

Mark schemes

- 1**
- (a) 1. Many lamellae / filaments so large surface area;
2. Thin (surface) so short diffusion pathway;
1 & 2 must each have a feature and a consequence 2
- (b) 1. Water and blood flow in opposite directions; *Allow diagram showing counter-flow*
2. Blood always passing water with a higher oxygen concentration;
3. Diffusion gradient maintained throughout length (of gill)
OR
Diffusion occurs throughout length of gill
OR
If water and blood flowed in same direction equilibrium would be reached; 3
- [5] (a) 1. Contraction of internal intercostal muscles;
- 2**
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] (a) 1. Trachea and bronchi and bronchioles;
- 3**
2. Down pressure gradient;
3. Down diffusion gradient;
4. Across alveolar epithelium. *Capillary wall neutral*
5. Across capillary endothelium / epithelium. 4 max
- (b) (About) 80.0%. 1

- (c) 1. (Group **B** because) breathe out as quickly as healthy / have similar FEV to group **A**;
 2. So bronchioles not affected;
 3. FVC reduced / total volume breathed out reduced.

Allow this marking point for group C

3

[8] (a) Stomata per mm² or cm²

4 OR

Number per mm² or cm²;

Accept: mm⁻² or cm⁻².

Reject: per μm² or μm⁻².

Reject: the use of a solidus / as being equivalent to per.

Ignore: 'amount'.

1

- (b) 1. Single/few layer(s) of cells;
Accept: more/too many/overlapping.
*'Single layer' without reference to cells/tissue should **not** be credited.*
 2. So light can pass through;

2

- (c) 1. Distribution may not be uniform
OR
 So it is a representative sample;
Accept: more/fewer stomata in different areas.
Ignore: anomalies/random/bias.
 2. To obtain a (reliable) mean;
Accept: 'average'.

2

- (d) 1. Hairs **so** 'trap' water vapour and water potential gradient decreased;
 2. Stomata in pits/grooves **so** 'trap' water vapour and water potential gradient decreased;
 3. Thick (cuticle/waxy) layer **so** increases diffusion distance;
 4. Waxy layer/cuticle **so** reduces evaporation/transpiration.
 5. Rolled/folded/curled leaves **so** 'trap' water vapour and water potential gradient decreased;
 6. Spines/needles **so** reduces surface area to volume ratio;
*1, 2 and 5. Accept: humid/moist air as 'water vapour' but **not** water/moisture on its own.*
1, 2 and 5. Accept: diffusion gradient as equivalent to water potential gradient.
1, 2 and 5. Accept: less exposed to air as an alternative to water potential gradient.

6. *Accept: spines/needles so 'reduce area'.*

2 max

- (e) 1. Water used for support/turgidity;
2. Water used in photosynthesis;
3. Water used in hydrolysis;
4. Water produced during respiration;

2 max

[9] (a) (Simple) diffusion;

5

Reject: facilitated diffusion.

1

- (b) 1. Thin/small **so** short diffusion pathway;
Reject: thin membrane/wall/cells.
2. Flat/long/small/thin **so** large surface area to volume ratio/surface area : volume;
Accept: small volume to surface area ratio.

2

- (c) 1. High/50% saturation (with oxygen) below (pO_2 of) 0.2 kPa;
Accept: fully saturated or above 50% saturation below 0.2kPa.
Accept: any number between 0.08 and 0.2 kPa
2. (Oxygen) for respiration;

2

- (d) 1. Water potential higher in worm
OR
Lower water potential in seawater;
Accept: correct reference to water potential gradient if direction of water movement is given.
Accept: ψ for water potential.
2. Water leaves by osmosis (and worm dies);
Reject: worm/cells burst.

2

[7] (a) 1. Large sample size;

6

Accept: 20 + as equal to large sample size.

2. Individuals chosen at random;
3. Are healthy;
4. Equal number of males and females;
Accept: same sex/gender.
5. Repeat readings;

2 max

- (b) 1. (For) comparison;
Accept: provides a benchmark/standard.

2. To see effect of age/emphysema/smoking
OR
Takes into account outliers/anomalous results;

2

- (c) Internal intercostal muscle(s) less effective
OR

Less elasticity (of lung tissue);

Accept: different descriptions of less effective.

