Mark schemes

Q1.

(a) 1. As surface area to volume ratio increases, metabolic rate increases

OR

(Humans with) a large surface area to volume ratio have a high/fast metabolic rate;

Accept the converse for all marking points

Accept the relationship is proportional

Ignore 'directly' if prefixing proportional

*Accept the relationship is **positively** correlated*

2. (A large(r) surface area to volume ratio will) lose **more** heat;

*Accept lose heat faster/**more** easily*

3. (A high(er) rate of metabolism/respiration) releases/provides/replaces heat

OR

(A high(er) rate of metabolism/respiration) maintains body temperature;

*Accept (a higher rate of metabolism/ respiration) releases energy **OR** produces /generates heat*

Reject produces energy/ heat energy

3

(b) Person **A and** correct ratio of 23.7:1 **OR** 23.8:1 = **3 marks**;;;

Person **A and** correct ratio (23.75349227:1) not to 3 sf = **2 marks**

Person **A and** correct answer not expressed as a ratio = **2 marks**

Person **A and** 2.14:0.09 = **2 marks**

Person **B and** correct ratio of 23.7 **OR** 23.8:1 = **2 marks**

Person **B and** 26.0:1 = **2 marks** (correct calculations, wrong person)

Person **A and** answer not expressed as a ratio (23.75349227) **and** not to 3 sf = **1 mark**

Evidence of 2.14 **and** 1.61 in working = **1 mark**

Evidence of 0.09 **and** 0.06(2) in working = **1 mark**

1.61:0.06(2) = **1 mark**

Ignore named person alone

If no person remove 1 mark

3

(c) Due to a typographical error, this question has been discounted and all candidates will receive 1 mark, even the non-attempts.

1

(d) (Gill) lamella(e) **and** (gill) filament(s);

*Accept primary **and** secondary lamellae*

*Ignore (gill) arch **and** (gill) rakers*

1

[8]

Q2.

21-25	Extended Abstract Generalised beyond specific context	Response shows holistic approach to the question with a fully integrated answer which makes clear links between several different topics and the theme of the question. Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained. No significant errors or irrelevant material. For top marks in the band, the answer shows evidence of reading beyond specification requirements.
16-20	Relational Integrated into a whole	Response links several topics to the main theme of the question, to form a series of interrelated points which are clearly explained. Biology is fundamentally correct A-level content and contains some points which are detailed, though there may be some which are less well developed, with appropriate use of terminology. Perhaps one significant error and, or, one irrelevant topic which detracts from the overall quality of the answer.
11-15	Multistructural Several aspects covered but they are unrelated	Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question. Biology is usually correct A-level content, though it lacks detail. It is usually clearly explained and generally uses appropriate terminology. Some significant errors and, or, more than one irrelevant topic.
6-10	Unistructural Only one or few aspects covered	Response predominantly deals with only one or two topics that relate to the question. Biology presented shows some superficial A-level content that may be poorly explained, lacking in detail, or show limited use of appropriate terminology. May contain a number of significant errors and, or, irrelevant topics.
1-5	Unfocused	Response only indirectly addresses the theme of the question and merely presents a series of biological facts which are usually descriptive in nature or poorly explained and at times may be factually incorrect. Content and terminology is generally below A-level. May contain a large number of errors and, or, irrelevant topics.
0		Nothing of relevance or no response.

Commentary on terms and statements in the levels mark scheme

The levels mark scheme for the essay contains a number of words and statements that are open to different interpretations. This commentary defines the meanings of these words and statements in the context of marking the essay. Many words and statements are used in the descriptions of more than one level of response. The definitions of these remain the same throughout.

Levels mark scheme word/statement	Definition
Holistic	Synoptic, drawing from different topics (usually sections of the specification)
A fully integrated answer which makes clear links between several different topics and the theme of the question.	All topics relate to the title and theme of the essay; for example, explaining the biological importance of a process. When considering, for example, the importance of a process, the explanation must be at A-level standard. 'Several' here is defined as at least four topic areas from the specification covered. This means some sentences, not just a word or two. It does not mean using many examples from one topic area.
Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained.	Detailed and comprehensive A-level content is the specification content. Terminology is that used in the specification. Well written and clearly explained refers mainly to biological content and use of terminology. Prose, handwriting and spelling are secondary considerations. Phonetic spelling is accepted, unless examiners are instructed not to do so for particular words; for example, glucagon, glucose and glycogen.
No significant errors or irrelevant material.	A significant error is one which significantly detracts from the biological accuracy or correctness of a described example. This will usually involve more than one word. Irrelevant material is several lines (or more) that clearly fails to address the title, or the theme of the title.
For top marks in the band, the answer shows evidence of reading beyond specification requirements.	An example that is relevant to the title and is not required in the specification content. The example must be used at A-level standard.
Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question.	Not addressing the biological theme of the essay (eg importance) at A-level standard.

The mechanisms and importance of transport within organisms.

