AQA

A-level BIOLOGY (7402/3)

Paper 3

Mark scheme

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 Assessment Writer.

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 <u>not</u> 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. Draw grid over (map of) area; 2. Select squares/coordinates at random;	2	
01.2	1. No emigration/immigration; 2. No losses to predation; 3. Marking does not affect survival; 4. Birth rate and death rate equal; 5. (In this case) all belong to one population;	2 max	
01.3	1. Only glows brightly with UV, so doesn't make insects more visible; 2. So doesn't affect/increase predation; ***OR*** 1. Glows brightly with UV making visible; 2. So makes it easy to pick out labelled insects;	2	
01.4	10 130; Tolerance of ± 1	2	$N = \frac{M \times C}{R}$ = 1 mark
01.5	1. Scientists removed large numbers of insects (which were not returned) from same area/same population; 2. Affecting ratio of marked to unmarked;	2	

Question	Marking Guidance	Mark	Comments
02.1	1. Add drop of water to (glass) slide; 2. Obtain thin section (of plant tissue) and place on slide / float on drop of water; 3. Stain with/add iodine in potassium iodide; 4. Lower cover slip using mounted needle;	4	3. Allow any appropriate method that avoids trapping air bubbles
02.2	1. **W** – chloroplast, photosynthesis; 2. **Z** – nucleus, contains DNA/chromosomes / holds genetic information of cell;	2	
02.3	1. High resolution; 2. Can see internal structure of organelles;	2	
02.4	Length of bar in mm × 1000;	1	

Question	Marking Guidance	Mark	Comments
03.1	1. Maltose; 2. Salivary amylase breaks down starch;	2	
03.2	Maltase;	1	
03.3	(Mimics/reproduces) effect of stomach;	1	
03.4	1. Add boiled saliva; 2. Everything same as experiment but salivary amylase denatured;	2	
03.5	1. Some starch already digested when chewing / in mouth; 2. Faster digestion of chewed starch; 3. Same amount of digestion without chewing at end;	3	Accept use of values from graph

Question	Marking Guidance	Mark	Comments
04.1	1. Rank all STs in ascending order; 2. Find value with same number (of people) above and below;	2	2. Accept find middle value
04.2	Not ethical to fail to treat cancer;	1	
04.3	Yes since with ipilimumab: 1. Median ST increased by 2.1 months; 2. Percentage of patients showing reduction in tumours increased from 10.3% to 15.2%; No because: 3. No standard errors shown / no (Student) t- test / no statistical test carried out; 4. (So) not able to tell if differences are (statistically) significant / due to chance (alone); 5. Improvement might only be evident in some patients / no improvement in some patients; 6. Quality of (extra) time alive not reported;	4 max	If answers relate only to 'Yes' or 'No', award 2 marks max
04.4	1. Faulty protein recognised as an antigen/as a 'foreign' protein; 2. T cells will bind to faulty protein/to (this) 'foreign' protein; 3. (Sensitised) T cells will stimulate clonal selection of B cells; 4. (Resulting in) release of antibodies against faulty protein;	3 max	

Question	Marking Guidance	Mark	Comments
05.1	1. To kill any fungus/bacteria on surface of seeds or in soil; 2. So only the added fungus has any effect;	2	
05.2	So that only nitrate or ammonia/type of fertiliser affects growth;	1	
05.3	1. So that effects of nitrate or ammonium alone could be seen; 2. So that effects of fungus can be seen;	2	
05.4	1. Weigh samples at intervals during drying; 2. To see if weighings became constant (by 3 days);	2	
05.5	With live fungus – showing effects of the fungus: 1. Fungus increases growth of roots and shoots in both; 2. Produces greater growth with nitrate; With heat-treated fungus – showing effects of fertiliser: 3. Similar dry masses for roots and shoots; 4. (Probably) no significant difference because SDs overlap;	4	
05.6	1. Dry mass measures/determines increase in biological/organic material; 2. Water content varies;	2	
05.7	1. Fungus with nitrate-containing fertiliser gave largest shoot: root ratio; 2. And largest dry mass of shoot; 3. 6.09:1 compared with ammonium-containing fertiliser 4.18:1;	2 max	

Question 6 Level of response marking guidance

Level of response marking instructions

Level of response mark schemes are broken down into five levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are five marks in each level. Thus the descriptor for the level represents the mid mark in that 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. i.e. 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.

Question 6 Level of response marking guidance

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.

Question 06.1: The importance of movement in living organisms

The following are suitable topic areas from the specification that could obviously be used to demonstrate the importance of movement. Movement can include any movement from the molecular level to whole organisms.

Please note that to obtain full credit, students must use information to show **the importance of movement**, not just write about topics that include movement. In order to fully address the question and reach the highest mark bands students must also include at least **five topics** in their answer, to demonstrate a synoptic approach to the essay.

Specification Reference	Topic Area
3.1.4.2	Enzyme-catalysed reactions
3.1.5.2	DNA replication
3.1.6	ATP
3.2.2	Cell division
3.2.3	Transport across membranes
3.2.4	Immune response
3.2.2	Gas exchange
3.3.3	Digestion and absorption
3.3.4.1, 4.2	Mass transport
3.4.2	DNA and protein synthesis
3.4.3	Meiosis
3.5.1	Photosynthesis
3.5.2	Respiration
3.6.1	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	Synapses
3.6.2.2	Synaptic transmission
3.6.3	Skeletal muscle
3.6.4.2	Control of blood glucose concentration
3.6.4.3	Control of blood water potential
3.7.3	Evolution (population isolation and movement between)
3.8.2.2	Regulation of transcription and translation
3.8.2.3	Gene expression and cancer

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 06.2: The importance of receptors in living organisms

The following are suitable topic areas from the specification that could obviously be used to demonstrate the importance of receptors. Receptors can include any receptors from the molecular level to whole organs.

Please note that to obtain full credit, students must use information to show **the importance of receptors**, not just write about topics that include receptors. In order to fully address the question and reach the highest mark bands students must also include at least **five topics** in their answer, to demonstrate a synoptic approach to the essay.

Specification Reference	Topic Area
3.1.4.2	Enzymes
3.2.1.2	Structure of prokaryotic cells and of viruses
3.2.3	Transport across cell membranes
3.2.4	Cell recognition and the immune system
3.3.4.1	Mass transport in animals
3.4.2	DNA and protein synthesis
3.5.1	Photosynthesis
3.5.2	Respiration
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
3.6.3	Skeletal muscles
3.6.4.1	Principles of homeostasis
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
3.8.2.3	Gene expression and cancer

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.



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