

Potometer and Transport in plants work sheet question answers:

The Potometer practical handout questions:

1. 20 mm min^{-1}
 6 mm min^{-1}
 40 mm min^{-1}
 14 mm min^{-1}
 0.6 mm min^{-1}
2. Most movement of the bubble and therefore the highest rate of transpiration came in the warm, moving air in light. These three factors increase the rate of transpiration. In light, the stomata are open to allow carbon dioxide to be absorbed and photosynthesis to take place. In warm air environments, the water on the surface of the spongy mesophyll evaporates and diffuses out of the leaf more quickly due to the increased kinetic energy available. In moving air, the concentration gradient between the air spaces inside the leaf and the air outside is maintained and water vapour diffuses out constantly.
3. Valid procedure. However, remember to allow the plant to equilibrate to its surroundings for 5-10 minutes each time a condition is changed. Also, it is essential to repeat readings at least twice more and calculate average results in order to achieve reliable data.
4. The potometer measures the rate of water uptake in a shoot.
5. This is highly indicative and proportional to the rate of transpiration (water lost from the leaves) in the plant.
6. Not all water absorbed is lost by transpiration; it is used in photosynthesis, in other metabolic reactions and to provide turgor to plant cells.

Potometer PPQ:

- (a) That the rate of transpiration is equal to the rate of water uptake (actually measured using the apparatus); [1]
- (b) To prevent air collecting in the xylem vessels/air locks preventing water uptake;
the open end of the capillary tube is exposed to the air which is drawn up as the shoot takes up water;
to enable the air bubble to be moved back to the origin;
to allow the rate of transpiration to acclimatise to the surrounding conditions; [4]
- (c) (i) Any three from
- transpiration is reduced when the plant is covered (with a clear plastic bag) since the air becomes more humid
 - there are no air currents
 - humid air reduces the diffusion gradient of moisture out of the plant/no air movement allows diffusion shells to build up
 - transpiration is further reduced when the plant is covered with a black plastic bag since the stomata close in the dark
 - thus the main route of water loss from the leaf is closed/only cuticular transpiration occurs
- [3]
- (ii) $90 \times 0.8 = 72 \text{ mm}^3$;
 $72 \div 10 = 0.72 \text{ mm}^3 \text{ min}^{-1}$; [2]
- (d) Different shoots may be different sized/differ in the number of leaves/
differ in the size of leaves/other appropriate response; [1]

Transport in plants hand out questions:

Xylem:

- (a) A: root hair cell;
B: parenchyma cell/cortex;
C: endodermal cell/endodermis; [3]
- (b) Arrow 1; [1]
- (c) Contains waterproof material (suberin)/makes cell wall impervious to water;
diverts water from apoplast route to symplast route/offers plant some control over what enters pericycle/forces water to pass through semi-permeable membrane; [2]
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- (a) **Any two from**
- hollow/no cytoplasmic contents
 - continuous tubes/no cross walls
 - lignified to waterproof/prevent collapsing
 - pits for lateral movement of water
- [2]
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- (a) **Any four from**
- water moves along the cell walls (by capillarity) via the apoplast pathway
 - water may also move through the cytoplasm of cells via the symplast pathway
 - most water moves via apoplast as it is the route of less resistance
 - water may not pass through the endodermis by the apoplast pathway
 - since it is prevented from doing so by the Casparian strip
 - water passing through the endodermis via the symplast pathway comes under the control of the cells' metabolism
 - ions are actively pumped into the xylem vessels and water follows by osmosis/water is essentially pumped into the xylem in the root
- [4]
- (b) **Any four from**
- the evaporation of water from the mesophyll surface
 - and subsequent diffusion through open stomata
 - causes water to be drawn through the mesophyll cells (mostly apoplast pathway) and ultimately out of the leaf's xylem vessels
 - creating a negative pressure in the leaf
 - the forces of adhesion and cohesion maintain a continuous water column
 - the pulling up of water is known as the transpiration stream
- [4]