



GCSE BIOLOGY

8461/2H - PAPER 2 HIGHER TIER

Mark scheme

8461

June 2018

Version/Stage: 1.1 Final

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

Information 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
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information 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 and underlining

- 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 a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

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 error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 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.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the mark scheme.

3.6 Phonetic spelling

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

3.7 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.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do not accept

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

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- 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 two 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.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise 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.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 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.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	releasing saliva when food enters the mouth		1	AO2 4.5.2.1
	withdrawing the hand from a sharp object		1	
01.2	bright light	allow described method of increasing light ignore light unqualified allow correctly named drug eg morphine / heroin	1	AO1 4.5.2.3
01.3	iris		1	AO1 4.5.2.3
01.4	muscle contraction	allow muscles shorten ignore radial / circular ignore muscles relax / constrict do not accept muscles expand do not accept ciliary muscle contracts	1	AO1 4.5.2.3

Question	Answers	Mark	AO / Spec. Ref.
01.5	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.5.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content <ul style="list-style-type: none"> • receptor detects stimulus • eg receptor detects pressure • receptor generates impulses / electrical signals • neurones conduct impulses / electrical signals • neurone A conducts impulses to spinal cord • neurone A = sensory neurone • synapse between neurones • chemical (/ neurotransmitter) crosses synapse • chemical stimulates impulse(s) in neurone B • neurone B = relay neurone • neurone C = motor neurone • effector carries out response • eg muscles of the arm / leg contract • muscles contract or gland secretes chemicals <p>to access level 2, candidates need to consider, in terms of the indicative content, the receptor, the neurones and the effector in the correct sequence</p>		
Total			11

Question	Answers	Extra information			Mark	AO / Spec. Ref.
02.1		1960–1977	1977–2003	2003–2015	1 1	AO3 4.7.3.5
	trend in carbon dioxide concentration		increasing	increasing		
	trend in air temperature	decreasing	increasing	constant / decreasing		
allow synonyms eg level / goes up / goes down						
02.2	traps heat / energy or (long-wavelength / IR) radiation or less loss of heat or insulates	do not accept light / UV allow stops (some) heat escaping do not accept stops all heat escaping ignore greenhouse effect ignore reference to ozone layer			1	AO1 4.7.3.5

Question	Answers	Mark	AO / Spec. Ref.	
02.3	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3 4.7.3.5	
	Level 1: Relevant points are made. They are not logically linked.	1–2		
	No relevant content	0		
	Indicative content for the theory: <ul style="list-style-type: none"> • (overall increased CO₂ parallels) overall increased temperature (eg by 0.4 (°C)) • CO₂ traps (long-wave) radiation / IR / heat against the theory: <ul style="list-style-type: none"> • in some years (eg 1960–1977) temperature falls (while CO₂ is rising) • many (large and small) erratic rises and falls in temperature • overall correlation does not necessarily mean a causal link • other (unknown) factors may be involved in temperature change <p>to access level 2 there must be evidence both for and against the theory and use of data from the graph</p>			
02.4	burning of (fossil) fuels	allow eg coal / oil / gas allow driving cars allow any activity which leads to burning fuels – eg using central heating ignore power stations unqualified ignore burning / fires unqualified ignore deforestation	1	AO2 4.7 4.7.2.2 4.7.3.5
02.5	photosynthesis	allow full description or full equation allow a symbol equation which is not balanced	1	AO2 4.4.1.2 4.7 4.7.2.2 4.7.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any two from: <ul style="list-style-type: none"> • (some) plants grow faster / higher yield • loss of habitat • migration • or change in distribution • extinction 	allow points made using examples } if neither is given allow alters biodiversity for 1 mark allow (in terms of extinction) death due to eg lack of water / food or increased disease ignore death unqualified	2	AO1 4.7.3.1 4.7.3.5
Total			11	

