A-Level Biology

Gas Exchange

Mark Scheme

Time available: 62 minutes
Marks available: 48 marks

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1.

(a) Mark in pairs: 1 **and** 2 OR 3 **and** 4

1. Flattened cells

OR

Single layer of cells;

Reject thin cell wall/membrane

Accept thin cells

Accept 'one cell thick'

2. Reduces diffusion distance/pathway;

3. Permeable;

4. Allows diffusion of oxygen/carbon dioxide;

Ignore gas exchange

2

(b) Correct answer for 2 marks = 1.10–1.15;;

Accept for 1 mark,

0.6(1) : 1 (correct FEV_1 : FEC ratio)

2

(c) 1. Less carbon dioxide exhaled/moves out (of lung)

OR

More carbon dioxide remains (in lung);

2. (So) reduced diffusion/concentration gradient (between blood and alveoli);

3. Less/slower movement of carbon dioxide out of blood

OR

More carbon dioxide stays in blood;

3

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2.

(a) 1. Large(r) organisms have a small(er) surface area:volume (ratio);

OR

Small(er) organisms have a large(r) surface area:volume (ratio);

2. Overcomes long <u>diffusion</u> pathway

OR

Faster <u>diffusion</u>;

Accept short diffusion pathway

Accept for 'faster', more

2

(b) Mark in pairs, 1, **and** 2 OR 3. **and** 4.

1. Water has low(er) oxygen partial pressure/concentration (than air);

2. So (system on outside) gives large surface area (in contact with water)
OR
So (system on outside) reduces diffusion distance (between water and blood);

3. Water is dense(r) (than air);

4. (So) water supports the systems/gills;

2

(c) 1. In fish, blood leaving (V) has more oxygen than water leaving (E);

2. (But) in humans, blood leaving (V) has less oxygen than air leaving (E);

3. Difference in oxygen (concentration) between artery and vein is greater in fish than in humans;

4. (So) fish remove a greater proportion from the oxygen they take in;

2 max

(d) 1. Blood and water flow in opposite directions;

2. Diffusion/concentration gradient (maintained) along (length of) lamella/filament;

Accept for 2 marks, suitably labelled diagram

2

(e) 1. and 2. Correct answer for 2 marks, 4.3 (times greater);;

Accept for 1 mark,

4.333333333 (correct answer not given to 2 significant figures)

OR

Evidence of 130 (cm^3 kg^{-1}) **and** 30 (cm^3 kg^{-1})

Correct explanation for 1 mark,

3. Provides more oxygen for <u>respiration</u>;

3

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3. (a) 1. Diaphragm (muscle) contracts **and** external intercostal muscles contract;

Ignore ribs move up and out

2. (Causes volume increase and) pressure decrease;

3. Air moves down a pressure gradient

Ignore along

OR

Air enters from higher atmospheric pressure;

3

(b) K = Bronchiole **and**

L = artery/arteriole/vein/venule;

Reject capillary

Ignore pulmonary

1

(c) 1. This/animal/lung tissue does not contain starch;

Accept cell(s) for 'tissue'

2. (Makes) nucleus visible;

OR

Nucleus contains DNA;

2

(d) **In support**

1. (Link/risk with asthma and) living with cat or dog is (statistically) significant;

2. (Link with) obesity is most/highly significant;
Reject 'results are significant'

Not supported

3. (Link/risk with asthma and) burned wood (indoors) is not (statistically) significant;
Accept 'due to chance' for 'not significant' and converse

3

[9]

4.

(a) F = Filament **and**
G = (Secondary) lamella(e) / (gill) plate;
Reject gill arch
Accept primary lamella(e) for F

1

(b) 1. Water **and** blood flow in opposite directions;

2. Maintains diffusion/concentration gradient of oxygen
Accept: converse for carbon dioxide
Accept: equilibrium not reached

OR

Oxygen concentration always higher (in water);

3. (Diffusion) along length of lamellae/filament/gill/capillary;
Accept: all/whole of lamellae/filament//gill/capillary

3

[4]

5.

(a) 1. (Across) alveolar epithelium;

2. Endothelium / epithelium of capillary;
Incorrect sequence = maximum of 1 mark

2

(b) 1. (The alveolar epithelium) is one cell thick;
Reject thin membrane

2. Creating a short diffusion pathway / reduces the diffusion distance;

2 max

(c) **For**

1. Significantly higher concentrations of CO (compared with no smoking) with closed window (as no overlap in 2 × SD);

   Accept higher concentrations of CO with closed window are not due to chance

   Idea of higher is required, not just difference

2. Any increase in CO could be dangerous;
   OR
   CO causes less oxygen to be carried / provided (which could be deadly in children);

3. (significantly) higher levels after (just) 5 minutes (with closed windows supporting short journey statement);

   Idea of higher is required, not just difference

Against

4. No idea if (roughly) 5ppm is 'deadly';

5. No significant difference with open window (as 2 × SD overlaps);

   Accept difference with open window could be due to chance

6. No data on child breathing rates;
   OR
   Idea that children breathe faster but have smaller lung volume, so overall volume of CO inhaled could be similar;

4 max

[8]

6.

(a)
1. Contraction of internal intercostal muscles;
2. Relaxation of diaphragm muscles / of external intercostal muscles;
3. Causes decrease in volume of chest / thoracic cavity;
4. Air pushed down pressure gradient.

4

(b) 19(%);

1

(c)
1. Muscle walls of bronchi / bronchioles contract;
2. Walls of bronchi / bronchioles secrete more mucus;
3. Diameter of airways reduced;
4. (Therefore) flow of air reduced.

4

[9]