AQA

A-level
BIOLOGY
7402/3

Paper 3

Mark scheme

June 2023

Version: 1.0 Final

236A7402/3/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information in the 'Comments' column is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for the same mark are indicated by the use of **OR**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can usually be gained by correct substitution / working and this is shown in the 'Comments' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.7 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking Guidance	Mark	Comments
01.1	1. (There are) stretch-mediated sodium ion channels (in the membrane); 2. (Increased pressure) deforms/changes (sensory neurone/axon) membrane/lamella(e) **OR** (Increased pressure) deforms/changes sodium ion channels; 3. Sodium ion channels open; 4. Sodium ions diffuse in; 5. Depolarisation (leading to generator potential);	3 max (3 x AO1)	1. 2. 3. or 4. Accept Na^+ **Max 2** if only reference to sodium and not sodium ions 4. Accept sodium ions move in down a concentration gradient 5. Accept inside becomes positive

Question	Marking Guidance	Mark	Comments
01.2	1. An action potential is only generated/produced when threshold is reached **OR** An action potential is **not** generated/produced until/unless threshold is reached; 2. When high pressure was applied (to the fingertip), threshold was reached **OR** High pressure is (an) above threshold (stimulus) **OR** High pressure generates an action potential;	2 (1 x AO1, 1 x AO3)	1. Ignore any numbers linked to threshold 1. and 2 Accept impulse for action potential 2. Accept references to 'the first peak' for high pressure 2. Accept the converse for low pressure

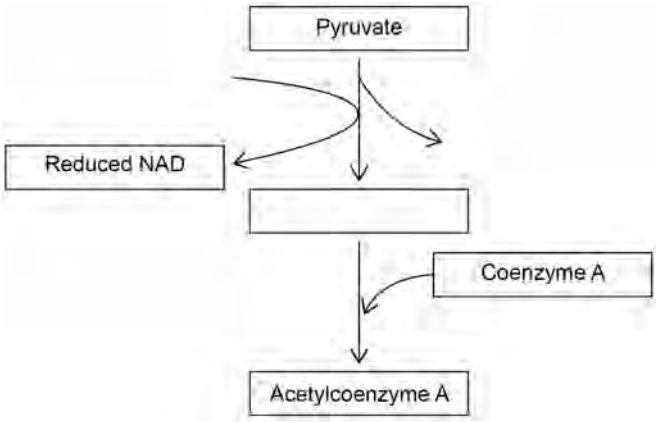
Question	Marking Guidance	Mark	Comments
01.3	(The) <u>refractory</u> (period);	1 (AO1)	Ignore any reference to absolute or relative Reject refraction period

Question	Marking Guidance	Mark	Comments
02.1	Accept any **two** of the following for **one** mark: Concentration/mass of yeast Concentration/mass of glucose/sugar (solution/s) Concentration of oxygen (in solution) Volume of yeast Volume of glucose/sugar (solution/s) pH (of glucose/sugar solution/s) Species/type of yeast Size/diameter/volume of test tubes	1 (AO3)	Ignore number of yeast cells Ignore amount for volume or concentration

Question	Marking Guidance	Mark	Comments
02.2	Correct answer of 2.5×10^{-2} **= 2 marks**;; 4.2×10^{-2} (scale read from the wrong direction) **= 1 mark** **OR** 2.5×10^{-3} (scale read as 3.7 mm not 3.7 cm) **= 1 mark** **OR** 2.4×10^{-2} (scale read as 36.5) **= 1 mark** **OR** Correct answer not in standard form and/or not to 2 significant figures, eg 0.0247/0.025/2.47×10^{-2} **= 1 mark** **OR** Answer in incorrect standard form eg 25×10^{-3} **or** 0.25×10^{-1} **= 1 mark** **OR** Evidence of 37 ÷ 1500 **or** 37 ÷ (25 x 60) **= 1 mark**	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
02.3	1. Maltose is a disaccharide; 2. (Time to be) hydrolysed into glucose **OR** (Time to) break glycosidic bond(s);	2 (2 x AO2)	1. Accept maltose is made of two glucose/ monosaccharides 2. Accept monosaccharides for glucose

Question	Marking Guidance	Mark	Comments
02.4	**This method would be less accurate because** 1. Colour/endpoint is subjective; **The accuracy of this method could be improved by** 2. (Have a) colour standard (of the yellow) as a reference for the end point; **OR** (Have a) colorimeter/absorbance/transmission reading (of the yellow) as a reference for the end point;	2 (2 x AO3)	1. Accept descriptions of the word 'subjective' 2. Accept use a colorimeter to time how long it takes to reach a certain value/absorbance/ transmission 2. Ignore any references to coloured filters used in a colorimeter

