**M1.**         (a)     (i)      1.      Stomata open;

*Allow converse*

2.      Transpiration highest around mid-day as middle of day warmer / lighter;

*2. Allow ‘Sun is at its hottest’*

3.      (Increased) tension / water potential gradient;

*Ignore ‘pull, suck’*

**3**

(ii)     (Inside xylem) lower than atmospheric pressure / (water is under) tension;

*Accept cohesion tension. Ignore vacuum*

**1**

 **[4]**

**M2.**         (a)     (i)      1.      Removes water vapour / moisture / saturated air;

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

**2**

(ii)     1.      Increases kinetic energy so water molecules move faster;

2.      Increases diffusion / evaporation;

**2**

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

**1**

(ii)     1.      Stomata open and photosynthesis increases / transpiration increases;

2.      More water pulled up due to cohesion between water molecules / by cohesion tension;

**2**

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

2.      Sticking / adhesion (between water and) cells / walls / pulls xylem in;

*Adhesion is not a specification requirement.*

*Accept cohesion in this context*

**2**

 **[9]**

**M3.**(a)     1.      In source / leaf sugars actively transported into phloem;

2.      By companion cells;

3.      Lowers water potential of sieve cell / tube and water enters by osmosis;

4.      Increase in pressure causes mass movement (towards sink / root);

5.      Sugars used / converted in root for respiration for storage;

*Accept starch*

**4 max**

(b)     Respiration;

**1**

(c)     1.      (About) 30 hours;

2.      Time between peak 14C at top of trunk and bottom;

**2**

(d)     Length of trunk (between top and bottom);

**1**

**[8]**

**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)     1. water evaporates / transpires from leaves;
2. reduces water potential in cell / water potential / osmotic gradient across
    cells *(ignore reference to air space)*;
3. water is drawn out of xylem;
4. creates tension *(accept negative pressure, not reduced pressure)*;
5. cohesive forces between water molecules;
6. water pulled up as a column;

**4 max**

(b)     (i)      same surface area of leaf / number of leaves / age / thickness of
cuticle;

**1**

(ii)     (environmental conditions) affect rate of transpiration / evaporation;

**1**

(iii)     presence of grease reduces water loss;

**1**

(c)     (i)      1.2 / 1.3g;

**1**

(ii)     more stomata on the lower surface;
(thicker) waxy cuticle on the upper surface;

**2**

**[10]**