Recoil without reference to elasticity is insufficient.

Accept: 'less elastin'.

1

- (d) 1. Less carbon dioxide removed;
Accept: carbon dioxide increases/high (in body/blood).
1 and 2. Accept: 'low amount' as equivalent to 'less'.
2. Less oxygen (uptake/in blood);
Accept: less oxygen inhaled.
2 and 3. Accept: less oxygen for respiration = 2 marks.
3. Less (aerobic) respiration/ATP
OR
(More) anaerobic respiration;
Accept: (more) lactic acid.

3

- [8]** (a) 1. Diaphragm moves up /becomes dome shaped;

7

2. Reduces volume of thorax / increase pressure in thorax;
Accept 'space' for volume, chest/lungs for thorax
3. Pressure in thorax **higher** than outside (air);
Accept chest/lungs

3

- (b) 1. FEV₁ of those who have stopped smoking increased after 1 year whereas the FEV₁ of smokers decreased;
Comparison required
2. (Between years 1 and 5, FEV₁ of both decreases but) the rate of decrease in FEV₁ of smokers is faster than those who stopped smoking;
Idea of a faster rate of decrease in smokers, not just quoting final FEV values

2

- (c) 1. Airways are narrowed/blocked;
2. Excess mucus (in airway);
3. Inflammation (of airways);
4. Elasticity is lost/scar tissue builds up;
Ignore answers in the context of reduced surface area of alveoli or increased diffusion distance

8

- (a) (i) Spiracle;

Accept: Spiracles

1

- (ii) Tracheole/trachea;

Accept: Tracheoles/tracheae

Ignore: System

1

- (b) 1. Oxygen used in (aerobic) respiration;
2. (so) oxygen (concentration) gradient (established);

Accept description of gradient

Ignore: 'along gradient idea' unless direction is made clear

Ignore: movement through gas/water

Reject: gradient in wrong direction

3. (so) oxygen diffuses in; 2 and 3.

Accept: oxygen moves down a diffusion gradient for 2 marks

3

- (c) 1. Abdominal pumping/pressure in tubes linked to carbon dioxide release;

MP1 relates to description of link shown in graphs

2. (Abdominal) pumping raises pressure in body;

Needs idea of causation, not just description of correlation

3. Air/carbon dioxide pushed out of body /air/carbon dioxide moves down pressure gradient (to atmosphere);

Reject ref to concentration gradients/diffusion

3

[8]

9

- (a) (Scientists) used fully grown leaves / used five plants of each (species).

Ignore other references to methodology. Reward only information provided in the Resource.

Do not accept reference to number of leaves – different plants were used.

1

- (b) Either

1. Draw around leaf on graph paper;

Mark as a trio – MP1, MP2 and MP3 OR MP4, MP5 and MP6. Do not mix and match.

Both aspects needed for mark – drawing and type of paper.

2. Count squares (however described);

There is no reward for additional detail e.g. dealing with part squares.

3. Multiply by 2 (for upper and lower leaf surface);
OR
4. Draw around a leaf on paper of known mass (per unit area);
Both aspects needed for mark – drawing and mass of paper.
5. Cut out *and* weigh;
6. Multiply by 2 (for upper and lower leaf surface).

3

(c) (i) Species **B** (no mark)

1. Smaller surface area

so

less evaporation / less heat absorbed;

Correctly selected feature and the explanation required for 1 mark.

In all marking points – ‘less water loss’ is insufficient as an explanation but accept transpiration for evaporation or diffusion.

2. Thicker leaves

so

greater diffusion distance (for water);

Accept ‘thicker leaves so more water storage’.

3. Fewer stomata / lower stomatal density so less
diffusion / evaporation (of water);

4. Smaller surface area to volume ratio so less
evaporation.

1 max

(ii) 1. Thick(er) cuticle

so increase in

diffusion

distance / slower (rate of) diffusion;

Feature and explanation needed for each mark.

Reject other features not related to leaves.

Reject features related to water storage.

‘Cuticle’ alone is insufficient (all leaves have a cuticle). Reject suggestion of ‘less’ diffusion, for idea of ‘slower diffusion’, an idea of rate is required.