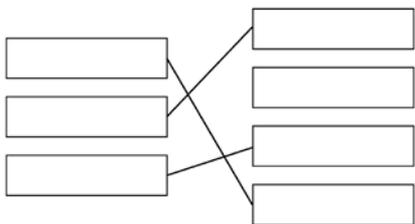
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	2400 and 2280 or 500 and 380	an answer of 120 scores 2 marks	1	AO2 4.5.3.3
	120		1	
03.2	respiration of glucose		1	AO1 4.4.2.1 4.4.2.3
03.3	(more) sweating	ignore reference to vasodilation / vasoconstriction	1	AO2 4.5.2.4 4.5.3.3
	(because) exercise releases heat or need to cool the body or need to lose heat or need to maintain body temperature	do not accept energy being produced	1	
03.4	more energy needed	'more' does not need to be stated a second time to gain marking point 1 and marking point 2 do not accept energy production do not accept energy needed for respiration	1	AO2 4.5.2.4 4.5.3.3
	(so) more (aerobic) respiration		1	
	(so) increased breathing (rate / depth) (to supply oxygen or remove carbon dioxide / water)		1	
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	there is an uneven distribution of dandelions or (more) representative / valid or avoid bias or more accurate / precise mean	ignore accurate / precise unqualified ignore repeatability / reproducibility / reliability / fair test	1	AO1 4.7.2.1
04.2	(correct mean per m ² =) 6 or 6.0 (correct field area =) 55 000 (m ²) mean x area – eg 6(.0) × 55 000 330 000 3.3 × 10 ⁵	an answer of 3.3 × 10 ⁵ scores 5 marks an answer of 330 000 scores 4 marks allow incorrect calculated values for mean and / or field area allow correct calculation from previous calculation allow calculated value in standard form	1 1 1 1 1	AO2 4.7.2.1

Question	Answers	Mark	AO / Spec. Ref.	
04.3	Level 3: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3	
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO2	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1	
	No relevant content	0		
	Indicative content <ul style="list-style-type: none"> • placing of quadrat • large number of quadrats used • how randomness achieved – eg table of random numbers or random number button on calculator or along transect • quadrats placed at coordinates or regular intervals along transect • in each of two areas of different light intensities or transect running through areas of different light intensity • for each quadrat count number of dandelions • for each quadrat measure light intensity • compare data from different light intensity <p>to access level 3 the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome</p>		4.7.2.1	
04.4	any two from: <ul style="list-style-type: none"> • temperature • water • (soil) pH • minerals / ions • wind • herbivores 	allow heat allow moisture / rain allow acidity allow eg magnesium ions or nitrate allow salts / nutrients allow trampling ignore carbon dioxide ignore space ignore competition unqualified do not accept oxygen	2	AO1 4.4.1.2 4.7.1.2
Total		14		

Question	Answers	Extra information	Mark	AO / Spec. Ref.																				
05.1	<table border="1" data-bbox="301 351 1177 779"> <thead> <tr> <th data-bbox="301 351 683 416"></th> <th colspan="3" data-bbox="683 351 1177 416">statement is true for</th> </tr> <tr> <th data-bbox="301 416 683 497"></th> <th data-bbox="683 416 815 497">mitosis only</th> <th data-bbox="815 416 967 497">meiosis only</th> <th data-bbox="967 416 1177 497">both mitosis and meiosis</th> </tr> </thead> <tbody> <tr> <td data-bbox="301 497 683 584">all cells produced are genetically identical</td> <td data-bbox="683 497 815 584">✓</td> <td data-bbox="815 497 967 584"></td> <td data-bbox="967 497 1177 584"></td> </tr> <tr> <td data-bbox="301 584 683 703">in humans, at the end of cell division each cell contains 23 chromosomes</td> <td data-bbox="683 584 815 703"></td> <td data-bbox="815 584 967 703">✓</td> <td data-bbox="967 584 1177 703"></td> </tr> <tr> <td data-bbox="301 703 683 779">involves DNA replication</td> <td data-bbox="683 703 815 779"></td> <td data-bbox="815 703 967 779"></td> <td data-bbox="967 703 1177 779">✓</td> </tr> </tbody> </table> <p data-bbox="738 813 1053 913"> 3 correct = 2 marks 2 correct = 1 mark 0 or 1 correct = 0 marks </p>		statement is true for				mitosis only	meiosis only	both mitosis and meiosis	all cells produced are genetically identical	✓			in humans, at the end of cell division each cell contains 23 chromosomes		✓		involves DNA replication			✓		2	AO1 4.1.2.2 4.6.1.2
	statement is true for																							
	mitosis only	meiosis only	both mitosis and meiosis																					
all cells produced are genetically identical	✓																							
in humans, at the end of cell division each cell contains 23 chromosomes		✓																						
involves DNA replication			✓																					
05.2	any two from: <ul data-bbox="301 1106 718 1621" style="list-style-type: none"> • many offspring produced • takes less time • (more) energy efficient • genetically identical offspring • successful traits propagated / maintained / passed on (due to offspring being genetically identical) • no transfer of gametes or seed dispersal • not wasteful of flowers / pollen / seeds • colonisation of local area 	ignore references to one parent only allow asexual is faster allow offspring are clones allow no vulnerable embryo stage allow no need for animals must imply local area	2	AO3 4.6.1.1 4.6.1.3																				

