Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	sucrose ;	1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
1	(a)	(ii)	sink ; neither ; sink ;	3	**Mark the first answer for each tissue.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
1	(b)		**1** elongated elements ; **2** elements , joined end to end / form column ; **3** sieve plates / pores in end walls / perforated end plates / sieve pores ; **4** little cytoplasm / cytoplasm pushed to cell edges / thin (layer of) cytoplasm ; **5** no nucleus / few organelles ;	max 2	**Mark the first <u>two</u> adaptations.** **1** **ACC** **PT** cells **2** **ACC** **PT** cells **3** response must refer to pores at ends of sieve elements **4** **IGNORE** hollow **5** **IGNOR** no organelles / few cell contents

Question			Expected Answer	Mark	Additional Guidance
1	(c)		**1** active transport of, **hydrogen ions** / **protons** / H^+ , out of **companion** cells **;** **2** creates **,** hydrogen ion / **concentration** / diffusion **,** **gradient ;** **3** **(facilitated) diffusion** (of H^+) back into companion cells **;** **4** sucrose / assimilates **,** move in with hydrogen ions **;** **5** by **cotransport** / through cotransport protein **;** **6** sucrose / assimilates **,** (diffuse) through **plasmodesmata** (from companion cell to sieve element) **;** **7** into **sieve, tube / element ;**	**max 3**	**1** **ACCEPT** description of active transport **DO NOT CREDIT** hydrogen, H, H_2, hydrogen molecules **2** **ACCEPT** description of gradient created **5** **IGNORE** carrier protein **For mark points 4 and 6** **IGNORE** sugar If wrong assimilate is named e.g. glucose penalise once and then apply ECF
			QWC **;**	**1**	Any **three** with correct spelling and a suitable context from: **companion, diffuse / diffusion,** **gradient, concentration,** **facilitated, cotransport,** **plasmodesmata, sieve tube,** **sieve element, hydrogen ions / protons**
			Total	**[10]**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		U ; R ; V ;	3	**Mark the first answer for each tissue.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**.
	(b)		no cross walls / cells joined end to end / continuous ; hollow / no contents / no organelles / no cytoplasm ; (walls / vessels) lignified ; (bordered) pits in walls ;	2 max	**IGNORE** ref to dead cells / tubes **DO NOT CREDIT** lined / covered with lignin **DO NOT CREDIT** (walls) made of lignin **ACCEPT** xylem has lignin
	(c)	(i)	evaporation / loss of water vapour ; from, aerial parts of plant / leaf / leaves ; via stomata ;	2 max	**movement of water vapour out of leaf = 2 marks** **DO NOT CREDIT** loss of water alone **CREDIT** loss through cuticle / epidermis

Question			Expected Answers	Marks	Additional Guidance
	(c)	(ii)	*In the leaf:* *idea of :* **1** water loss (from leaf) is replaced **;** **2** via, **apoplast** / **symplast** / **vacuolar**, pathways **;** **3** down **water potential** gradient / AW **;** **4** (lost water replaced) by water from the **xylem ;** *In the xylem:* **5** (loss of water) causes, low / negative, (**hydrostatic**) pressure (at top / in leaf) **OR** creates pressure gradient **;** *idea of :* **6** water moves, from higher pressure to lower pressure / down pressure **gradient ;** **7** under **tension** / pulled up / drawn up **;** **8** by **<u>mass flow</u> ;** **9 cohesion** / attraction, between water molecules **;** *idea of :* **10** column / stream / chain, of water (molecules) **;** **QWC ;**	**4 max** **1**	**DO NOT CREDIT** ref to water potential in context of xylem **IGNORE** ref to root pressure or capillarity **ACCEPT** Ψ / WP for water potential For mp 2 & 3 **DO NOT CREDIT** in context of root **CREDIT** pathways described in correct context Idea of : water leaving xylem to enter leaf cells (that have lost water) **IGNORE** 'water moves by the cohesion-tension theory' without further explanation **ACCEPT** along pressure gradient Idea of: pulling force and not just water movement created by transpiration **DO NOT CREDIT** mp 7 or 8 in context of adhesion / capillarity or water potentials **IGNORE** suction, transpiration pull unqualified **CREDIT** hydrogen bonding between water molecules **IGNORE** long unqualified <u>TWO</u> terms used appropriately and spelt correctly: **xylem , apoplast/symplast/vacuolar , hydrostatic , gradient , cohesion / cohesive , tension , mass flow , water potential**