2. Hairs on leaves

so

reduction in air movements / increase in humidity / decrease in water potential gradient;

3. Curled leaves

so

reduction in air movements / increase in humidity / decrease in water potential gradient;

4. Sunken stomata

so

reduction in air movements / increase in humidity / decrease in water potential gradient.

2 max

(d) Small leaves / surface area so (total) number of stomata is low.

Both aspects needed for mark.

1

[8]

10

(a) 1. (No grease)

means stomata are open

OR

allows normal CO₂ uptake;

Allow 'gas exchange' for CO₂ uptake.

'As a control' is insufficient on its own.

2. (Grease on lower surface) seals stomata

OR

stops CO₂ uptake through stomata

OR

to find CO₂ uptake through stomata

OR

shows CO₂ uptake through cuticle / upper surface;

3. (Grease on both surfaces) shows sealing is effective

OR

stops all CO₂ uptake.

3

(b) (i) 1. (Mean rate of) carbon dioxide uptake was constant *and* fell after the light turned off;

Ignore absence of arbitrary units in both marking points.

Both ideas needed for mark.

Accept 'stayed at 4.5' as equivalent to 'was constant'.

2. Uptake fell from 4.5 to 0 / uptake started to fall at 60 minutes and reached lowest at 80 minutes / uptake fell over period of 20 minutes;
One correct use of figures required.

Accept fell to nothing / no uptake for 0.

2

- (ii) 1. (Because) water is lost through stomata; 2. (Closure) prevents / reduces water loss;
3. Maintain water content of cells.
This marking point rewards an understanding of reducing water loss e.g. reduce wilting, maintain turgor, and is not related to photosynthesis.

2 max

- (c) (i) (Carbon dioxide uptake) through the upper surface of the leaf / through cuticle.

1

- (ii) 1. No use of carbon dioxide in photosynthesis (in the dark);
2. No diffusion gradient (maintained) for carbon dioxide into leaf / there is now a diffusion gradient for carbon dioxide out of leaf (due to respiration).

2

[10]

11

- (a) 1. Other gases / nitrogen / water vapour in atmosphere / **A**;
2. Only oxygen and carbon dioxide in gas mixtures / **C** and **D**;
3. Composition of / gases in **A** not controlled / composition of gas mixtures / **C** and **D** controlled.

2 max

- (b) 1. Breathing rate *lowest* when no carbon dioxide / in (pure) oxygen / **B**;
Idea of 'lowest' must be stated.
2. (Generally) presence of carbon dioxide increases breathing rate / as concentration of carbon dioxide increases breathing rate increases / there is a positive correlation;
A general point incorporating all concentrations.
3. Breathing rate increases when (carbon dioxide) higher than 0.1% / concentration in atmosphere / **A**;
This MP requires a specific comparison to 0.1% or the atmospheric concentration.
Accept 'gas mixtures 1 and 2 / C and D' for 'higher carbon dioxide'.
4. Breathing rate of **grasshopper 3** falls in **D** / 16% / gas mixture 2 (whereas others increase).
Restating data alone is insufficient for any mark point.

3 max

- (c) (i) 54;
OR
1. Correct data / column **A** chosen;
A correct answer of 54 gets 2 marks.
MP1 and MP2 allow a possible mark for an incorrect calculation or choice of wrong data.

2. Correct calculation of mean from data chosen;
Check – the three values must be from same column.

2 max

- (ii) 1. Small sample / only 3 (grasshoppers) so may not be representative (of all grasshoppers / insects);
2. Grasshoppers are not the only insects / species; so genetic / behavioural / metabolic differences;
3. (Insects) not all mature / are at different stages of development / different sizes; so different metabolic rates;
4. Movement not restricted / not at rest in meadow; so (rate of) respiration higher;
5. (Naturally-occurring) carbon dioxide concentration lower in meadow; so breathing rate lower;

Explanations required, therefore both parts of answer required for credit in each marking point.

Accept appropriate converse answers.

Accept 'respiration' for 'metabolism' and vice versa.

3 max

- [10] (a) Fish keep moving / swimming / movement of gill covers too fast to count (at higher

12

temperatures).

Accept converse.

Reject personal errors e.g. with counting.

