Mark scheme

Transport in plants

Biology 0610 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

89

MARKS FOR EACH QUESTION

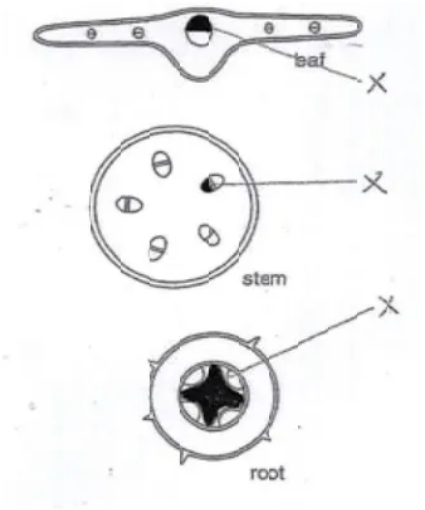
1	2	3	4	5	6	7	8	9	10	Total
6	6	10	11	12	6	6	8	10	14	**89**

Question 1 [6]

1	(a) (i)	ring of xylem / phloem (bundles); inner most part labelled as xylem / outermost part labelled phloem;	 [2]	A – if only half bundles (xylem) are drawn in a ring
	(ii)	sucrose / amino acids;	[1]	
	(b)	water enters root hair (cell); by osmosis / diffusion; moves across root cortex (by osmosis); enters xylem; moves to leaf mesophyll (cells); by transpirational pull / force;	 max [3]	 Any three – 1 mark each
			[Total: 6]	

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Question 2 [6]

2 (a)	movement of sugars / named sugar / amino acids ; in phloem ; from region of production / leaves / source ; to region of utilisation / storage / growth ; energy required / AW ;	max [3]	**A** water and sugars / water and amino acids **R** starch
2 (b)	*correctly labelled:* *xylem in leaf* ; *xylem in stem* ; *xylem in root* ;  	[3] **[Total: 6]**	

Question 3 [10]

3(a)(i)	2.5 g;	1	
3(a)(ii)	28.1%;;	2	$\frac{1.8 \times 100}{6.4}$ or 0.281×100
3(b)	hot and dry;	1	
3(c)(i)	large surface area / elongated cells;	1	
3(c)(ii)	**O** at start; **P** before **N**; **M** at the end;	3	
3(d)(i)	xylem;	1	
3(d)(ii)	mineral ions;	1	
		Total: 10	

Question 4 [11]

4(a)(i)	arrow drawn going **into** the root **;** arrow drawn coming **out** from (either surface) of the leaf **;**	2	**R** if no arrowheads shown
4(a)(ii)	xylem **;**	1	
4(b)(i)	evaporation **;** (spongy) mesophyll **;** stoma(ta) **;**	3	
4(b)(ii)	*any two from:* *idea of* rate of transpiration increasing in both, (then levels out with increasing temperature) **;** (rate of) transpiration is greater in the lower surface (than in the upper surface) AW **;** AVP **;**	2	e.g., there are more stomata on the lower surface
4(c)	(as the humidity increases, the rate of transpiration) decreases **;**	1	
4(d)	**X** - condensation **;** **Y** - precipitation **;**	2	

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Question 5 [12]

5	**(a)**	evaporation of water ; from (surface of) mesophyll cells ; (followed by) loss of water vapour ; diffusion of water ; through stomata ; of (plant) leaves ;	max [3]	
	(b)	**G** ; *any two from:* has largest surface area; (so it has the) greatest number of stomata; more water vapour will escape;	max [3]	**A J** with *two* of the following reasons mesophyll cells directly exposed to air ; water vapour escapes without passing through stomata ; so more water vapour will escape ;
	(c) (i)	plant lost mass ; (plant lost more mass) during 12 hours in light than during 12 hours in dark / in dark and light for same amount of time ; data (to support) ;	max [2]	
	(ii)	(bag) impermeable to water ; prevents loss of water from soil ; water only lost from leaves ; so mass lost is only due to transpiration ;	max [2]	
	(iii)	temperature ; humidity ; wind speed ;	[2]	
			[Total 12]	

Question 6 [6]

6(a)(i)	label line and **X** pointing to any part of the 'star' in the centre of the root section **;**	**1**	
6(a)(ii)	composed of (group of) cells with similar structures **;** working together to perform shared functions **;**	**2**	
6(b)	xylem supplies water **;** air spaces **;** large (internal) surface area **;** water evaporates from surface of mesophyll cells **;** guard cells, open / close, stomata **;** water vapour, diffuses / moves, out through stomata **;**	**3**	

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Question 7 [6]