Question			Expected Answers	Marks	Additional Guidance
		(iii)	*Ref to :* bubbles / air (present / being removed) **;** (blockage) in xylem **;** restore (continuous) column of water (in xylem) **;**	**2 max**	**air in the xylem = 2 marks**
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
3	**(a)**	**(i)**	osmosis **;**	1	
		(ii)	**2** = symplast (pathway) **;** **3** = apoplast (pathway) **;**	2	**ACCEPT** symplastic **ACCEPT** apoplastic
		(iii)	S **;**	1	

Question			Expected Answers	Marks	Additional Guidance
3	(b)		*This is a QWC question* **1** water moves into xylem down **water potential** gradient **;** **2 root pressure** / high (**hydrostatic**) **pressure** at bottom of xylem **;** **3** water vapour loss / **transpiration** / **evaporation**, at leaves / top of plant **;** **4** (creating) low (hydrostatic) pressure at top of xylem **;** **5** water**,** under **tension** / pulled up (in a continuous column) **;** **6 cohesion** between water molecules / described **;** **7 adhesion** of water molecules to xylem / described **;** **8 capillary action** / described **;** **9** water moves up (xylem / stem) by **mass flow ;** **10** from high(er) (hydrostatic) pressure to low(er) (hydrostatic) pressure / down (hydrostatic) pressure gradient **;**	max 4	**ACCEPT** ψ for water potential **ACCEPT** water moves from high ψ to low ψ **IGNORE** drawn for pulled up **ACCEPT** ref to xylem being very narrow so water rises
			QWC (three terms used in correct context and spelt correctly) **;**	1	Any **three** terms from the following **:** water potential, hydrostatic pressure, transpiration / evaporation, cohesion / cohesive, adhesion / adhesive, tension, root pressure, capillary action / capillarity, mass flow

Question			Expected Answers	Marks	Additional Guidance
3	(c)				

xylem vessel	phloem sieve tube element	
present	absent	;
present	absent	;
(water and), minerals / ions / salts	products of photosynthesis / sucrose / assimilates / amino acids / minerals / ions / salts / plant 'hormones'	;
(only) up stem / towards leaves	both directions / up and down / from source to sink	;

One mark per row

Both statements must be correct to achieve mark

DO NOT CREDIT ticks and crosses

Read whole list – if any suggestion is wrong then do not award mark

XYLEM

DO NOT CREDIT 'nutrients' OR 'water' alone

PHLOEM

ACCEPT 'sugar' in place of sucrose

IGNORE unspecified 'solutes'

DO NOT CREDIT glucose

ACCEPT arrows ↑ (xylem) ↓↑ (phloem)

DO NOT CREDIT 'all directions'

IGNORE ref to pits / lateral movement

			Total	**13**	

Question			Expected Answers	Mark	Additio Guidance
4	(a)		timer **OR** scale / ruler **;**	1	
4	(b)				***Mark the first three suggestions*** *irrespective of numbered points* *IGNORE reasons – just mark* ***steps*** *in the process*
			shoot is healthy **;**		**ACCEPT** shoot not wilted
			assemble apparatus / cut shoot**,** under water **;**		
			cut last 2-3 cm off cut end / cut at an angle **;**		**ACCEPT** cut end off shoot
			check there are no air bubbles in apparatus **;**		**ACCEPT** make sure cut end of shoot is in contact with water once apparatus assembled
			apparatus**,** water tight / air tight / has no leaks **;**		**ACCEPT** screw clip tight **DO NOT ACCEPT** use Vaseline unqualified
			leaves dry **;**		
				3 max	**DO NOT CREDIT** allow time for acclimatisation, equilibration