Neutral – 'water not clear' or 'difficult to see movement of gill covers'.

1

- (b) 1. There is only one dependent variable / there are not two dependent variables / water temperature is the independent variable / breathing rate is dependent on water temperature;

Accept either approach for 1 mark.

For 'independent' accept 'manipulated'.

Reject – 'need two continuous variables'.

2. Water temperature *plus* breathing rate are not both properties of fish
or water temperature plus breathing rate are not both properties of water.

Accept reference to the 'two variables' (instead of water temperature plus breathing rate)

1 max

- (c) (i) As (water) temperature increases, oxygen (concentration / solubility) falls and ventilation rate increases.

MP requires all 3 aspects before credit is possible. The correct context is required for each aspect so e.g. do not reward 'as oxygen concentration falls, water temperature increases' or 'as temperature increases, ventilation rate increases and oxygen concentration falls'.

1

- (ii) 1. As concentration / solubility of oxygen falls less oxygen flows over gills / less oxygen enters gills / less oxygen enters fish;
*For MP1 and MP2 accept converse.
Both aspects needed for mark.*
2. (As a result) blood oxygen (concentration) falls / is lower;
3. An increase in ventilation rate increases / maintains the flow of oxygen / carbon dioxide across gills / into (or out of) fish; *Accept idea in relation to either gas or 'gas exchange'.*
4. Maintains diffusion / concentration gradient(s) (in gills); *Gradient(s) relates to either / both gas(es).*
5. To maintain oxygen supply to cells / tissues / organs / to maintain respiration.
Accept a named example of 'tissues' e.g. muscle.

3 max

- [6] (a) 1. Water and blood flow in opposite directions;

13

Accept: diagram if clearly annotated

2. Maintains concentration / diffusion gradient / equilibrium not reached / water always next to blood with a lower concentration of oxygen;
*Must have the idea of 'maintaining' or 'always' in reference to concentration / diffusion gradient
Accept: constant concentration / diffusion gradient*
3. Along whole / length of gill / lamellae;
Accept: gill plate / gill filament

3

- (b) 1. (Thicker lamellae so) greater / longer diffusion distance / pathway; **Q**
Neutral: 'thicker' diffusion pathway

2. (Lamellae fuse so) reduced surface area;
Accept: reduced SA:VOL

2

- (c) (i) Correct answer of **5.1** or **5.14(2857)** (dm³) = 2 marks;;

Allow 1 mark max for an answer of **5** if the correct answer of **5.1** or **5.14(2857)** is **not** shown

One mark for incorrect answers that show **36** or **0.4 × 90** or **90 ÷ 7**;

2

- (ii) 1. Increased metabolism / respiration / enzyme activity;
Accept: enzymes work more efficiently
2. Less oxygen (dissolved in water);
Neutral: references to increased kinetic energy (of water molecules)

1 max

[8] (a) 1. Protein synthesis **and** cell wall synthesis **and** cell expansion

14

stop at -0.7 / at a *higher* water potential than other two;

If all 3 are correctly identified in marking point 1, accept 'the others / the other two' in marking point 2, and vice versa

2. Photosynthesis **and** stomatal opening stop at -1.5 / at a *lower* water potential than other three;

Correct processes must be named in at least one of marking point 1 or marking point 2

Where reference to water potential differences are made, they must be comparative, eg 'higher'

2

- (b) 1. Stomata allow uptake of carbon dioxide;
2. Carbon dioxide used in / required for photosynthesis;

2

- (c) 1. Growth involves cell division / cell expansion / increase in mass; *Marking point 1 is for the principle*

2. Protein synthesis stops **so** no enzymes / no membrane proteins / no named protein (for growth / division);

Marking points 2, 3 and 4 require appreciation of 'why' before credit can be awarded

'named' protein must relate to proteins involved in growth or cell division

3. Cell wall synthesis stops **so** no new cells can be made;

Full credit is possible without a statement of the principle (marking point 1)

4. No cell expansion / increase in mass **because** (cells) stop taking up water;

3 max

- (a) (i) (Simple) diffusion;

[7]

15

Reject facilitated diffusion

Accept lipid diffusion

1

- (ii) 1. Thin walls / cells;
1. *'Short diffusion pathway' alone is an explanation not a description*
 1. *Accept squamous epithelia / one cell thick*
2. (Total) surface area is large;
2. *Ignore references to 'volume ratio'*

