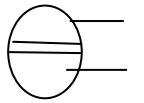
| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (a) | (i) | Stoma(ta) **;** | 1 | |
| | | | | | |
| | (a) | (ii) | *idea of:* unevenly thickened (cell) wall **;** | | Statement should be comparative<br>**CREDIT** wall beside pore thicker / wall is thicker on one side<br>**ACCEPT** refs to: thick inner **and** thin outer walls / inner wall thicker / outer wall thinner<br>**ACCEPT** thickened for thicker |
| | | | able to, change shape / bend **;** | | **CREDIT** so can bend<br>**DO NOT CREDIT** 'contract' 'recoil' 'move'<br>**IGNORE** functions such as 'open / close stoma' 'flexible' 'expand' 'stretch' 'bulge' |
| | | | transport proteins / ion pumps, in plasma membrane **;** | | |
| | | | (presence of) chloroplasts (to provide, ATP / energy) **;** | 2 max | **ACCEPT** mitochondria<br>**IGNORE** chlorophyll<br>**DO NOT CREDIT** 'produce / make energy' |
| | | | | | |
| | (a) | (iii) | epidermis / cuticle **;** | 1 | **Mark the first answer.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks**<br>**ACCEPT** guard cell<br>**IGNORE** 'surface' |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| | (b) | | <u>water potential</u> ;<br><br><u>osmosis</u> ;<br><br>selectively / partially / differentially, <u>permeable</u> ;<br><br><u>turgidity / turgor (pressure)</u> ; | 4 | **Mark the first answer on each prompt line.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks**<br><br>**DO NOT CREDIT** water potential gradient<br>**IGNORE** Ψ<br><br>**IGNORE diffusion**<br><br>**DO NOT CREDIT** semi permeable<br><br>**ACCEPT** 'turgidness'<br>**IGNORE** shape / rigidity / stability |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| | (c) | | | | **IGNORE** refs to adhesion / capillarity |
| | | | evaporation at top of, plant / xylem ; | | **ACCEPT** leaf or named part of leaf<br>**IGNORE** ref to transpiration / loss of water vapour |
| | | | (creates) tension in xylem ; | | **IGNORE** xylem (vessels) under tension |
| | | | water molecules, stick together / are cohesive / form a chain or column ; | | **CREDIT** water molecules, attracted together / (hydrogen) bonded together / form a continuous stream |
| | | | (column / chain) pulled up (by tension); | | **IGNORE** column, moves up / sucked up<br>**ACCEPT** column drawn up<br>**ACCEPT** description if linked to tension at top e.g. tension at top forces water up |
| | | | | 3 max | **DO NOT CREDIT** chain 'pushed' up xylem |
| | | | | | |
| | | | **Total** | **11** | |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 2 | (a) | (i) | letter **X** marking upper part of vascular bundle<br>**and**<br>letter **P** marking lower part of vascular bundle **;** | 1 | <br>**X**<br>**P**<br>**ACCEPT** Xylem & Phloem<br>**DO NOT CREDIT Y** |
| | | (ii) | vascular bundle / vein **;** | 1 | **IGNORE** tissue / midrib |
| | (b) | (i) | (the charged particles are) hydrogen ions / $H^+$ / protons **;**<br><br>(ions are) moved out of the cells / move into surrounding (solution) **;** | 2 | **IGNORE** descriptions of observations 2 and / or 3<br>**IGNORE** ref to $OH^-$ / alkaline substances<br><br>**Note** do not need to refer to hydrogen ions for mp 2<br><br>**Note** that 'hydrogen ions move out of the cell' **= 2 marks** |
| | | (ii) | active transport involved / cyanide prevents active transport / (mechanism) is active / (mechanism) needs energy / (mechanism) needs ATP **;** | 1 | **IGNORE** descriptions of observation 4 e.g. no ATP is made<br><br>**IGNORE '**mechanism / active loading, does not work in presence of cyanide' as too vague |
