Mark schemes

Q1.

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]

Q2.

(a)

Aorta	**6**	Pulmonary vein	**1**
Left atrioventricular valve	**3**	Left semi-lunar valve	**5**
Right atrioventricular valve		Vena cava	
Left atrium	**2**	Left ventricle	**4**
Right atrium		Right ventricle	
Pulmonary artery		Right semi-lunar valve	

All correct **2 marks**,

3–4 correct **1 mark**,

0–2 correct **0 marks**

Ignore numbers 7-12

Penalise more than one use of numbers 1-6

2

(b) 1. (Rest to medium-intensity exercise)
Increased stroke volume **and** increased heart rate;

Accept description of increased stroke volume

2. (Medium-intensity exercise to high-intensity exercise)
Increased heart rate;

Reject reference to increase stroke volume here.

1 and 2 Ignore figures.

2

(c) 1. Arteriole;

2. (Circular/smooth) muscle relaxes;

3. Vasodilation increases blood flow

OR

Widens/dilates (lumen of) blood vessel so increases blood flow;

3

[7]

Q3.

(a) **One mark** for each row.

If values do not match the given unit, **max 1**.

Concentration of copper sulfate solution/ g kg^{-1}	**Volume of 100 g kg^{-1} copper sulfate solution / cm^3**	**Volume of water / cm^3**
75	22.5	7.5

Accept dm^3 / mm^3 for volume unit.

Accept 0.0225/2.25 × 10^{-2}/22 500 and 0.0075/7.5 × 10^{-3}/7500

Ignore units in 2nd row.

Do not accept mm^{-3}/cm^{-3}/dm^{-3}/ml

2

(b) 1. Density of 10% protein solution = 1.028;

2. More dense (than 25 g kg^{-1} copper sulfate solution);

2

(c) 16.5 **and** 22;

Must be in correct order

1

(d) Any **three** from:

(Tom)

1. (Healthy donor) not allowed to donate;

2. Less blood collected
OR
Fewer patients treated;

3. Cause Tom anxiety (about his health);

(Lucy)

4. (Gives blood) when it may not be safe (for her) to do so;

5. (Her blood) may not help patients;

6. Her (missed) low haemoglobin goes untreated;

***Max 2** for either Tom or Lucy*

If no credit awarded, max 1 mark for idea of too little haemoglobin left to carry oxygen in blood

OR

reduced oxygen to respiring tissues

3 max

[8]

Q4.

(a) 1. Enters by diffusion;

Reject facilitated diffusion

'down a diffusion gradient' = 2 marks

2. **Down** a concentration gradient

OR

From high to low pO_2;

'down a diffusion gradient' = 2 marks

Reject 'along' for 'down'

Accept description of O_2 is always higher in the water than the lugworm

3. More/most across parts of body with gills;

4. Gills provide a larger surface area for absorption;

Accept Gills increase SA:volume ratio

5. 8.8 (kPa) over gills;

6. 2.4 (kPa - rest of body surface) / 1.9 (kPa - front end before gills) / 0.5 (kPa - rear end after gills);

4 max

(b) Correct answer for 3 marks, 9.3×10^{-6} / 0.000 0093;;;

Accept correct rounding of 9.3×10^{-6}

MP1 − correct reading from graph (1.5)

MP2 − correct rearrangement of equation

($CdO_2 = 0.000\ 031 \times$ their pO_2)

MP3 − their $CdO_2 \times 0.2$
OR
their $CdO_2 \div 5$

3

(c) 1. (Measure light) absorption/transmission;

2. Interpolate/draw line to curve/line then to pO_2

OR

Read off (pO_2 figure) against absorbance/transmission value obtained;

Accept 'absorbance' for absorption

2

[9]

Q5.