2

- (b) 1. Loss of elasticity / elastic tissue / increase in scar tissue;
1. *Accept elastin*
 2. Less recoil;

2

[5]

FOR

16

1. (If the husband smokes) there's a greater risk of dying from lung cancer / emphysema/ cervical cancer;
2. The more the husband smokes, the greater the risk of dying from lung cancer /emphysema;
3. Suitable use of figures from the table to illustrate answer;

AGAINST

4. Little difference in risk of dying of stomach / heart disease;
5. Other factor (than husband smoking) / named factor might cause death;
6. Only one sample / further studies needed;

4 max

[4] (a) Correct answer of $342.8 - 343 = 2$ marks;;

17

Credit incorrect answers that show the numerator as 144 (or $186-42$) or denominator as 42 for 1 mark;

2

- (b) 1. More air / oxygen enters / air / oxygen enters quickly / quicker;
1. *Accept: converse for carbon dioxide*
 1. *Can be in any correct context eg insect, tracheoles, muscle*
 1. *Neutral: air / oxygen enters*

(So) maintains / greater diffusion or concentration gradient;

2

(c) Large(r) SA:VOL / short(er) diffusion distance (to tissues);

Accept: thin diffusion pathway

1

(d) 6 / 6.6 / 6.7 / 7 / 7.5 / 8 = 2 marks;;

Different answers given for different interpretations of the graph

Award 1 mark for incorrect answers that have divided 60 by any number;

2

(e) Less / no water lost / (more) water retained;

Accept: less dehydration / less evaporation

Q Reject: less 'transpiration'

Q Reject: less water lost by osmosis

1

(f) 1. Greater surface area exposed to air;

Neutral: shorter diffusion distance

2. Gases move / diffuse faster in air than through water;

2. **Q Neutral:** 'harder to diffuse'

2. *Accept gases diffuse directly, rather than through water*

3. Increases volume / amount of air;

1 max

[9] (a) (P) Trachea / windpipe and (Q) bronchus;

18

For P or Q, accept (ring of) cartilage (i.e. not for both)

Accept bronchi

Reject bronchioles

Ignore reference to left or right lung

1

(b) 1. Increases volume (in lungs / thorax);

Context must be lungs / thorax

Ignore space increases

2. Lowers pressure (in lungs / thorax);

Accept lungs / chest expand

Ignore reference to 'change in pressure'

3. Air (pushed) in by higher outside pressure / down pressure gradient; *Ignore reference to 'sucked in'*

2 max

19

- (a) 1. The more recent the sample the greater the concentration;

Accept converse

This could be expressed by reference to time e.g. 'concentration has increased since 25 000 years ago'

2. Increases most in last 5000 years / more or less constant / slight increase between 30 000 and 15 000 years ago;

2

- (b) 1. Variation in data / spread of data;

Reject references to range e.g. 'range of data'

2. Around the mean;

Both marks are possible in the context of using the data

2

- (c) 1. Yes as pine leaves not in organic matter of the same age;

2. No as organic matter would be the same age as the pine leaves;

Accept either approach

1 max

- (d) Can get more CO₂ for photosynthesis;

More CO₂ enters leaf is insufficient.

Accept light-independent (reaction) as equivalent

1

- (e) Any **three** from:

1. (Overall data show) negative correlation;

Do not allow description of correlation because in question stem

2. Little change in number of stomata in last 10 000 years;

3. Small sample size;

4. Only one species studied;

5. Other factors / named factor may have affected number of stomata;

6. Evidence does not support the conclusion between 30 000 and 25 000 years ago / between 5000 years ago and present day;

Accept reference to either one of these age ranges

7. Appropriate reference to standard deviations (in comparing means);

E.g. no overlap between 15 000 and 10 000 years ago

3 max

(f) Any **three** from :

1. Thick cuticle;
2. Small leaves / low surface area;
Accept other ways of describing 'small', e.g. 'needle-like'
3. Hairy leaves;
4. Sunken stomata;
5. Rolled leaves;

3 max

[12] (a) 1. Random;

