

Mark schemes

- 1**
- (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**
- [6]** (a) Phagocytes engulf / ingest pathogens / microorganisms / bacteria / viruses;
- 2**
- Phagocytes destroy pathogens / microorganisms / bacteria / viruses;
- Lung diseases are caused by pathogens / microorganisms / bacteria / viruses;
- Q Allow description of process of engulfing*
- 2 max**
- (b) (i) Alveoli / lungs will not inflate / deflate fully / reduced lung capacity;
- Breathing out particularly affected / no longer passive;
- 2**
- (ii) Alveolar walls thicken;
- Longer diffusion pathway;
- Scarred / fibrous tissue;
- Reduces surface area (for gaseous exchange);
- Q Diffusion is essential for 2nd point and surface area for 4th point.*
- 4**
- (c) (i) Cancer develops 20 – 30 years after exposure (to asbestos);
- 1**
- (ii) Smoking / air pollution / specified industrial source;

- (a) 1. Large surface area provided by lamellae / filaments increases diffusion / makes **3** diffusion efficient;;

Q Candidates are required to refer to lamellae or filaments. Do not penalise for confusion between two

2. Thin epithelium / distance between water and blood;
3. Water and blood flow in opposite directions / countercurrent;
4. (Point 4) maintains concentration gradient (along gill) / equilibrium not reached /as water always next to blood with lower concentration of oxygen;
5. Circulation replaces blood saturated with oxygen;
6. Ventilation replaces water (as oxygen removed);

6

- (b) Mixing of air and water (at surface);

Air has higher concentration of oxygen than water;

Diffusion into water;

Plants / seaweeds near surface / in light;

Produce oxygen by photosynthesis;

2 max

- (c) Not much oxygen near sea bed;

Toadfish haemoglobin (nearly) saturated / loads readily at / has higher affinity for oxygen at low partial pressure (of oxygen);

2

- (d) The chimpanzee and the bonobo are more closely related (than to the gorilla);

They have identical amino acids / one of the amino acids is different in the gorilla;

2

[12] (a) Lengthways / down the root;

4

Through one tissue only / through same part / same proportion of tissues;

2

- (b) To prevent the water from evaporating / prevent evaporation;

Changing the concentrations / water potential (of solution);

2

- (c) (i) Plot data on a graph;

Find (sucrose concentration) from the graph where the ratio is 1;

2

(ii) No, because the results are given as a ratio / as a proportion of initial length;

1

[7] (a) (i) Many people do not go to the doctor;

5

1

(ii) 36000;

No marks awarded for working here as calculation is very straightforward

1

(b) Same sugars / antigens on bacteria / nerve cells;

Do not accept references to same shape as equivalent to complementary.

Bind with antibody / form antigen-antibody complex;

Reject react

Have complementary shape / fit binding site;

Reject active site

3

(c) Diaphragm will not move down / flatten / contract;

Ignore references to breathing out

Thoracic cavity / lung volume not increased so cannot breathe in;

2

[7]

General principles for marking the Essay:

6

Four skill areas will be marked: scientific content, breadth of knowledge, relevance and quality of language. The following descriptors will form a basis for marking.

Scientific content (maximum 16 marks)

Category	Mark	Descriptor
	16	
Good	14	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	12	

	10	
Average	8	A significant amount of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A-level study. Generally accurate with few, if any fundamental errors. Shows a sound understanding of most of the principles involved.
	6	
	4	
Poor	2	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A-level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	0	

Topics

3.1.7 Water

3.2.3 Transport across cell membranes

3.3.1 Surface area to volume ratio

3.3.2 Gas exchange

3.3.3 Digestion and absorption

3.3.4 Mass transport

3.5.3 Energy and ecosystems

3.5.4 Nutrient cycles

3.6.4 Homeostasis is the maintenance of a stable internal environment

Breadth of Knowledge (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all areas that might realistically be covered on an A-level course of study.
2	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
1	Unbalanced account with all or almost all material based on a single aspect
0	Material entirely irrelevant.

Relevance (maximum 3 marks)

Mark	Descriptor
3	All material presented is clearly relevant to the title. Allowance should be made for judicious use of introductory material
2	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
1	Some attempt made to relate material to the title but considerable amounts largely irrelevant.

0	Material entirely irrelevant or too limited in quantity to judge.
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Quality of language (maximum 3 marks)

Mark	Descriptor
3	Material is logically presented in clear, scientific English. Technical terminology has been used effectively and accurately throughout.
2	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate.
1	The essay is generally poorly constructed and often fails to use an appropriate scientific style and terminology to express ideas.
0	Material entirely irrelevant or too limited in quantity to judge.

[25]

Additional notes on marking this question

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will be. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

- (a) Two marks for correct answer of 64.285 / 64.3 / 64;

7

(allow 1 mark for (8100 / 100 × 30) / 37.8)

2

- (b) dissolve in / add ethanol then mix with water; emulsion / white colour indicates triglycerides present;

2

- (c) (i) increase the surface area for absorption;

(ignore wrong ref. to name)

1

- (ii) **R** = tissue fluid / interstitial fluid / extracellular fluid / intercellular space;

S = lymph(atic) vessel / lymph capillary / lacteal;

2

- (iii) proteins are synthesised by **U**; involvement of ribosomes; protein isolation / transport (inside RER); vesicle formation;

2 max

- (iv) exocytosis / description of; because of size / too large to leave by other methods;

2

[11] (a) (Small alveoli with) large surface area;

8

For diffusion;

2

- (b) (i) Epithelium / epithelial / squamous / pavement cells; *Reject endothelium.*

1

- (ii) 0.11 μm ;

