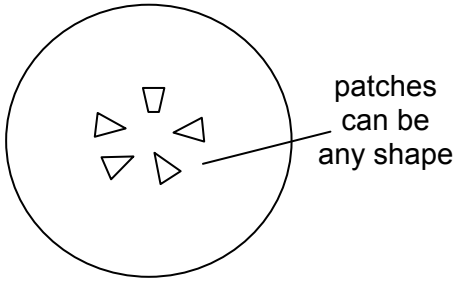
Question			Expected Answers	Marks	Additional Guidance
1	(a)		3 – 5 discrete patches in ring (near centre) **;**	**1**	if xylem drawn then phloem must be labelled **DO NOT ACCEPT** vascular bundles around edge **DO NOT ACCEPT** if phloem occupies more than half total width 
1	(b)		**A** / labelled carbon can be observed in the phloem soon after being supplied to the plant **;** **B** / the rate of flow of sugars in the phloem is higher than diffusion **;** **C** / an insect such as an aphid feeds by inserting its proboscis (mouth parts) into the phloem **;**	**max 2**	*mark first two letters only*

Question			Expected Answers	Marks	Additional Guidance
	(c)		*source* site where, sucrose / sugars / assimilates, loaded (into phloem) / AW **;** *sink* site where, sucrose / sugars / assimilates, unloaded / removed (from phloem) / AW **;**	**2**	**DO NOT ACCEPT** glucose / substance throughout **ACCEPT** where, sucrose / sugars / assimilates, produced/created or converted from stored products **DO NOT ACCEPT** terms 'loading' and 'unloading' in wrong context **ACCEPT** where, sucrose / sugars / assimilates, stored or used (in metabolic processes) **DO NOT ACCEPT** 'required' or 'needed' instead of 'used'
1	**(d)**		(sugars) cannot pass the cut / AW **;** decrease water potential **;** water moves into cells **;** (damage triggers) increased cell division **;** to produce cells to store sugars **;** cut causes, gall / infection **;**	**2 max**	**ACCEPT** sugars, stuck above cut / stuck at top of tree / can't move down/build up above cut
				[Total: [7]	

Question			Answer	Marks	Guidance
2	(a)	(i)	0.6 : 1 ; ;	2	Correct answer = 2 marks **Ratio must be correct way round** 1: 0.6 is not correct but can still allow mark for correct working if shown If answer incorrect **ALLOW** 1 mark for working e.g. 600 ÷ 1000 600 : 1000 = 1 mark
		(ii)	as SA:VOL ratio decreases rate of diffusion decreases **OR** as SA:VOL ratio increases rate of diffusion increases ; use of two pairs of figures with correct units (mms^{-1}) for rate to illustrate trend ; ref to rate of diffusion in either of the first two cubes not fitting trend ;	max 2	**ACCEPT** positive correlation **DO NOT CREDIT** as rate of *diffusion* decreases *SA:VOL ratio* decreases use of figs requires ratio quote and rate quote at two points e.g. at SA:VOL of 3:1 rate is 0.02 mms^{-1}, at SA:VOL ratio of 0.2:1 rate is 0.013 (correct units only need to be used once) **DO NOT CREDIT** if unit for SA:Vol given **ACCEPT** correct calculation of rate change e.g. when the SA:VOL ratio was 3:1 the rate of diffusion was 0.020mms^{-1} which is 0.007mms^{-1} faster than the cube with 0.2:1 SA:VOL ratio
		(iii)	(large plants) have a, small / low, SA : VOL ratio ; *idea of* diffusion too slow (to supply requirements) ; *idea of* need transport system (for water / minerals / assimilates) ; *idea of* need (special) surface area for, gaseous exchange / uptake of minerals ;	max 2	**DO NOT CREDIT** smaller unless we know smaller than what **ACCEPT** e.g. larger plants have a smaller SA : Vol ratio must have idea of ***too*** slow **ACCEPT** diffusion takes ***too*** long **DO NOT CREDIT** transport of gases

Question			Answer	Marks	Guidance
	(b)	**(i)**	divided length of side by time taken **;**	**1**	**IGNORE** divide mm by s (units alone too vague)
		(ii)	*idea that* student used whole length of side, rather than half length **;**	**1**	**ACCEPT** needs to divide answer by 2 / distance has to be to centre of cube rather than whole length of side / assumed diffusion occurs (across whole cube) from one side
	(c)		*squamous epithelium* short(er) diffusion, distance / path **;** *large number of alveoli* large(r) surface area **;** *good blood supply* high / large / steep, concentration gradient OR removes oxygen (from lung surface) / brings carbon dioxide (to lung surface)**;** *good ventilation* high / large / steep, concentration gradient OR supplies oxygen (to alveoli) / removes carbon dioxide (from alveoli) **;**	**4**	**ACCEPT** reduced / shorter diffusion distance **ACCEPT** thin diffusion barrier **IGNORE** thin diffusion pathway **ACCEPT** increases surface area **IGNORE** SA : Vol ratio **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **IGNORE** ref to air
			Total	**12**	

Question			Answer	Marks	Guidance
3	(a)	(i)	provides, strength / support **;** to keep, it / the vessel / the tube, open **OR** prevent collapse of, vessel / tube **;** (because) transpiration produces, tension / negative pressure **;** to waterproof the, cell / vessel / tube / wall **;** (so) <u>cell</u>**,** dies / content decays **;** to create a hollow, tube / vessel **OR** to create a continuous column / allow unimpeded flow **;** to limit lateral flow of water **;** ref to adhesion (between water molecules and wall) **;**	3 max	**IGNORE** ref to flexibility **IGNORE** xylem unqualified **IGNORE** 'collapse of wall' **IGNORE** 'xylem' **IGNORE** xylem vessels die **CREDIT** reduce / prevent lateral movement **ACCEPT** lignin helps water move by adhesion
		(ii)	(provides) strength / support, to keep, it / trachea / airway, open **OR** (provides) strength / support, to prevent collapse **;** during, inspiration / inhaling / breathing in **;** volume of, chest cavity / thorax / lungs, increases **;** low(er) / negative, pressure in, trachea / thorax / lungs **;**	3 max	**IGNORE** ref to alveoli / C-shape of cartilage **ACCEPT** in context of bending the neck