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<p>05.3</p>	<p>genetic variation (in offspring)</p>	<p>allow bluebell example described (max 3 if not bluebell)</p>	<p>1</p>	<p>AO1</p>
	<p>(so) better adapted survive</p>	<p>allow reference to natural selection or survival of the fittest</p>	<p>1</p>	<p>AO1</p>
	<p>(and) colonise new areas by seed dispersal or can escape adverse event in original area (by living in new area)</p>	<p>must imply new area</p>	<p>1</p>	<p>AO3</p>
	<p>many offspring so higher probability some will survive</p>		<p>1</p>	<p>AO3 4.6.1.1 4.6.2.1 4.6.1.3 4.7.1.1</p>
<p>Total</p>			<p>8</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	to prevent water affecting the direction of root growth		1	AO3 4.5.4.1
06.2	gravity acts evenly on all sides	allow cancel out the effect of gravity do not accept there is no gravity	1	AO3 4.5.4.1
06.3	(mean) includes the (anomalous) result for seedling 4	allow (mean) includes the (anomalous) result which only grew 1 mm	1	AO3 4.5.4.1
06.4	calculate (mean) from just seedlings 1, 2, 3 and 5 or repeat the investigation and recalculate (a new mean)	allow omit seedling 4 from (mean) calculation	1	AO3 4.5.4.1
06.5	uneven distribution of hormone in (root / seedling of) A	allow reference to auxin allow more hormone at bottom do not accept more hormone at the top	1	AO1 4.5.4.1
	even distribution of hormone in B	allow B does not have an uneven distribution of hormone	1	AO1 4.5.4.1
	(so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)	allow (more) cell elongation or cell division on top of A allow converse for lower surface	1	AO3 4.5.4.1
06.6		extra line for a hormone cancels mark for that hormone	1 1 1	AO1 4.5.4.2
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	x-axis: scale + labelled, including units	scale $\geq \frac{1}{2}$ width of graph paper label: biomass in g/m^2	1	AO2 4.7.4.1 4.7.4.2
	bar widths correct	$\pm \frac{1}{2}$ -square each side allow 1 mark if 3 correct	2	
	all 4 bars correctly labelled	large fish + small fish + invertebrate (animals) + algae or (trophic level) 4 + 3 + 2 + 1 or tertiary consumer + secondary consumer + primary consumer + producer ignore bar heights	1	
07.2	$\frac{840 - 10}{840} \times 100$	an answer of 99 scores 3 marks allow equivalent calculation	1	AO2 4.7.4.3
	98.809523... / 98.810 / 98.81 / 98.8		1	
	99	allow answer given to two significant figures from an incorrect calculation in step 2	1	
07.3	inedible parts / example or egested / faeces or respiration / as CO_2	allow eaten by other animals or not all organisms eaten allow not digested allow excretion / urine ignore waste ignore energy losses ignore movement	1	AO1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	bacteria decay organic matter / sewage / algae / dead plants	ignore causes of death for algae and plants	1	AO1 4.7.2.3
	(by) digestion	allow example such as starch broken down to sugar or protein broken down to amino acids	1	AO1 4.2.2.1 4.7.4.1
	(and) bacteria respire aerobically or respire using oxygen		1	AO1 4.4.2.1
	(which) lowers oxygen concentration (in water) or fish have less oxygen	allow reduced respiration of fish	1	AO2 4.4.2.1
	(so) reduced energy supply causes death of fish	allow toxins in the sewage kill fish ignore pathogens or (pathogenic) bacteria cause disease in fish and kills them	1	AO2 4.4.2.1
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	3.7		1	AO2 4.7.2.1
08.2	2		1	AO1 4.6.1.6
08.3	(different combinations of alleles cause) many / 22 values or in-between values or large range of values or there are not only two values	allow continuous variation allow there are not only 3 values if 3 is given in question 08.2	1	AO3 4.6.1.6 4.6.2.1
08.4	different protein made <u>active site</u> changed so substrate does not fit / bind	allow change in shape (of enzyme) or change in 3-D structure ignore denature allow description of substrate allow cannot form E-S complex ignore lock and key description	1 1 1	AO1 4.2.2.1 4.6.1.5
08.5	produces (some) offspring with high-fat milk or not all offspring have low-fat milk	ignore reference to alleles	1	AO3 4.6.1.6
08.6	takes less time (to obtain results) or more offspring at the same time	allow other sensible suggestion – eg allows screening or allow cow 7 to continue to produce eggs or avoid injury to cow 7 during mating or giving birth	1	AO3 4.5.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	<p>male gametes correct: d (and d)</p> <p>female gametes correct: D and d</p> <p>correct derivation of offspring genotypes from given gametes</p> <p>Dd identified as low-fat and dd identified as high-fat in offspring</p>	<p>max 3 marks if own symbols used with no key</p> <p>max 3 marks if alternative diagram to Punnett square used</p> <p>allow 1 mark if gametes are correct but gender not identified</p> <p>allow 2 × 2 or 2 × 1 derivation</p> <p>if DD offspring are produced, must also identify as low-fat</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO2 4.6.1.6</p>
08.8	<p>find female with low(est) fat in milk and high(est) milk yield</p> <p>find male whose female offspring have high(est) milk yield and low(est) fat in milk</p> <p>or</p> <p>find female with lowest fat in milk or cow 13 (1)</p> <p>find male whose female offspring have high(est) milk yield (1)</p> <p>cross the best (for both features) female with the best male</p> <p>select best offspring (for both features) from each generation and repeat for several generations</p>	<p>allow choose from 7, 9, 12, 13 which has the highest yield</p> <p>allow choose from 16 or 18 whose female offspring has the highest yield</p> <p>allow female with high(est) milk yield</p> <p>allow male whose female offspring have lowest fat in milk / male 16</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO3 4.6.2.3</p> <p>AO3 4.6.2.3</p> <p>AO2 4.6.2.3</p> <p>AO2 4.6.2.3</p>
Total			16	

