**Additional Exchange Answers**

**M1.**   (a)     (gills have) lamellae on filaments;  
lots of both;

**2**

(b)     (i)      all 3 go up; *Accept converse*

**1**

(ii)     more oxygen can be supplied;  
for more respiration; *Accept answer relating to CO2*

**2**

**[5]**

**M2.**          (a)     Small surface area to volume ratio;  
Loses less heat (to the water);

**2**

(b)     (i)      Diffusion through cell/body surface;

***Q*** *The key term here is diffusion*

**1**

(ii)     Small organisms have large surface area to volume ratio;  
Rate of diffusion depends on surface area;  
All parts of cell only a short distance from exchange surface;

**2 max**

(c)     Surface area of leaves;  
Different shoots will have leaves with different surface areas;

**2**

(d)     Draw line/curve of best fit/from line/curve of best fit;  
Find slope/gradient/divide distance moved by time;

**2**

(e)     1 Air enters through (open) spiracles;  
2 Through tracheae;  
3 Diffusion gradient in trachea  
4 Tracheae associated with all cells/closely associated with cells;  
5 Oxygen diffuses into cells;  
6 Ventilation replacing air in tracheae;  
7 Body covered with (waterproof) waxy layer/cuticle;  
8 Spiracles are able to close;

**6 max**

**[15]**

**M3.**          (a)     235–240;;  
*(one mark for an answer between 200-300  
based on 2 - 3 stomata in 0.01mm2Alternatively, one mark for calculating the area of the  
rectangle correctly as 0.016 – 0.017mm2)*

**2**

(b)     grows in arid / dry conditions;  
less surface area;  
(rate of) transpiration / water loss would be reduced;

**3**

**[5]**

**M4.** (a)     increasing carbon dioxide concentration / partial pressure;  
*(decrease in oxygen negates)*

**1**

(b)     (oxygen is used in) respiration;  
therefore diffuses (from tracheae) to tissues;  
oxygen unable to enter organism;

**2 max**

(c)     spiracles not open all the time;  
therefore there is less water loss  
(by diffusion through spiracles);

**2**

**[5]**

**M5** (a)     (i)      high/higher CO2 concentration / lack of oxygen;

**1**

(ii)     CO2 asphyxiates / is toxic;  
lack of oxygen for (aerobic) respiration;  
lack of energy / ATP (for pumping movements);  
reduced muscle function / muscle fatigue

**2 max**

(b)     removal of (excess) CO2 / oxygen to break down lactate / to  
repay oxygen debt/to enable aerobic respiration;

**1**

**[4]**

**M6.**          (a)     *(explanation must be linked to structures to gain second mark for each linked pair)*

|  |  |
| --- | --- |
| filaments/lamellae ; | large SA; |
| gill plates or secondary lamellae; |  |
| large number of capillaries; | to remove oxygen / to maintain a gradient; |
| thin epithelium; | short diffusion pathway; |
| pressure changes; | to bring in more water / to maintain gradient; |
| countercurrent flow (or description); | exchange/diffusion along whole length / concentration gradient maintained / equilibrium not achieved / blood always meets water with higher oxygen concentration; |

**6**

(b)     (i)      requires 20 cm3 of oxygen / extracts 7.2 cm3 of oxygen /

*reject if referring to volume of water*

**;

2.7/2.8 (dm3h–1);

*(correct answer award 2 marks)*

**2**

(ii)     high (relative) density/heavy;  
requires large input of energy;  
difficult to push back out;

**2 max**

(c)     (*for each pair second point must be linked to first*)  
to provide same amount of oxygen;   
need to have more water flowing over gills;  
OR  
metabolic rate/respiration increases (with increase in temperature);  
so more oxygen required;

**2 max**

**[12]**

**QWC 1**

**M7.**          (a)     Filaments/lamellae provide large surface area;

Thin/flattened epithelium/one/two cell layers so short diffusion  
pathway (between water and blood);

Countercurrent/blood flow maintains concentration/diffusion gradient;

***Q*** *Do not credit thin cell walls/membranes*

**2 max**

(b)     (i)      Large/wide range of values (so can fit on graph);

**1**

(ii)     Decrease in uptake with increase in mass/negative correlation;

**1**

(iii)     Enables comparison;

As animals differ in size/mass;

**2**

(iv)    Smaller animals have larger surface area to volume ratio;

*Allow converse for larger animals.*

*Allow appropriately named animal as an alternative to smaller or larger animals.*

Lose more heat per gram of tissue;

Respire more/faster (relative to body mass);

Oxygen used in respiration;

**3 max**

**[9]**