- 3.1.3 Phospholipids
- 3.1.4 Proteins
- 3.1.6 ATP
- 3.1.7 Water
- 3.2.1.1 Structure of eukaryotic cells
- 3.2.2 All cells arise from other cells
- 3.2.3 Transport across cell membranes
- 3.2.4 Cell recognition and the immune system
- 3.3.1 Surface area to volume ratio
- 3.3.2 Gas exchange
- 3.3.3 Digestion and absorption
- 3.3.4.1 Mass transport in animals
- 3.3.4.2 Mass transport in plants
- 3.4.2 DNA and protein synthesis
- 3.4.3 Genetic diversity can arise as a result of mutation or during meiosis
- 3.5.1 Photosynthesis
- 3.5.2 Respiration
- 3.6.1.1 Survival and response (IAA)
- 3.6.1.2 Receptors
- 3.6.1.3 Control of heart rate
- 3.6.2.1 Nerve impulses
- 3.6.2.2 Synaptic transmission
- 3.6.3 Skeletal muscles
- 3.6.4.1 Principles of homeostasis and negative feedback
- 3.6.4.2 Control of blood glucose concentration
- 3.6.4.3 Control of blood water potential
- 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins
- 3.8.2.2 Regulation of transcription and translation
- 3.8.2.3 Gene expression and cancer

In order to fully address the question and reach the highest mark bands students must also include at least four topics in their answer, to demonstrate a synoptic approach to the essay.

Students may be able to show the relevance of other topics from the specification.

Note, other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.

[25]

Q3.

(a)

Shape	Surface area / cm^2	Volume / cm^3	Surface area to volume ratio
C	96	64	1.5 : 1
D	136	64	2.125 : 1

; ;

Mark as columns
Allow ECF for ratio
Allow 2.1:1 and 2.13:1 for D
Ignore fractions for ratio

2

(b) 3520;

1

(c) Repeat with an undamaged (shape C) block;

Accept 'Replace with an undamaged (shape C) block and repeat'
Allow 'Repeat with a new block (shape C)'

1

(d) Any **three** for **2 marks**;;

Any **two** for **1 mark**;

1. Temperature

2. Concentration of indicator

3. pH/concentration of solution/acid

4. pH/concentration of alkali in blocks

5. Concentration/type of agar

6. Ensure total surface area of the block is in contact with the solution/acid

Ignore
Mass, shape, volume

2 max

(e) 1. Diffusion (across the cell surface membrane);

2. Large organisms have small(er) sa : vol ratio

OR

Single-celled organisms have a large(r) sa : vol ratio;

3. Diffusion pathway would be too long

OR

(Rate of) Diffusion too slow;

Must be in the context of larger organisms

3 max

[9]

Q4.

(a) 1. (Red blood cells) do not have a nucleus/DNA;

Accept (To distinguish RBCs from other cells as) fish red blood cells have a nucleus

2. Haemoglobin;

Accept haem OR globin

Ignore Hb

2

(b) 1 mark for each correct row

		Volume / μm³	**Surface area:volume ratio**
			0.32:1
		8.5×10^4 **OR** 85 000	:

If no marks awarded, accept for 1 mark,

0.3217 (correct ratio calculation not given to 2 significant figures)
OR
Number that can be rounded to 85 000 eg 84615 (correct calculation not given to 2 significant figures)

2

(c) **(Difference)**

1. More cells (between water and capillary/ blood)
OR
Wider/thicker filament/lamella;

Accept thicker epithelium for more cells

Accept gill plate for lamella

(Explanation)

2. Longer diffusion pathway
OR
Longer diffusion distance;

3. (So) slower gas exchange
OR
(So) slower absorption of oxygen
OR
(So) slower release of carbon dioxide
OR
(So) slower rate of diffusion;

Ignore efficiency

Ignore less

3

Accept a correct difference and a correct explanation in either section

(d) 1 mark for each correct row

Difference	Circulation of blood in fish	Circulation of blood in mammal;
1	2 chambers **OR** 1 ventricle **OR** 1 atrium **OR** 2 valves	4 chambers **OR** 2 ventricles **OR** 2 atria **OR** 4 valves
2	Blood does not return to heart after being oxygenated **OR** Blood does not return to heart after passing through gills **OR** Heart contains deoxygenated blood	Blood returns to heart after being oxygenated **OR** Blood returns to heart after passing through lungs **OR** Heart contains oxygenated and deoxygenated blood;
3	One vein (carrying blood towards the heart)	Two veins (carrying blood towards heart)
4	One artery (carrying blood away)	Two arteries (carrying blood away)
5	Single circulation	Double circulation
6	Blood reaching body capillaries at low(er) pressure	Blood reaching body capillaries at high(er) pressure;

3 and 4 Accept name of relevant blood vessels eg aorta, pulmonary artery/vein, vena cava

5 Accept descriptions of single circulation and double circulation

5 Accept 'system' for circulatory system

2 max

[9]