Question	Answers	Extra information	Mark	AO / Spec. Ref.										
09.1	<table border="1"> <thead> <tr> <th>Classification group</th> <th>Name</th> </tr> </thead> <tbody> <tr> <td>Class</td> <td><i>Mammalia</i></td> </tr> <tr> <td>Order</td> <td><i>Primates</i></td> </tr> <tr> <td>Family</td> <td><i>Lemuroidea</i></td> </tr> <tr> <td>Species</td> <td><i>catta</i></td> </tr> </tbody> </table>	Classification group	Name	Class	<i>Mammalia</i>	Order	<i>Primates</i>	Family	<i>Lemuroidea</i>	Species	<i>catta</i>	all 4 correct = 2 marks 2 or 3 correct = 1 mark 0 or 1 correct = 0 marks	2	AO1 4.6.4
Classification group	Name													
Class	<i>Mammalia</i>													
Order	<i>Primates</i>													
Family	<i>Lemuroidea</i>													
Species	<i>catta</i>													
09.2	Lemur catta	ignore capitalisation / non-capitalisation of initial letters ignore italics / non-italics ignore underlining / non-underlining	1	AO2 4.6.4										
09.3	carried by (favourable) currents on masses of vegetation	allow description of currents from Figure 13 ignore swimming	1	AO2 4.6.3.2										

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	isolation of different populations		1	AO2 4.6.3.2
	habitat variation between lemur populations	allow examples – biotic (eg food / predators) or abiotic (eg temperature)	1	AO1 4.6.2.2 4.7.1.4
	genetic variation or mutation (in each population)		1	AO1 4.6.2.1 4.6.2.2 4.6.3.1 4.7.1.4
	better adapted survive (reproduce) and pass on (favourable) allele(s) to offspring	allow natural selection or survival of the fittest and pass on (favourable) allele(s) to offspring allow gene(s) / mutation as an alternative to allele(s)	1	AO1 4.6.2.2 4.6.3.1 4.7.1.1
	(eventually) cannot produce fertile offspring with other populations	allow cannot reproduce 'successfully' with other populations ignore cannot reproduce unqualified	1	AO1 4.6.3.1 4.6.2.2
Total			9	