1

- (c) (i) Less oxygen / more carbon dioxide / more water vapour; *Two differences required, but only one mark for this part of the question.*

1

- (ii) Gas exchange takes place in alveoli / does not take place in trachea;

1

- (d) (i) Pulmonary artery;

1

- (ii) Concentrations reach equilibrium / become equal; Diffusion occurs when there is a concentration gradient (so some will remain in blood);
OR
Lung cells / vessel cells respire;
Add / produce carbon dioxide;

2

[9] (a) Muscles (associated with breathing) relax;

9

1

- (b) Produces lower pressure (and air moves in down pressure gradient);

1

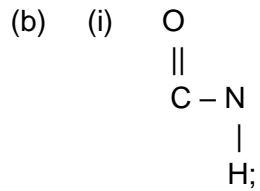
[2] (a) Rate of movement / diffusion proportional to concentration gradient /

10

difference in concentration;

High concentration of potassium ions inside cell compared to outside;
Must mention high concentration. Ignore reference to other factors if reasoning is appropriate.

2



1

(ii) 10;

1

(c) Action of vanilomycin depends on fluidity of membrane;
Fluidity reduced / not fluid at low temperatures;
Pore formed by gramicidin A remains in place / permanent;

3

(d) Pore between sterol molecules lined with polyene antibiotic;
Hydrophobic region next to sterol;

2

[9]

(a) Large surface area to volume ratio;

11

For diffusion;

OR

Flat / thin;

So oxygen can reach all haemoglobin / centre rapidly / short pathway;

max 2

(b) (i) Partially permeable / allows water through but not sucrose;
Accept semi-permeable / selectively permeable.

1

(ii) Phospholipid (in membrane) / bilayer dissolved / broken down;
Allows haemoglobin / contents to leak out;

2

[5] (a) Epithelium of alveolus, capillary wall / epithelium / endothelium, plasma;

12

1

(b) Cell wall;
Capsule;
Flagellum;
Mesosomes;
Plasmid;
Genetic material / DNA / nucleoid;
Ribosomes;

Accept references to size only if some idea of range is given

max 2

(c) Large (surface) area; For diffusion;
or

Short distance to centre of cell / to all haemoglobin;
For diffusion;

2

(d) (i) Correct answer of approximately $7800 / 8000 = 2$ marks
Incorrect answer but clearly derived by
dividing diameter of cell A by 7 = 1 mark

2

(ii) Idea of cut through maximum diameter / middle;

1

[8]

(a) (gills have) lamellae on filaments;

13 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] (i) (waxy so) impermeable to water / waterproof / stops water

14 passing through;

1

(ii) reference to hairs / position of stomata (sunken stomata /
stomata in pits)

LINKED to reduced air movement / trap layer of air /
trap water vapour (*reject water*) / maintains humidity;

reduces diffusion gradient / concentration gradient of water /
water potential gradient;

OR

stoma can close;

reduces area for evaporation or transpiration;

2

[3] (a) shallow roots enable rapid uptake of rainfall (in X and / or Z);

15

widespread / shallow roots allow collection of larger volume water / over a larger area / rapid uptake of water (in **Z**); swollen stem for water storage (in **X**); deep roots for accessing deep groundwater (in **Y**); small / no leaves so little transpiration;

3

- (b) **Z**; wide spread of roots for rapid water absorption;
(accept **X**; if linked to leaves channelling water to roots)
(ignore references to water storage abilities)
(accept other responses if justified)

2

[5]

- (a) (i) one feature;

16

then linked Explanation;

(many) filaments / lamellae / secondary lamellae;
so large surface area;

large number of capillaries; (NOT "good blood supply")
maintains a diffusion gradient / removes oxygen;

thin epithelium / lamellae wall;
short diffusion pathway;

2

- (ii) maintains diffusion / concentration gradient / equilibrium not reached;
diffusion occurs across whole length (of lamellae / gill);

2

- (b) less energy needed / continuous flow of water or O₂;

1

[5] (a) transmission / reflected / misses chlorophyll / chloroplasts / wrong wavelength;

17

1

- (b) (larger area) to absorb light;
(larger surface area) to absorb carbon dioxide;
short diffusion pathway for gases / oxygen / CO₂;
light able to penetrate to all cells;

2 max

- (c) effect; detail; effect on photosynthesis; some effects are less light / light absorbed by water different wavelength of light temperature

availability of carbon dioxide
availability of water

(more than one effect award 1 mark only)

3

[6] (a) 1. mouth opens, operculum / opercular valve shuts;

18

2. floor of mouth lowered;
3. water enters due to decreased pressure / increased volume;
4. mouth closes, operculum / opercular valve opens;
5. floor raised results in increased pressure / decreased volume;
6. high / increased pressure forces / pushes water over gills;

4 max

- (b)
1. alveoli provide a large surface area;
 2. walls of alveoli thin to provide a short diffusion pathway;
 3. walls of capillary thin / close to alveoli provides a short diffusion pathway;
 4. walls (of capillaries / alveoli) have flattened cells;
 5. cell membrane permeable to gases;
 6. many blood capillaries provide a large surface area;
 7. intercostal / chest muscles / diaphragm muscles / to ventilate lungs / maintain a diffusion / concentration gradient;
 8. wide trachea / branching of bronchi / bronchioles for efficient flow of air;
 9. cartilage rings keep airways open;
(reject moist and thin membranes)

6 max

[10] (a) exchange / diffusion across body surface / skin;

19 short diffusion pathway / distance / large SA:V ratio;

2

- (b) large numbers of lamellae so large SA; lamellae thin so short (diffusion) pathway to blood / capillaries; high rate of oxygen uptake for respiration / energy release;
(accept more oxygen)

3

[5]