

Gas exchange PPQs answers – use to correct yours after you complete them

1. (a) A: palisade mesophyll layer [$\frac{1}{2}$]
B: spongy mesophyll layer [$\frac{1}{2}$] [1]
- (c) Clear cuticle;
to allow passage of light to underlying mesophyll tissue;
or
Epidermal cells lack chloroplasts/epidermal cells are thin;
to allow passage of light to underlying mesophyll tissue;
or
Chlorophyll/chloroplast gradient from top to bottom of leaf;
most chlorophyll is concentrated where most light hits;
or
Palisade cells are packed closely together;
allowing more chloroplasts to be held close to the upper surface;
or
Chloroplasts may be concentrated at the upper end of the palisade cells;
concentrated where most light falls; [2]
- (d) Any two from
• larger surface area of leaf
• greater concentration of chloroplasts within the palisade cells
• greater concentration of chlorophyll within the chloroplasts
• chloroplasts may contain more grana
• leaves produced at an earlier time before the leaf canopy develops
• reduced number of cells/lower compensation point [2]
2. (a) Any three from
• mesophyll provides a large surface area for CO₂ absorption (compared to the volume of tissue absorbing it)
• thinness results in a short diffusion distance between atmosphere and mesophyll
• stomatal pores allow the direct diffusion of CO₂ into the leaf interior
• air space system greatly speeds up CO₂ diffusion
• chloroplasts are only just beneath the cell membrane (so CO₂ has a short intracellular diffusion pathway) [3]
- (b) (i) Temperature has no effect at low light intensities;
at high light intensity, an increase in temperature raises the rate of photosynthesis; [2]
- (ii) At temperatures above 30 °C enzymes are denatured (and so photosynthesis is inhibited)/excessive water loss causes the stomata to close which limits photosynthesis; [1]
3. (a) (i) The lowering of the diaphragm/contraction of (external) intercostal muscles (decreasing the pressure of the thoracic cavity); [1]
- (ii) Relaxation of the diaphragm muscles/relaxation of the intercostal muscles/diaphragm being forced up due to abdominal pressure (increasing thoracic pressure); [1]
- (b) The lung pressure decreases;
as the volume in the thoracic cavity increases/as the pressure in the thoracic cavity decreases/but increases as air enters from the atmosphere/since the pressure outside is greater; [2]
- (c) 1 breath in 4 seconds;
15 breaths per minute; [2]
4. (a) (i) The lung/alveolus is ventilated;
so that a high concentration of oxygen is maintained in the alveoli;
or
the oxygenated blood is transported away from the lung/deoxygenated blood is brought to the alveolar surface;
so maintaining a low concentration of oxygen in the blood; [2]
- (ii) Squamous epithelium; [1]
- (iii) Surface area;
a large surface area is provided by numerous alveoli in the lung; [2]
- (b) Surfactant reduces the surface tension in the water film on outer surface of alveoli/preventing water film within the alveoli coalescing/preventing the alveoli collapsing; [1]
5. (a) (i) Alveoli;
ventilation of lungs (bringing fresh air to alveoli)/rich blood supply (taking oxygen away from alveoli and bringing carbon dioxide to alveoli); [2]
- (ii) Decreasing the diffusion distance/thin membrane; [1]
- (iii) Thin (squamous) cells lining both alveoli and surrounding blood capillaries; [1]
- (b) Alveoli broken down (so reducing the surface area for gas exchange)/loss of elasticity in alveolar walls/alveoli stay inflated on expiration/difficulty in exhalation;
inhalation/exhalation delivers less air (to alveolar surface so affecting the concentration gradient)/inflammation of bronchi or bronchioles/narrowing of bronchi or bronchioles/build-up of mucus in bronchi or bronchioles; [2]