| | (c) | (i) | active transport **;**<br><br>concentration / pH / $H^+$ / proton / electrochemical **;**<br><br>facilitated **;**<br><br>diffusion **;**<br><br>amino acids **;** | 5 | **Mark the first answer.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks**<br>**IGNORE** active loading<br><br>**IGNORE** high **DO NOT ACCEPT** diffusion<br><br>**ACCEPT** facilitated diffusion<br><br>**ACCEPT** plasmodesmata<br>**DO NOT CREDIT** facilitated diffusion<br><br>**DO NOT CREDIT** glucose / fructose / ions |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| | | (ii) | many / large, mitochondria **;**<br><br>plasmodesmata (between companion cell and sieve tube) / described **;**<br><br>many ribosomes / extensive RER **;**<br><br>many proteins in the, plasma / cell surface, membrane **;** | 2 | **IGNORE** qualification of type of protein |
| | | | **Total** | **12** | |

<table>
<tr><td>3</td><td>(a)</td><td></td><td>transpiration<br>loss of water <u>vapour</u> / evaporation of water ;<br>from, aerial parts of plant / leaves / stomata ;<br><br>transpiration stream<br>movement of water (up xylem vessels) ;<br>from roots to, leaves / air surrounding leaves ;</td><td>max 3</td><td>IGNORE evaporation of water vapour</td></tr>
<tr><td></td><td>(b)</td><td></td><td>F ;<br>G ;<br>K ;</td><td>3</td><td>Only one tick per set – if more than one tick then apply CON<br>IGNORE crosses and hybrid crosses</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Xylem</th><th>Phloem</th></tr><tr><td>(named) mineral(s) / salts</td><td>sucrose / amino acids</td></tr><tr><td>no, end / cross, walls</td><td></td></tr><tr><td>lignin</td><td></td></tr><tr><td>(bordered) pits</td><td>Plasmodesmata</td></tr></table></td><td>4</td><td>Award 1 mark for a correct row.<br><br>IGNORE ions unqualified / nutrients<br>IGNORE proteins / sugars / minerals / salts for phloem<br>DO NOT CREDIT glucose<br><br>IGNORE continuous tube<br><br>DO NOT CREDIT holes / pores</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 4 | (a) | (i) | <u>units</u> ;<br><br>mm $s^{-1}$ ;<br><br>raw data ;<br><br>leaf area ; | 2 max | <br><br>**ACCEPT** mm $min^{-1}$ / cm $min^{-1}$ / cm $s^{-1}$ / written in words<br>**ACCEPT** $mm^3$ $min^{-1}$ / $cm^3$ $min^{-1}$ / $cm^3$ $s^{-1}$ / written in words<br><br>e.g. individual trial results / the repeat readings / data used to calculate the mean<br>**IGNORE** only the mean is shown<br>**IGNORE** 'how many repeats were done' |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | | (ii) | | 3 max | **ACCEPT** ORA throughout<br>**IGNORE** refs to more bubbles / photosynthesis |
| | | | *description*<br>as number of leaves increases the (rate of) bubble movement increases **;**<br>(pair of) figs to illustrate the change **;** | | must be pair of figures illustrating change<br>eg 7 bubble movement with 0 leaves and 92 bubble movement with 8 leaves<br><br>**ACCEPT** calculated difference e.g. increase of 21 between 2 & 4 |
| | | | *explanation*<br>larger (surface) area **;** | | **ACCEPT** 'surface area increases' |
| | | | more stomata **;** | | **IGNORE** 'many stomata' OR 'more stomata open' |
| | | | more / fast(er), evaporation / transpiration / loss of water vapour **;** | | **NOTE** e.g. more, stomata / surface area for transpiration = 2 marks (as more transpiration implied) |
| | | | more / fast(er), uptake of water (by shoot) **;** | | |
