Piece together Accept eg. temperature – AC room / room temperature humidity - clear bag over plant light intensity – distance from lamp air movement - distance from fan Accept repeat and carry out appropriate stats test eg t-test, 95% confidence limits, Mann Whitney U test	**Exp (4)**

Q3.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to five of the following: • because there would be less water to take up from the soil (1) • therefore there will be fewer {mineral ions / minerals} (transported to the rest of the plant / taken up) (1) • example of a mineral ion deficiency on the plant explained (1) • there will be less water for {photolysis / light-dependent reaction / photosynthesis} (1) • therefore there will be less GALP produced in the {light-independent reaction / Calvin cycle} (1) • therefore less {NPP / plant biomass} (1)	**ACCEPT** plants will {wilt / die} without water **ACCEPT** less glucose produced	(5)

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to the following: • as the pressure gradient increases there is (a linear) increase in the velocity (for all three radii) (1) • as the radius of the xylem increases the velocity increases (1)	**ACCEPT converse for both points** **ACCEPT** higher the pressure gradient the higher the velocity **ACCEPT** greater the radius the higher the velocity	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	• velocities read from graph (1) • correct percentage calculated (1)	156 / 157 and 61 / 62 (156 - 61) x 100 ÷ 61 = 155.73 / 155.7 / 156 % (156 - 62) × 100 ÷ 62 = 151.61 / 151.6 / 152 % (157 - 61) x 100 ÷ 61 = 157.38 / 157.4 / 157 % (157 - 62) × 100 ÷ 62 = 153.23 / 153.2 / 153 % CE applies if 155 / 158 and / or 63 given as values from graph (155 – 61) ×100 ÷ 61 = 154.1 / 154 % (155 – 62) ×100 ÷ 62 = 150 % (155 – 63) ×100 ÷ 63 = 146.03 / 146 % (156 - 63) x 100 ÷ 63 = 147.62 / 147.6 / 148 % (157 - 63) x 100 ÷ 63 = 149.21 / 149.2 / 149 % (158 – 61) ×100 ÷ 61 = 159.02 / 159 % (158 – 62) ×100 ÷ 62 = 154.84 / 154.8 / 155 % (158 – 63) ×100 ÷ 63 = 150.79 / 150.8 / 151 %	**(2)**

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	**The only correct answer is B** **A** is incorrect because respiration takes place in the root **C** is incorrect because photosynthesis does not take place in the root **D** is incorrect because respiration takes place in the root		(1) COMP

Question Number	Answer	Additional Guidance	Mark
(ii)	**The only correct answer is A** **B** is incorrect because pits are in the xylem **C** is incorrect because plasmodesmata are between cells **D** is incorrect because stomata are in the leaves		(1) COMP

Q6.

Question Number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of 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. • mistletoe lowers the NPP of apple trees over time (D) • NPP of trees without mistletoe shows an upward trend over 20 years (D) • NPP of trees with mistletoe shows an downward trend over 20 years (D) • mistletoe decreases the transpiration rate of the trees (D) • mistletoe has a higher transpiration rate than the apple tree (D) • higher transpiration rate of mistletoe diverts transpiration stream to mistletoe rather than apple tree / mistletoe takes the water from apple tree (E) • so less minerals are given to the apple tree (E) • less water for photosynthesis (E) • nitrogen content of apple trees is lower (D) • less amino acid / protein synthesis occurs (E) • less enzyme production so less photosynthesis (E) • lowering NPP (due to less enzymes) (E) • less nucleic acid synthesis (E) • less chlorophyll synthesis (E) • calcium content of the apple trees is lower (D) • so there is less production of cell walls / calcium pectate (E) **Level 1: one or two D or E** **Level 2: three or four from both D and E** **Level 3: five or six from both D and E, must explain effect of either low nitrogen / calcium and have no major errors**

Level	Marks	
Level	Marks	
0	0	No awardable content
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

Q7.

Question Number	Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • transpiration rate is greater than absorption rate from 6am to 5pm because stomata are open (1) • between 5pm and midnight, the absorption rate is greater than the transpiration rate because stomata are closed (1) • lag effect because the uptake of water depends on transpiration (1) • the cohesion-tension effect (1)		**(4)**

Q8.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four from the following: • sugars are loaded / pumped / transferred into phloem / sieve tubes in leaf (1) • lowering water potential so that water enters phloem (1) • pressure in phloem increases (moving sugars) (1) • sugars are converted to (insoluble) starch in root cells / low sugar concentration in root cells (1) • increasing the water potential, so water moves out (1)		**4**

Q9.