Question	Marking Guidance	Mark	Comments
02.5	All 4 correct **= 2 marks**;; Any 2 or 3 correct **= 1 mark**  	2 (2 x AO1)	Accept pyruvic acid for pyruvate For reduced NAD accept NADH, NADH + H^+ or $NADH_2$ For reduced NAD reject reduced NAD**P** / NAD**P**H / NAD**P**H_2 / NAD**P**H + H^+ For acetylcoenzyme A accept acetyl co A

Question	Marking Guidance	Mark	Comments
03.1	Second box ticked; Answer key: **B** – statements **1**, **2** and **4**	1 (AO1)	

Question	Marking Guidance	Mark	Comments
03.2	A correct answer of 9(.144) x 10^8 **= 2 marks**;; Answer not in standard form (914 400 000) **= 1 mark** **OR** Answer in incorrect standard form **= 1 mark** **OR** 1.016 × 10^8 (everything else correct except failed to multiply by 9) **= 1 mark** **OR** 2.286 × 10^8 (everything else correct but failed to take the plating of 0.25 cm^3 into account) **= 1 mark** **OR** 9.432 x 10^8 (discounted 238 as anomalous, all other calculations correct) **= 1 mark**	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
03.3	30;	1 (AO2)	Accept correct number of generations from incorrect response to **03.2, Table 1 on page 11 will help with this** **Examples of how to use logs to solve** $2^x = 9.14 \times 10^8$ $\ln(2^x) = \ln(9.14 \times 10^8)$ $x \cdot \ln(2) = \ln(9.14 \times 10^8)$ $x = \frac{\ln(9.14 \times 10^8)}{\ln(2)}$ $x = 30$ **OR** $2^x = 9.144 \times 10^8$ $\log_2(9.144 \times 10^8) = 29.768$ (so 30 generations)

Table 1 for question 03.3

Number of generations	Standard form	Population size
1	2×10^0	2
2	4×10^0	4
3	8×10^0	8
4	1.6×10^1	16
5	3.2×10^1	32
6	6.4×10^1	64
7	1.28×10^2	126
8	2.56×10^2	256
9	5.12×10^2	512
10	1.024×10^3	1024
11	2.048×10^3	2048
12	4.096×10^3	4096
13	8.192×10^3	8192
14	1.638×10^4	16384
15	3.277×10^4	32768
16	6.553×10^4	65536
17	1.311×10^5	131072
18	2.621×10^5	262144
19	5.243×10^5	524288
20	1.049×10^6	1048576
21	2.097×10^6	2097152
22	4.194×10^6	4194304
23	8.388×10^6	8388608

Number of generations	Standard form	Population size
24	1.678×10^7	16777216
25	3.355×10^7	33554432
26	6.711×10^7	67108864
27	1.342×10^8	134217728
28	2.684×10^8	268435456
29	5.369×10^8	536870912
30	1.073×10^9	1073741824
31	2.147×10^9	2147483648
32	4.295×10^9	4294967296
33	8.590×10^9	8589934592
34	1.718×10^{10}	17179869184
35	3.436×10^{10}	34359738368
36	6.872×10^{10}	68719476736
37	1.374×10^{11}	
38	2.749×10^{11}	
39	5.498×10^{11}	
40	1.100×10^{12}	
41	2.199×10^{12}	
42	4.398×10^{12}	
43	8.796×10^{12}	
44	1.759×10^{13}	
45	3.518×10^{13}	

Question	Marking Guidance	Mark	Comments
03.4	1. The concentration (of chloramphenicol) was too low/dilute (to kill all) **OR** There were too many *M. luteus*/bacteria for chloramphenicol/antibiotic to kill; 2. (Contamination with) other/resistant bacteria; 3. Mutation (occurred);	2 max (2 x AO3)	Accept as an additional mark point 4. Chloramphenicol/ antibiotic not (evenly) mixed in the liquid culture/bottle

Question	Marking Guidance	Mark	Comments
04.1	1. (The vesicle) fuses/binds with a lysosome; 2. Lysozyme/s hydrolyses/digests (SCFR) **OR** Hydrolytic enzyme/s breaks down/hydrolyses/ digests (SCFR);	2 (2 x AO2)	2. Accept protease hydrolyses/digests (SCFR);