| | | | *idea that:* (some) bubble movement with no leaves as not all uptake due to transpiration from leaves **;** | | e.g some loss from other parts of stem / uptake into cells |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | (b) | | *statement 1*<br>surface area / SA, of leaves is different<br><br>**OR**<br><br>different number of stomata **;**<br><br>(choose shoot(s) with), similar sized leaves / similar surface area<br><br>**OR**<br><br>repeats to calculate mean **;**<br><br>*statement 2*<br>reduces water (vapour) potential gradient (between inside and outside of leaf) **;**<br><br>assemble without wetting leaves / dry the leaves / wait until leaves dry<br>**;**<br><br>*statement 3*<br>(increased temperature) will increase, evaporation / transpiration / loss of water vapour **;**<br><br>control the temperature / carry out in room with controlled temperature **;** | 6 | **IGNORE** 'surface area to volume ratio' (as a phrase)<br><br>**ACCEPT** measure surface area of each leaf **and** calculate rate of movement per unit area<br>**ACCEPT** measure leaves to check they are same size<br>**DO NOT CREDIT** cut or trim leaves to size<br><br>**ACCEPT** water potential outside leaf is too high<br>**OR** WP outside higher than inside<br><br>**IGNORE** ref to light<br><br>**ACCEPT** do it in constant temperature<br>**CREDIT** suitable practical method of achieving this<br>**IGNORE** 'pull blinds down' / 'open the window' / 'general ref to environment or conditions', without mentioning temperature or heat |
| | | | **Total** | **11** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 5 | (a) | (i) | <u>sucrose</u><br>**and**<br><u>phloem</u> **;** | 1 | Both needed for one mark<br>**Mark the first answer on each line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**<br>**DO NOT CREDIT** sucrase<br>**DO NOT CREDIT** phloem sieve tubes / companion cells |
| | | (ii) | **1** hydrogen ions / $H^+$ / protons**,** pumped out of companion cells **;**<br>**2** increases**,** hydrogen ion / $H^+$ / proton, concentration (gradient) (outside companion cell) **;**<br>**3** hydrogen ions, re-enter / flow back into**,** companion cells **;**<br>**4** sucrose / sugar**,** moves with hydrogen ions / AW **;**<br>**5** down <u>concentration</u> gradient **;**<br>**6** ref. cotransporter proteins / cotransport(ation) **;**<br>**7** by <u>facilitated</u> diffusion **;**<br>**8** sucrose / sugar**,** diffuses into sieve tube (element) **;**<br>**9** through plasmodesmata **;** | 3 max | **1 ACCEPT** hydrogen ions leave companion cells using ATP<br>**2 ACCEPT** creates gradient<br>**2 DO NOT CREDIT** increase, hydrogen ion / $H^+$ / proton concentration, in sieve tube element<br>**3 ACCEPT** diffuse / move<br>**4 DO NOT CREDIT** glucose (penalise once)<br>**4 DO NOT CREDIT** sucrose follows $H^+$<br>**8 IGNORE** sucrose diffuses into *phloem* |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | (b) | | **1** active transport requires ATP **;**<br><br>*at low temperatures:*<br>**2** (molecules have) little kinetic energy **;**<br>**3** (therefore) less, respiration / ATP made **;**<br><br>**4** less active transport **or** less, movement / loading, of sugars into sieve tube (element) **;**<br>**5** less, osmosis / movement of water, into sieve tube (element) **;**<br>**6** low (hydrostatic) pressure created **;**<br><br>*as temperature increases:*<br>**7** (molecules have) more kinetic energy **;**<br>**8** (therefore) more, respiration / ATP made **;**<br>**9** more active transport **or** more, movement / loading, of sugars into sieve tube (element) **;**<br>**10** more , osmosis / movement of water, into sieve tube (element) **;**<br>**11** higher / more (hydrostatic) pressure created **;**<br><br>**12** at high temperature (plant), enzymes / proteins, denatured **;** | 3 max | **1 ACCEPT** loading / uptake for transport<br><br>**3 IGNORE** no respiration / no ATP made / no loading of sucrose<br>**4 ACCEPT** slow active transport / slow loading<br><br>**9 ACCEPT** faster active transport / faster loading<br><br>**12 DO NOT CREDIT** cells denatured<br>**12 CREDIT** change to tertiary structure, damage to proteins |
