**Additional Transpiration Answers**

Ex 70

**M1.**          (a)     endodermis;  
xylem;

**2**

(b)     Casparian strip / suberin (*accept casparien, not caspian);*impermeable / barrier to water movement *(“idea” of waterproof, not waxy*);  
water enters cell along water potential/osmotic gradient / by osmosis;

**2 max**

(c)     ATP supplies energy (reject produces/creates energy);  
for active transport / movement against a concentration gradient  
*(allow active uptake)*;  
to move sugars/sucrose (from phloem tissue) *(allow glucose, mineral ions  
neutral, not carbohydrate*);

**2 max**

**[6]**

**M2.**          (a)     (i)      apoplast;

**1**

(ii)     (pathway from cells) along cell walls /   
through spaces and out through stoma(ta);

by diffusion *(disqualify if osmosis mentioned)*;

down a WP/diffusion/concentration gradient;

**3**

(b)     two suitable adaptations plus explanation, e.g.

sunken stomata, reduce air movement/diffusion gradient;

rolled leaves, reduce surface area (for evaporation) /   
enclose still air around stomata;

waxy cuticle, reduce (cuticular) evaporation / impermeable to water;

*(reject waterproof)*

few stomata, to reduce SA for diffusion;

small leaves, reduce SA for diffusion;

**2**

**[6]**

**M3.**          (a)     (i)      Endodermis(reject pericycle / suberin);

*(accept endodermis and / containing Casparian strip)*

**1**

(ii)     S;

**1**

(iii)     R;

**1**

(b)     (i)      (waxy so) impermeable to water/waterproof/stops water  
passing through;

**1**

(ii)     reference to hairs / position of stomata (sunken stomata /  
stomata in pits )  
LINKED to reduced air movement / trap layer of air /  
trap water vapour (*reject water) /* maintains humidity;

reduces diffusion gradient / concentration gradient of water /  
water potential gradient;

*OR*

stoma can close;  
reduces area for evaporation or transpiration;

**2**

**[6]**

**M4.**          (a)     Light (intensity)/temperature/air movement/humidity;

**1**

(b)     Prevent air entering/continuous water column;

*Allow answer in context of shoot, xylem or potometer.*

**1**

(c)     Distance and time;

*Reject ‘amount bubble moves’*

**1**

Radius/diameter/area (of capillary tube);

**1**

(d)     (used to provide) turgidity/support/description of;

(used in) photosynthesis/(produced in) respiration;

Apparatus not sealed/’leaks’;

**2 max**

(e)     (i)      Returns bubble (to start);

**1**

(ii)     Increases reliability (of results)/anomalous result can be identified;

***Q*** *Ignore references to validity/precision/accuracy etc.*

**1**

**[8]**

**M5.**          (a)     Light;

Humidity / moisture in air;

Air movement / wind;

Temperature;

**2 max**

(b)     Decreases chance of error / larger difference in mass / improves  
accuracy/precision;

*Neutral: Reliability, references to anomalies.*

**1**

(c)     1. (Water) transpired/evaporates / diffuses out;

2. (Via) water potential gradient / leaf has higher water potential;

3. Stomata open;

4. Water potential/diffusion gradient reduces (during investigation);

5. Water not being replaced / no water supply;

6. Stomata close/closing;

*Must clearly indicate that stomata are open for third marking point. However, allow correct descriptions of guard cells being turgid or flaccid as being equivalent to stomata being open or closed. ‘Loss through stomata’ on its own is not sufficient.*

*Neutral: Any reference to ‘loss by osmosis’.*

**3 max**

(d)     Stomata (on upper surface) covered / stomata close due to lack of  
light / (grease provides) longer diffusion pathway;

Less evaporation/transpiration / diffusion out;

*Accept: Evaporation / transpiration/diffusion ‘stops’ for second point as this could be referring to upper surface.*

**2**

**[8]**

**M6.**          (a)     water enters root hair cells;  
by osmosis;  
because active uptake of mineral ions has created a WP gradient;  
water moves through the cortex;  
(by osmosis) down a WP gradient;  
through cell vacuoles and cytoplasms / symplastic pathway;  
through cell walls / apoplastic pathway;

**max 5**

(b)     WP in leaf cells decreases / becomes more negative;  
therefore water moves out of xylem (into surrounding tissues)  
by osmosis; this creates a pull/tension on the water in xylem;  
which is in a continuous column / water molecules cohere;  
cohesion due to H bonding;  
column doesn’t break because of adhesion with xylem walls;

**max 4**

(c)     (water is used in) the light-dependent reactions of photosynthesis;  
electrons from water enable ATP production / H+ are used to reduce  
NADP / produces O2 ;  
(water can be used in) hydrolysis reactions within the plant;  
to create turgor;  
as a solvent for transport;  
as a medium for chemical reactions;  
component of cells / cytoplasm;

**6**

**[15]**

**M7.**          (a)     long cells / tubes with no end walls;

continuous water columns;

no cytoplasm / no organelles/named organelle;

to impede/obstruct flow / allows easier water flow;

thickening/lignin;

support / withstand tension / waterproof / keeps water in cells;

pits in walls;

allow lateral movement / get round blocked vessels;

**4 max**

(b)     (i)      increase in transpiration rate/evaporation due to  
increase in temperature ;

increased (kinetic) energy of water molecules;

*OR*

increase in light (intensity) increases transpiration rate/evaporation;

greater stomatal aperture / more stomata open;

increase in flow rate due to cohesion/attraction of water molecules;

**2 max**

(ii)     adhesion/attraction of water molecules to walls of xylem;

results in tension as water pulled up stem;

pulling in walls;

**2**

**[8]**

**M8.**          (a)     increased humidity leads to decreased transpiration;  
high humidity means more water in the air / increased saturation /   
increased water potential;  
reduced diffusion gradient / water potential gradient;  
slower rate of water loss / less evaporation;

**3 max**

**[4]**

**M9.**         (a)     (i)      1.       Removes water vapour/moisture/saturated air;

2.       Increases water potential gradient/more diffusion/more  
evaporation;

**2**

(ii)     1.       Increases kinetic energy;

2.       Water molecules move faster;

3.       Increases diffusion/evaporation;

**2 max**

(b)     (i)      Positive correlation/as light intensity increases so does  
rate of water movement/follows same pattern/directly proportional;

**1**

(ii)     1.       Stomata open;

2.       Photosynthesis increases/transpiration increases;

3.       More water pulled up;

4.       Cohesion between water molecules/by cohesion tension;

**2 max**

(iii)     1.       Water pulled up trunk/moves up at fast rate;

2.       (Water column under) tension;

3.       Sticking/adhesion (between water and) cells/walls/xylem;

*Adhesion is not a specification requirement.*

*Accept cohesion in this context*

4.       Pulls xylem in;

**2 max**

**[9]**