Question	Marking Guidance	Mark	Comments
04.2	**Control** 1. Cardiomyocytes/(cardiac muscle) cells have **not** been replaced **OR** Infarcted tissue is **not** repaired/replaced **OR** (The contraction of the ventricle is weak as) there is a small number of cardiomyocytes/ (cardiac muscle) cells still alive **OR** (The ventricular pressure is low as) cardiomyocytes/(cardiac muscle) cells are damaged/dead; 2. (Pressure is not zero as) not **all** cardiomyocytes/(cardiac muscle) cells died **OR** (Pressure is not zero as) not **all** cardiomyocytes/(cardiac muscle) cells became infarcted tissue; **c-KIT–** 3. Higher than control, **so** (some) stem cells (must) have been able to differentiate **OR** Higher than control, **so** (some) cardiomyocytes/(cardiac muscle) cells have been replaced/infarcted tissues have been repaired; 4. (So) *c-KIT* is not the only gene responsible for differentiation **OR** (So) SCF must be able to bind to something other than SCFR **OR** (So) something else must be able to activate TK in cells; 5. Increase is less than **c-KIT+** group as they could not make SCFR **OR** Increase is less than **c-KIT+** group as they could not activate TK;	4 (4 x AO3)	1. Reject 'some stem cells from bone marrow moved to the infarcted tissue'

Question	Marking Guidance	Mark	Comments
04.3	A correct answer 34% **= 2 marks**;; Evidence of 2 and 1 **= 1 mark** An answer of 42.8/43% **= 1 mark** (answer that did not subtract the 'control' from read values)	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
04.4	**Connexin-43** 1. (Connexin-43) allows impulses to pass to the bottom/apex of the heart/ventricles **OR** (Connexin-43) allows impulses to pass through Purkyne tissue/the bundle of His; **GATA-4** 2. More actinomyosin bridges **OR** More binding sites on actin **OR** More myosin filaments/heads;	2 (2 x AO3)	1. Accept (connexin-43) allows diffusion/movement of ions (between cardiomyocytes) 1. Ignore references to signals/ information/ messages 2. Accept cross bridges for actinomyosin bridges 2. Accept more binding of myosin to actin

Question	Marking Guidance	Mark	Comments
05.1	1982 and 2003;	1 (AO3)	Reject if any other years are given

Question	Marking Guidance	Mark	Comments
05.2	1. There were many/48 (different) species **OR** (1997 had) the high**est** number of (different) species; 2. (However,) one/a few species were present in (very) large numbers **OR** **Most** species were present in (very) small numbers;	2 (2 x AO2)	1. Accept a lot/lots of (different) species for many 2. Accept dominated by one/a few species 2. Ignore each/all species were present in (very) small numbers

Question	Marking Guidance	Mark	Comments
05.3	1. The species richness/*d* are lower after 29 years; 2. The data is only for one (fish/local) community/site **OR** The data might not be representative of all fish communities **OR** Other communities might have different (fish) species; 3. (The measurements) only done in October **OR** The community might be different at other times of year (other than October); 4. The volume/temperature of the heated water (released each year) might have varied **OR** Timing/frequency of heated water release (each year) not known; 5. Fluctuations suggest other **named** factor had an effect (on biodiversity/species richness/*d*); 6. Species richness/*d* are not the only measures of 'effect'; 7. Don't know when the power station opened **OR** There is no data before 1980 **OR** There is no data before heated water was released **OR** No control (river) **to** compare with;	4 max (4 x AO3)	5. Named factors could include weather/oxygen concentration/food availability/plants/ predators/prey/ insects/ invertebrates/ fishing

Question	Marking Guidance	Mark	Comments
06.1	1. Pathogens **OR** Cells from an organism of a different species; 2. Cells from other organisms of the same species; 3. Abnormal body cells; 4. Antigen-presenting cells;	2 max (2 x AO1)	Reject toxins 1. Accept named examples of pathogens 1. Accept bacteria/fungi 1. Ignore viruses 2. Accept named appropriate cells from other organisms of the same species 2. and 3. Ignore B cells/T cells 3. Accept cancer cells 3. Accept cell infected with virus

Question	Marking Guidance	Mark	Comments
06.2	As a control (experiment), to show that it is OXA affecting the (immune) response **OR** As a control (experiment), to show that (olive) oil is **not** affecting the (immune) response **OR** To use as a control/standard/reference/starting point, to compare with (after) OXA (exposure);	1 (AO3)	Reject 'control/controlled variable'

Question	Marking Guidance	Mark	Comments
06.3	1. Labelled axes correct way round, linear scale and units; 2. Mean points plotted correctly; 3. SD bars correctly plotted above <u>and</u> below the peak of each bar;	3 (3 x AO2)	1. Reject if line graph drawn 1. Reject if Y-axis does not cover at least half of the grid 1. Reject if bars not of equal width 1. Accept a dual bar chart drawn 1. Reject if bars are touching (except dual bars) 1. Accept interruption drawn on the y axis 2. and 3. Allow all plots to the nearest half cm