| | | | **Total** | **7** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | (a) | (i) | increases / rises / goes up **;**<br>use of figures to illustrate **;** | 2 | figures must include **mean values** for two comparative points within the range either stated or calculated.<br>eg (between 20 and 50) it rises from 5.7 to 32.3<br>eg (between 20 and 50) rate rises by 26.6<br>eg between 30 and 40 rate rises from 11.7 to 24.3<br>eg between 20 and 50 rate rises by 467%<br>**IGNORE** units<br>**Note:** as light intensity goes from 20 to 50, the rate increases from 5.7 to 32.3 = **2 marks**<br><br>**DO NOT ACCEPT** figures that include 10 a.u. (as not asked for in the question) |
| | | (ii) | stomata are (nearly) closed **;**<br><br>*idea that*: light <u>intensity</u> not high enough **;** | 1 max | **ACCEPT** no extra stomata are opened / stomata are not opened wider |
| | (b) | ( | **1** stomata are open **;**<br>**2** allow, gaseous exchange / entry of carbon dioxide / exit of oxygen **;**<br>**3** for photosynthesis **;**<br>**4** water <u>vapour</u> leaves (the leaf) **;**<br>**5** down a water (vapour) potential gradient **;**<br>**6** high(er) temperatures (during the day) **;**<br>**7** causes greater <u>evaporation</u> / some water vapour loss through leaf surface all the time **;** | 3 max | **DO NOT CREDIT** if gases are described moving in wrong direction<br>**IGNORE** ref to respiration<br>**ACCEPT** description of light independent stage<br><br>**ACCEPT** Ψ for water potential |

| Question | | | answer | Marks | Guidance |
|---|---|---|---|---|---|
| | | (ii) | | | **IGNORE** ref to moisture / moist air<br>**IGNORE** ref to sunken / small / closed / few stomata |
| | | | **1** <u>thick</u> , **cuticle** / waxy or layer **;** | | **ACCEPT** waterproof for waxy |
| | | | **2** leaf is, folded / rolled / curled / curved / AW **;** | | |
| | | | **3** reduces (exposed) **surface area** (for evaporation) **;** | | **DO NOT CREDIT** ref to surface area to vol ratio / SA:Vol |
| | | | **4** hairs **;** | | **DO NOT CREDIT** if hairs described in wrong place eg on palisade<br>**DO NOT CREDIT** cilia |
| | | | **5** reduces, **evaporation / diffusion** through leaf, surface / **epidermis**) **;** | | **DO NOT CREDIT** evaporation of water vapour |
| | | | *for points 6, 7 & 8 credit only in context of folded leaf or hairs:* | | |
| | | | **6** trap **water <u>vapour</u> ;** | | **ACCEPT** water <u>vapour</u> builds up in enclosed area<br>**ACCEPT** stop wind blowing, water vapour / diffusion shells, away<br>**ACCEPT** humid air collects in enclosed space |
| | | | **7** creates high **water (vapour) potential** outside (stomata) **;** | | **ACCEPT** Ψ for water potential<br>**DO NOT CREDIT** high water potential gradient outside stoma |
| | | | **8** reduces **water (vapour) potential gradient ;** **max 4** | | |
| | | | **Q** QWC – two technical terms used and spelt correctly **;** **1** | | any **2** from:<br>**cuticle** (derivatives of) **evaporation**<br>**water vapour** **potential gradient**<br>**epidermis** **area** **diffusion** |
| | | | | 5 max | |
| | | | **Total** | **11** | |