Question			Answer	Marks	Guidance
	(b)			3 max	ensure that 'surface area to volume ratio' is used correctly
			body has small <u>surface area to volume ratio</u> **OR** lungs, provide / have, large <u>surface area to volume ratio</u> **;**		**CREDIT** SA/Vol, SA:Vol **ACCEPT** person for body
			correct calculation of (one) surface area to volume ratio **;**		25.7 /26 (:1) for body OR 1000(:1) for lungs DO NOT CREDIT 1 : 1000 OR 1 : 26
			idea of: body SA / SA:Vol is not big enough to meet body's needs **OR** lung SA / SA:Vol is big enough to meet body's needs **;**		**e.g.** allows gaseous exchange at a high enough rate **IGNORE** ref to efficiency
			oxygen into (blood / body) **and** carbon dioxide out (of blood / body) **;**		**CREDIT** O_2 and CO_2
			Total	**9**	

Question			Answer	Marks	Guidance
4	(a)		stem / undifferentiated ; (bone) marrow ; differentiate ; meristem(atic) / cambium ;	4	**Mark the first answer for each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **ACCEPT** totipotent / pluripotent **IGNORE** unspecialised (as specialised in the passage) **IGNORE** specialise as given in the passage **ACCEPT** callus
	(b)	(	*idea of:* create flow of water / move water ;	1	**Mark the first answer only.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **DO NOT CREDIT** ref to movement of, organism / cell **IGNORE** ref to liquid / food particles
		(ii)	strain / filter (the water) **OR** trap particles ; to catch food (particles) ;	1 max	**Mark the first answer only.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **IGNORE** trap substances unqualified **ACCEPT** named suitable food particles eg bacteria **IGNORE** ref to preventing infection / catching pathogens **IGNORE** ref to nutrients unqualified as these are dissolved **IGNORE** ref to catching dust

Question			Answer	Marks	Guidance
	(c)		*xylem* consists of vessels **;** one cell specialisation described **;** transpiration stream **OR** movement of, water / minerals **;** *phloem* sieve tube element(s) and companion cell(s) **;** one cell specialisation described **;** translocation **OR** transports, sucrose / assimilates / products of photosynthesis / amino acids **;** AVP **;**	4 max	**ACCEPT** cells joined end to end **ACCEPT** continuous column / tube eg wall water proof / wall lignified / no end walls / (bordered) pits / hollow / no organelles / no cell contents **IGNORE** dead **IGNORE** transpiration unqualified **ACCEPT** sieve element / sieve tube, and companion cell eg sieve plates (between phloem elements) no nucleus / few organelles, in sieve tube (elements) little cytoplasm in sieve tube (elements) many plasmodesmata many mitochondria / dense cytoplasm, in companion cells **ACCEPT** sugar **IGNORE** load / unload sugars alone *in either xylem or phloem* ref to fibres ref to, packing cells / parenchyma cells
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		1500 ;		**ACCEPT** 1400 **and** 300,000 for 1 max only
			500 000 ;	**2**	
5	(b)		ability to see (two) objects (that are close together) as separate objects / AW ; see detail ;	**2**	**ACCEPT** ability to distinguish two objects **IGNORE** clarity / clear
5	(c)	(i)	transports water (up plant) ;		**ACCEPT** alternative wording for transport e.g. movement **DO NOT ACCEPT** up **and** down **DO NOT ACCEPT** water and sugars
			transports, minerals / ions, (up plant) ;		**ACCEPT** alternative wording for transport **IGNORE** ref nutrients / solutes **DO NOT ACCEPT** sugars
			support (plant / stem / shoot) ;	**1 max**	**ACCEPT** keeps plant upright

Question			Expected Answers	Marks	Additional Guidance
5	(c)	(ii)	*Functions:* **F1** (lignin), strengthens / thickens**,** the (xylem) wall **;** **F2** waterproofing (wall) / AW **;** **F3** (improving) adhesion of water (molecules) **;** **F4** (spiral) pattern allows flexibility / stretching / movement**;** **2 max**		**ACCEPT** support only if in specific context of supporting the xylem wall **ACCEPT** waterproofs cell **DO NOT ACCEPT** adhesion **and** cohesion when used together Flexibility / stretching must ref, *pattern* of lignin laid down i.e. spirals
			Explanation: **E1** prevents collapse of xylem **;** **E2** (water) under tension / at low pressure / negative pressure**;** **E3** reduces (lateral) loss of water, through wall **;** **E4** increases capillarity / AW **;** **E5** prevents stem breaking / AW **;** **2 max**	**3 max**	*Award mark(s) for function and explanation independently* **DO NOT CREDIT** loss of water unqualified

Question			Expected Answers	Marks	Additional Guidance
5	(c)	(iii)	(pits) allow water to move, in / out / between, vessel(s) ; to bypass blockage ; supply water to other, tissues / (other types) cells / parts of plant ;	2 max	**ACCEPT** lateral movement for 'out' **ACCEPT** bypass air lock **ACCEPT** any named, tissue / cells e.g. to allow water to other tissues 1 mark to allow water out to other tissues 1 mark to allow water out of vessel to other tissues 2 marks
			Total	**10**	