7	*independent variable:* **1** at least two different temperatures **;** *dependent variable:* **2** time for dye to reach the leaves or a set distance **or** distance moved by dye in a set time **or** number of cut sections containing dye **;** **3 and 4** *detail of method – max two from* **;;** • method of maintaining (at least one) air temperature • *idea of* slicing the end off the celery before immersion • cutting sections (with a, knife / scalpel) **5, 6 and 7** *variables kept constant - max three from* **;;;** • wind-speed • humidity • light intensity • length / height / size, of, celery / stalk • number of leaves / surface area of leaves • species / type / age, of, celery • (named) colour / concentration / volume, of dye • time (in dye) / time stated • thickness of cut sections / sections cut in the same plane / AW **8** two or more replicates at each temperature / repeat the investigation at least two more times **;** **9** suitable safety precaution **;**	**6**	e.g. cutting sections on a flat or stable surface / cut away from body / gloves / goggles

Question 8 [8]

8(a)	*any three from:* rate of transpiration increases and then remains constant with increasing temperature **;** ora (the rate of transpiration) is higher from the lower surface **;** rates of both become constant at (nearly) the same temperature **;** transpiration from lower surface increases, at a greater rate / faster, than from the upper surface (in X) **;**	**3**	
8(b)	*total of four from:* ***X*** *to max 3:* *as temperature increases and rate increases* 1 the rate of <u>evaporation</u> from the mesophyll (cells) increases **;** 2 the rate of <u>diffusion</u> of water vapour (through the stomata / from the leaf) increases **;** 3 particles / molecules, have more kinetic energy / move faster **;** 4 temperature is the limiting factor (for transpiration) **;** 5 more stomata opening / stomata open wider **;** ***Y*** *to max 3:* *as temperature increases and rate remains constant* 6 rate of diffusion of water vapour through stomata at a maximum **;** 7 evaporation from mesophyll (cells) at a maximum **;** 8 rate of movement of water in xylem slows **;** 9 rate of uptake of water is at a maximum **;** 10 the stomata are, all / fully, open **;** 11 humidity / light intensity / number of stomata, is the limiting factor **;**	**4**	
8(c)	more stomata on the lower surface **/** lower surface has a thinner cuticle **;** ora	**1**	

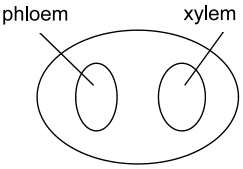
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Question 9 [10]

9(a)(i)	thick / strong, (cell) wall ; withstanding, tension / collapse / hydrostatic pressure / AW ; lignin (in walls) / walls are impermeable ; prevents collapse / waterproofing ; wide / AW ; transport large volumes of water ; no (cell) contents / empty / dead cells / like pipes / like tubes ; no / little resistance to flow of water / allows water to flow easily / lots of water / continuous columns of water / no obstruction ; no, cross walls / end walls ; no / little, resistance to flow of water / allows water to flow easily / lots of water / continuous columns of water / no obstruction ; (bordered) pits ; lateral transport / AW ;	**2**	
9(a)(ii)	evaporation from (cell walls) in mesophyll ; diffusion of water vapour through stomata ; reduction of, pressure / water potential, at top (of plant) resulting in water moving upwards ; continuous column of water (in the xylem) ; cohesion of water (molecules) ; **A** if described incorrectly cohesion described as, forces / attraction, between water molecules ; transpiration pull ; water enters *or* leaves xylem, by osmosis / down water potential gradient ; AVP ;	**4**	
9(a)(iii)	support / described ;	**1**	
9(b)	increase / decrease (in rate of transpiration) ; more / less, evaporation ; increase / decrease, rate of diffusion (of water vapour) ; *ref. to* (kinetic) energy of (molecules of) water ; stomatal pores become, wider / narrower ; guard cells become, turgid / flaccid ;	**3**	**A** stomata close

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Question 10 [14]

10	(a)		[2]	1 mark for drawing and 1 mark for labelling *drawing must represent correct position of xylem and phloem as shown in Fig. 4.1* *if cells are drawn, these must be in the correct positions for xylem and phloem as in the photograph*
	(b)	sucrose ;	[1]	**ignore** sugar / non-reducing sugar **A** phonetic spellings
	(c)	**1** during growing season / when photosynthesising / when food is made ; **2** (substances are) transported (down), to the roots *or* to (named) **3** transported (up) to the, growing points / flowers / fruits / seeds / new leaves / AW ; **4** (time of year) when no photosynthesis / when food is not made ; **5** (substances are transported upwards) from, roots / storage organ / seed ; **6** (substances transported) from source to sink ;	[max 4]	**A** when there is plenty of light **A** move for are transported **MP3 A** transported up for either time of year once only *source may be a storage organ or a leaf depending on the time of year*
	(d)	**1** evaporation of water, from (surfaces of) mesophyll ; **2** movement / diffusion / loss of, water vapour ; **3** from, leaves ; **A** (named) aerial / upper, parts ; **4** through / from, stomata / cuticle ;	[max 3]	
	(e)	**1** evaporation / transpiration, causes movement of water ; **2** in xylem ; **3** reduces pressure at the top of the plant / ref to a water potential **4** transpiration pull ; **5** maintained by cohesion between water molecules ; **6** maintains a continuous column of water / AW ; **7** adhesion of water / AW, to walls of xylem ;	[max 4]	**ignore** capillarity (except if discussing events at interface between water and air in mesophyll in leaf)

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