Question	Marking Guidance	Mark	Comments
06.4	**Cellular response** 1. Female to female no significant difference in cellular response as SD overlap; 2. Male to male no significant difference in cellular response as SD overlap; 3. Significant **increase** in cellular response in autoimmune male compared with autoimmune female as SD do not overlap **Humoral response** 4. Male to male no significant difference in humoral response as SD overlap; 5. Female to female significant **increase** in humoral response as SD do not overlap; 6. Significant **increase** in humoral response in autoimmune female compared with autoimmune male as SD do not overlap	3 max (3 x AO3)	**Max 2** for answers only relating to the cellular response **or** humoral response Accept '(ear) thickness' for cellular response, and 'concentration of anti-OXA/antibody' for humoral response If **no** other marks awarded, accept **1 principle mark** for the idea that if SD overlap there is no significant difference or the converse 1. 2. and 4. Accept difference (likely) due to chance for no significant effect 3. 5. and 6. Accept increase not (likely) due to chance for significant increase Allow 'error bars' for 'SD'

Question	Marking Guidance	Mark	Comments
06.5	**Supporting** 1. (Oestrogen) increases the humoral response that produces antibody; 2. More antibodies could increase progression of SLE; 3. (Oestrogen) decreases the cellular response that produces T_C cells; 4. Fewer T_C cells could decrease/slow progression of RA; 5. Mice and humans are both mammals, so likely to have similar effects in both; **Against** 6. Increase in response might mean quicker production of antibody (not more) **OR** Decease in response might mean slower production of T_C cells (not fewer); 7. Decrease in cellular response could (also) mean fewer antigen-presenting cells (and not just T_C cells); 8. (Investigation) done in mice/not humans; 9. **Table 3** does not state which type of autoimmune disease the mice had **OR** Mice might not suffer from SLE/RA;	4 max (4 x AO3)	**Max 3** for reasons supporting or against

Question	Marking Guidance	Mark	Comments
06.6	**No – no mark** 1. Mice with autoimmune disease will be unlikely to reproduce/survive **OR** Mice with autoimmune disease will be selected against; 2. Will not pass on allele (for autoimmune disease) **OR** Allele frequency (for autoimmune disease) will reduce/change; **Yes – no mark** 3. As long as the autoimmune disease did not affect the mice's ability to reproduce/survive; 4. The allele frequency will remain constant/not change;	2 max (2 x AO2)	Award as mark points 1 and 2, **OR** 3 and 4

Question 7 Level of response marking guidance

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity, you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level, you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

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.

Question	Marking Guidance	Mark	
07.1	**The importance of interactions between organisms and their environment.** • 3.1.2 Carbohydrates (the relationship of structure to function of glycogen, starch and cellulose in animal cells and plant cells) • 3.1.4.2 Many proteins are enzymes (enzyme inhibitors) • 3.1.7 Water • 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 • 3.4.4 Genetic diversity and adaptation • 3.4.5 Species and taxonomy (courtship) • 3.4.6 Biodiversity within a community • 3.5.1 Photosynthesis • 3.5.3 Energy and ecosystems • 3.5.4 Nutrient cycles • 3.6.1.1 Survival and response • 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 (effects of drugs) • 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 • 3.7.1 Inheritance • 3.7.3 Evolution may lead to speciation • 3.7.4 Populations in ecosystems • 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins • 3.8.2.1 Most of a cell's DNA is not translated • 3.8.2.2 Regulation of transcription and translation • 3.8.2.3 Gene expression and cancer	**[25 marks]** (13 x AO1, 12 x AO2)	

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.

Question	Marking Guidance	Mark	
07.2	**The importance of membranes in the functioning of cells.** • 3.1.3 Lipids (phospholipids) • 3.2.1.1 Structure of eukaryotic cells • 3.2.1.2 Structure of prokaryotic cells • 3.2.2 All cells arise from other cells (nuclear membrane breakdown in mitosis) • 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 • 3.4.2 DNA and protein synthesis • 3.5.1 Photosynthesis • 3.5.2 Respiration • 3.6.1.2 Receptors • 3.6.2.1 Nerve impulses • 3.6.2.2 Synaptic transmission • 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors • 3.6.4.2 Control of blood glucose concentration • 3.6.4.3 Control of blood water potential • 3.8.2.2 Regulation of transcription and translation	**[25 marks]** (13 x AO1, 12 x AO2)	

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