Question			Expected Answers	Mark	Additio Guidance
4	(c)	(i)	25.3 ;	1	**IGNORE** any units
4	(c)	(ii)	to make results (more) reliable ;		**DO NOT ACCEPT** accurate **and** reliable (use of **both** terms) anywhere in the answer
			to help identify anomalies ;	2	Look for idea of spotting the anomaly e.g. spot, notice, recognise, show, detect. **DO NOT CREDIT** prevents / take out / remove / accounts for, anomalies **DO NOT CREDIT** 'ensure there is no anomaly' unless qualified **ACCEPT** outliers for anomalies **ACCEPT** to identify other factors / (uncontrolled) variables that may be having an effect
4	(c)	(iii)	*in afternoon:* plant dying / less healthy / wilting ; ref to stomatal closure ; more humid / higher water (vapour) potential in air ; less air movement / wind / draughts ;	2 max	*Mark first response in each numbered section (1-2). If not all sections are used, return to the first section and mark further suggestions* Assume answer is for different conditions in the afternoon **ACCEPT** ORA if stated 'in morning...' **IGNORE** ref to light / dark Look for **comparative** statements – higher, greater etc **DO NOT CREDIT** more **moisture** in air

Question			Expected Answers	Mark	Additional Guidance
4	**(c)**	**(iv)**	(potometer) measures (water) uptake **;**		
			not all water (taken up) is lost **;**		**ACCEPT** ref to figs e.g. 99% water *taken up* is lost **ACCEPT** the assumption that water loss is equal to water uptake is incorrect
			some water used (in photosynthesis / making cells turgid) **;**	**2 max**	
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		transpiration ; xylem ; osmosis ; stoma(ta) / stomatal pore ;	4	**DO NOT ACCEPT** 'diffusion' alone **ACCEPT** diffusion with osmosis used as qualification **DO NOT ACCEPT** 'pore' or 'guard cells'
5	(b)	(i)	stomata (open to) allow, gaseous exchange / carbon dioxide in / oxygen out / AW ; (gaseous exchange) for photosynthesis ; (photosynthesis) essential for plant to, gain energy / make sugars ; some water lost through cuticle ;	2 max	look for reverse argument **DO NOT ACCEPT** ref to air OR to get gases OR let gases in **ACCEPT** 'gases in and out'
	(b)	(ii)	xerophyte ;	1	**DO NOT ACCEPT** cactus

Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	*Allow the first point **once** as further explanation for A1 – A4 in addition to the linked explanation:* reduce water (vapour) **potential gradient** / **diffusion** gradient **;** **[A 1]** hairy leaves **;** trap **water vapour** / moisture **;** **[A 2] stomata,** in pits / sunken **;** pits trap, **water vapour** / moisture **;** **[A 3]** rolled leaves / presence of **hinge cells ;** reduce **surface area** OR (rolled leaves) trap **water vapour** / moisture **;** **[A 4]** high solute concentration in cells **;** reduces water potential inside leaf cells **;** **[A 5]** thick(er) **cuticle ;** (which is) waterproof / (relatively) **impermeable ;** **[A 6]** small leaves / **needles ;** smaller **surface area ;** **[A 7]** fewer **stomata ;** reduces **diffusion** (of water vapour) **;** **[A 8] stomata** close, during the day **;** reduces **diffusion** (of water vapour) **;** **[A 9]** most **stomata** on lower surface **;** less exposure to sun OR cooler OR reduces diffusion (of water vapour) **;**		***MARK FIRST <u>TWO</u> ADAPTATIONS <u>ONLY</u>*** **ALLOW** max 2 for adaptation [A] marks Explanation must be linked to an appropriate statement of adaptation. Allow an explanation mark even if adaptation mark not awarded. **DO NOT ACCEPT ‘**water’ for ‘water vapour’ throughout **DO NOT ACCEPT** ‘transpiration’ for diffusion of water vapour throughout **DO NOT ACCEPT** surface area to volume ratio **ACCEPT ‘**spines’ **DO NOT ACCEPT** surface area to volume ratio

Question			Expected Answers	Marks	Additional Guidance
			[A 10] more densely packed spongy mesophyll **;** smaller surface area for evaporation (from mesophyll cell surface) **;** 4 max QWC - technical terms used appropriately and spelt correctly **;** 1	**5 max**	Use three terms from: cuticle, impermeable, water vapour, potential gradient, diffuse / diffusion, stoma(ta), needles, surface area, hinge cells, saturated
			Total	**12**	