20

Random number generator = 2 marks

2. Method e.g. number generator / number out of a hat;
Same age = 2 marks

OR

3. Matched / all the same;
4. For e.g. age / sex;

2 max

(b) 1. (Differences) are real / significant / not due to chance; *It = the difference*

2. (As) bars / SDs do not overlap;
2. Accept: 'standard errors do not overlap' as told 'standard deviation' in the question stem

2

(c) 1. No / slight (placebo) effect;

2. Group **2** and **3** results are similar / the same / SDs / bars overlap;
2. Accept: other descriptions of Groups 2 and 3
2. Accept: that Groups 2 and 3 are not significantly different

2

(d) 1. (Allows) anomalies to be identified / ignored / effect of anomalies to be reduced / effect of variation in data to be minimised / concordant results;

Accept: 'outliers' instead of anomalies

1. Reject: idea of not recording anomalies / preventing anomalies from occurring

1. Accept: 'cancels out anomalies' as bottom line response

2. (Makes) average / mean (more) reliable;

2. Q Neutral: makes the average / mean more accurate

2. Ignore: 'more reliable' alone

2

(e) (i) 1. Unethical / unfair not to treat patients;

2. Dangerous / could cause an asthma attack;

1 max

(ii) 1. Ensures normal treatment does not affect results / improvements are only due to the spray;

2. (As) normal treatment is short-lived / effective for less than 24 hours / (24h) is long enough for normal treatment to wear off;

2

(f) (i) 1. (Improvement scores) are qualitative / subjective / rely on own judgement / different patients may assess symptoms differently;

Accept: converse arguments for measuring FEV₁ e.g. quantitative / objective patients cannot lie

2. Some patients may lie / exaggerate / want to please doctors;

1. Neutral: empirical evidence

2

(ii) 1. Not blind / patients knew they were not receiving treatment / patients did not receive treatment;

2. (So) more likely to underestimate / give lower scores / did not expect to improve / less improvement;

2

[15] (a) 1. Flatten / moves down;

21

1. *Ignore: additional information about rib movements*

2. (Diaphragm muscle) contracts;

2

(b) 1. Diaphragm contracts / moves down / flattens; *Ignore refs to rib movement*

2. Increases volume (of thorax) and decrease in pressure;

2. *Accept pressure lower than atmospheric pressure*

3. Air moves from high to lower pressure / down pressure gradient; *3. Reject: by diffusion*

3

(c) 1. Diffusion;

Accept down diffusion gradient

2. Across (alveoli) epithelium / (capillary) endothelium;
2. Accept: capillary epithelium / squamous cell

2 max

[7] (a) (i) Diffusion;

22

Ignore references to structures, membrane components etc

Allow simple diffusion

Reject facilitated diffusion

1

- (ii) 1. (Thin / flat body) so short distance for diffusion / short diffusion pathway;
Ignore references to membrane, wall, body surface

2. (Thin / flat body so) large surface area to volume ratio;
'It' refers to flatworm's body

2

- (b) (i) A group of tissues;

Ignore references to function Group = more than one

1

- (ii) 1. (Carbon dioxide enters) via stomata;
Reject stroma

2. (Stomata opened by) guard cells;

3. Diffuses through air spaces;

Allow concentration gradient. Reject along gradient unless direction made clear

4. Down diffusion gradient;

3 max

[7]

- (a) 1. (Diaphragm / diaphragm muscle) relaxes / relaxed;

23

Ignore references to inhalation, intercostal muscles or ribs if given as additional information.

2. Domed shape / (diaphragm) moves up;

3. Increases pressure and decreases volume;

3

- (b) 1. Extend / extrapolate curve / graph;

2. (Read off where) it flattens / reaches maximum / peaks;

2

- (c) 1. (Without inhaler) narrower bronchioles / bronchioles not dilated as muscle (surrounding bronchioles) contracted;

Assume answer relates to Curve A, unless otherwise stated.