(a) 1. (Is) charged/polar

OR

(Is) part of haem(oglobin);
*Accept Fe^{2+} **OR** Fe^{3+} for 'charged'*

2. (So) binds/associates/loads (with) oxygen

OR

(So) forms oxyhaemoglobin

OR

(So) transports oxygen;
Accept 'carries' for transports

2

(b) 1. Less/no ferroportin hydrolysis/breakdown;
Accept 'channel protein' for ferroportin

2. (So) more ferroportin (in cell-surface membranes);
Accept 'channel protein' for ferroportin
Accept 'many' for more

3. (So) more iron (ion) transport **from** cytoplasm/cell;
Accept 'many' for more

3

(c) Correct answer for 2 marks = 30.52:1 / 30.5:1 / 31:1;;

Accept for 1 mark,

31 (ratio not given)
OR

30:1 (incorrect rounding)
OR

200 (correct mass in healthy person)

OR

1526 (correct iron concentration in person with haemochromatosis)

OR

6104 : 200 (correct ratio, but not simplified)
Accept for 1 mark any correct ratio (not simplified)
e.g. 763:25 or 1526:50

2

[7]

Q6.

(a) Accept for 2 marks, three correct responses, one of which MUST be MP1.

Accept for 1 mark, any two correct responses.

1. Carry with blade protected

OR

Do not carry if likely to be jostled;

*Accept for 'protected', e.g. in tray **OR** pointing down*

2. Cut away from body;

3. Cut onto hard surface;

*Accept for 'hard surface', e.g. board **OR** tile. Ignore 'flat'*

4. Use sharp blade;

5. Disinfect/dispose of used scalpel (blade) as instructed;

Accept for 'as Instructed', eg in tray/beaker/as directed (by teacher)

2

More than one correct answer can be given in each cell row

*Ignore wear safety glasses **OR** gloves*

Ignore 'no running'

*Ignore washing **OR** disinfecting hands/surfaces*

*Ignore taking care **OR** act safely **OR** keep away from fingers*

(b) Accept for 2 marks, 6150;;

Accept for 1 mark,

82 (correct blood volume pumped in one heartbeat)

OR

Evidence of 120 and 38 (correct readings from graph)

OR

75 (correct heart rate, bpm)

OR

e.c.f. from graph, e.g. 120 − 40 = 80 and 80 × 75 = 6000;

2

(c) 1. Treatment 2 reduces bp/risk more (than treatment 1)

OR

Treatment 2 is more effective (than treatment 1)

2. Neither treatment achieves ideal bp

OR

Neither treatment achieves low(est) risk;

3. With treatment 1, patients (still) have high bp/ 20.3 bp so (still) at high risk

4. With treatment 2, patients in pre-high bp/18 bp so (still) at higher risk than normal;

5. No statistics test so do not know if changes/differences (in bp) are significant

OR

No statistics test so do not know if changes/differences (in bp) are due to chance;

Reject 'results are significant'

6. Unknown side effects of treatment(s);

7. Unknown duration of treatments;

8. Large sample size so results representative;

4 max

[8]

Q7.

(a) **Two** marks for three correct answers, **one** mark for two correct answers;;

(Left amino acid) Serine

(Middle amino acid) Alanine

(Right amino acid) Aspartic (acid)

Accept phonetic spellings

2

(b) One mark for each correct row

DNA	ATP	Reverse transcriptase	Phospholipid	
		✓		;
✓	✓	✓	✓	;
✓		✓		;

3

(c) Correct answer of 574 (amino acids) = **2 marks;**;

573.99936 = **1 mark**

OR

146/145.99986 = **1 mark**

OR

287 = **1 mark**

OR

292 = **1 mark**;

2

(d) Accept curve drawn to the right, following the same pattern **and** starting at Y = 0 and finishing at the same percentage saturation as original curve;

1

(e) 1. During exercise

OR

At low pO_2 (in the tissues);

Accept 'high altitude' or 'lack of red blood cells' for 'exercise'

Accept when there is a high pCO_2 (in the tissues)

Accept at low concentration of O_2 (in the tissues)

2. (Allowing) more oxygen for respiration
OR
(Allowing) **more** aerobic respiration
OR
To delay anaerobic respiration;

Accept descriptions of aerobic respiration, eg more oxygen to act as a terminal electron acceptor

*Accept oxygen can unload/dissociate eas**ier**/**more** readily for respiration*

2

[10]