Question Number	Correct Answer	Additional guidance	Mark
	D		**(1)**

Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to one of the following: • stems are {stronger / less likely to break / better supported} (1) • more {mineral ion / water} transport (1)		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to three of the following: • cut thin sections (of the stem) (1) • from same height of stem in young and old plants (1) • {use a stain / named stain} to see xylem (1) • measure thickness of xylem tissue (1)	Accept cut a core (if rings are being measured) Measure thickness of {rings / xylem} 1 mark if potometer used in method	(3)

Q11.

Question Number	Indicative content
*	Answers will be credited according to candidates' 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. Indicative content: • male gamete fertilise female gamete to produce embryo • one male gamete fuses with {both polar nuclei / (diploid) endosperm nucleus} to form a triploid endosperm nucleus • endosperm is a store of {starch / protein / oils} • ovules will become the seeds inside the berries • xylem transports the water needed for berry formation shown in graph 1 • xylem transports the water needed for hydrolysis of food stores • xylem transports mineral ions for berry formation • phloem transports the sucrose needed for berry formation and ripening in graph 2 • more sucrose is transported from the leaves when berries are present in graph 2 • ^{14}C incorporated into glucose during photosynthesis • glucose converted into sucrose for transport in the phloem

Level 0	Marks	No awardable content
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context. **2 or 3 comments made which may include description of graphs and / or explanations**
Level 2	**3-4**	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure. **4 of 5 comments that include explanations with reference to at least two components**
Level 3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. **6 or 7 comments that include explanations with reference to all three components**

Q12.

Question Number	Answer	Mark
(i)	**The only correct answer is D** ***A*** *is not correct because xylem carries water and mineral ions and the sucrose is in solution in the phloem* ***B*** *is not correct because xylem carries water and mineral ions* ***C*** *is not correct because the sucrose is in solution in the phloem*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to **three** of the following: • xylem cell walls contain {cellulose and lignin / lignin} but phloem cell walls contain {only cellulose / no lignin} (1) • xylem is {hollow / no end walls} but phloem has {cell contents / sieve plates} (1) • xylem has pits but phloem does not (1) • xylem {does not have companion cells / is dead} but phloem has companion cells (1)	**Do not piece together unless points are clearly paired in adjacent sentences** **ACCEPT** xylem has thick cell walls but phloem has thinner cell walls {xylem is / xylem cells are} lignified **ACCEPT** {modified / enlarged} plasmodesmata	**(3)**

Q13.

Question Number	Answer	Additional Guidance	Mark
	An answer including at least one similarity • both tissues contain tubes (1) • both have cell walls containing cellulose (1) **and** at least one difference • xylem vessels contain lignin, but phloem does not (1) • in xylem, end walls of cells break down completely (to leave hollow tubes), but in phloem there are sieve plates (1) • phloem (sieve tubes) have companion cells, but xylem does not (1) • phloem (sieve tubes) contains cytoplasm, but xylem does not (1)	Accept both have vessels which are cylindrical Accept xylem has thicker walls / xylem vessels have pits in side walls and phloem does not Accept phloem has sieve plates, but xylem does not Accept phloem contains plasmodesmata but xylem does not / phloem contains organelles but xylem does not	**Exp (3)**

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • multiply cross-sectional area by distance moved by bubble / $\pi r^2 \times d$ / $\pi r^2 \times h$ (1) • divide by total area of leaves (1) • divide by 5 (1)		**(3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: • moving air moves {water molecules / droplets} away (from leaf) (1) • therefore increases concentration gradient / diffusion gradient / water potential gradient (1) • difference is significant because SDs do not overlap (1)	**ACCEPT** converse **ACCEPT** wind	**(2)**

Q15.

Question Number	Answer	Additional Guidance	Mark
(i)	**The only correct answer is C** **A** is incorrect because 31 460 would be rounded up to 3.15×10^4 **B** is incorrect because 314 600 would be rounded up to 3.15×10^5 **D** is incorrect because 3 139 000 would be rounded up to 3.14×10^6		(1)
(ii)	**The only correct answer is C** **A** is incorrect because symplast pathway does not go through cell walls **B** is incorrect because it shows the pathways the wrong way round **D** is incorrect because it shows apoplastic going through the cytoplasm		(1)
(iii)	**The only correct answer is B** *A is incorrect because water moves from a dilute solution to a moreconcentrated one* ***B** is incorrect because water moves from a high water potential to alower one* ***D** is incorrect because water moves from a high water potential to alower one*		(1)