2. Less air able to pass through / more difficult for air to pass through;

2

- [7] (a) 1. Haemoglobin carries oxygen / has a high affinity for oxygen / oxyhaemoglobin;

24

2. Loading / uptake / association in lungs;

3. at high p.O₂;

4. Unloads / dissociates / releases to respiring cells / tissues;

5. at low p.O₂;

6. Unloading linked to higher carbon dioxide (concentration);

6. Ignore reference to incorrect pH in relation to effect of higher carbon dioxide concentrations for marking point

6

- (b) 1. Allows comparison;

Do not credit 'temperature affects results' on its own;

2. (Different temperature) affects enzymes;

2. *Allow reference to denaturation of enzymes.*

3. (Different temperature) affects respiration / metabolism;

4. (Different temperature) affects amount of dissolved oxygen;

2 max

- (c) 1. Increases then levels out / stops increasing / fluctuates slightly;

2. At 5 (cm³ dm⁻³) / 320 (cm³ g⁻¹h⁻¹);

Allow description of 'fluctuates slightly' in terms of candidate quoting figures after 320.

2

- (d) 1. *Chronimus longistylus* has higher uptake at low (oxygen) concentrations;

Chronimus longistylus has higher uptake to (oxygen concentration of) 2 / lower uptake after 2; (= 2 marks)

2. (Higher uptake) up to 2 cm³ dm⁻³;

2. Award mark if candidate uses figures from table e.g. higher at concentration 1 (220) or concentration 2 (285). Higher uptake at concentration 1 or 2 = 2 marks.

2

(e) (i) More (than in African) lost via gills in Australian lungfish / less (than African) lost via lungs in Australian lungfish;

1

(ii) 1. More / most exchange is via lungs (in African lungfish);

1. Allow converse for first point.

2. Gills will not function / function less efficiently (in air);

Allow water is required for gills to function.

2

[15] (a) Something that increases chance / increases probability / makes it more likely;

25

1

(b) (i) 1976 - / to / and 1980;

1

(ii) 1980 - / to / and 1996;

1

(c) 1. Correlation does not mean that there is a causal relationship;

1. Do not accept casual

2. May be some other factor / named factor associated with vehicles and asthma / producing rise in both;

3. (After 1980) asthma continues to rise but exhaust concentration falls / negative correlation (after 1980);

3

[6] (i) (Lung volume) increases / reaches a maximum (at B);

26

Do not negate mark for 'breathing out' if qualified e.g. when (lung volume) decreases

1

(ii) Flattens / lowers / moves down;

(Diaphragm / muscle) contracts;

Reject: second mark only if intercostal muscles cause the diaphragm to flatten

2

[3]

(a) 1. (Simple / facilitated) diffusion from high to low concentration / down concentration

27

gradient;

Q Do not allow across / along / with concentration gradient

2. Small / non-polar / lipid-soluble molecules pass via phospholipids / bilayer;

Reject: named molecule passing through membrane by an incorrect route

Accept: diagrams if annotated

OR

Large / polar / water-soluble molecules go through proteins;

3. Water moves by osmosis / from high water potential to low water potential / from less to more negative water potential;

4. Active transport is movement from low to high concentration / against concentration gradient;

*Only penalise once if active transport is not named
e.g. 'movement against the concentration gradient involves proteins and requires ATP' = 2 marks*

5. Active transport / facilitated diffusion involves proteins / carriers;

Accept: facilitated diffusion involves channels

Reject: active transport involves channels

6. Active transport requires energy / ATP;

7. Ref. to Na⁺ / glucose co-transport;

Credit ref. to endo / exocytosis as an alternative

5 max

(b) 1. Many alveoli / alveoli walls folded provide a large surface area;

Neutral: alveoli provide a large surface area

2. Many capillaries provide a large surface area;

3. (So) fast diffusion;

Neutral: greater / better diffusion

Neutral: fast gas exchange

Allow 'fast diffusion' only once

4. Alveoli or capillary walls / epithelium / lining are thin / short distance between alveoli and blood;

Reject: thin membranes / cell walls

Accept: one cell thick for 'thin'

5. Flattened / squamous epithelium; *Accept: endothelial*

6. (So) short diffusion distance / pathway;

7. (So) fast diffusion;

8. Ventilation / circulation;

Accept: descriptions for ventilation / circulation

9. Maintains a diffusion / concentration gradient;

10. (So) fast diffusion;

Do not double penalise if description lacks detail

e.g. thin membranes so a short diffusion distance = 1 mark

5 max

[10]