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.

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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 <u>not</u> 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 withdrawing the hand from a sharp object		1 1	AO2 4.5.2.1
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 • 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 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		
Total			**11**

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>02.1</td><td>
<table>
<tr><th></th><th>1960–1977</th><th>1977–2003</th><th>2003–2015</th></tr>
<tr><td>trend in carbon dioxide concentration</td><td></td><td>increasing</td><td>increasing</td></tr>
<tr><td>trend in air temperature</td><td>decreasing</td><td>increasing</td><td>constant / decreasing</td></tr>
</table>
allow synonyms eg level / goes up / goes down
</td><td></td><td>1

1</td><td>AO3
4.7.3.5</td></tr>
<tr><td>02.2</td><td>traps heat / energy or (long-wavelength / IR) radiation
or
less loss of heat

or
insulates</td><td>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</td><td>1</td><td>AO1
4.7.3.5</td></tr>
</table>

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:** • (overall increased CO_2 parallels) overall increased temperature (eg by 0.4 (°C)) • CO_2 traps (long-wave) radiation / IR / heat **against the theory:** • in some years (eg 1960–1977) temperature falls (while CO_2 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 to access level 2 there must be evidence both for and against the theory **and** use of data from the graph			
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: • (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' does not need to be stated a second time to gain marking point 1 and marking point 2		AO2 4.5.2.4 4.5.3.3
	more energy needed	do **not** accept energy production do **not** accept energy needed for respiration	1	
	(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		an answer of 3.3×10^5 scores **5** marks an answer of 330 000 scores **4** marks		AO2 4.7.2.1
	(correct mean per m^2 =) 6 or 6.0		1	
	(correct field area =) 55 000 (m^2)		1	
	mean x area – eg 6(.0) × 55 000	allow incorrect calculated values for mean and / or field area	1	
	330 000	allow correct calculation from previous calculation	1	
	3.3×10^5	allow calculated value in standard form	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 • 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 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			4.7.2.1
04.4	any **two** from: • 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**	

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>05.1</td><td>
<table>
<tr><th></th><th colspan="3">statement is true for</th></tr>
<tr><th></th><th>mitosis only</th><th>meiosis only</th><th>both mitosis and meiosis</th></tr>
<tr><td>all cells produced are genetically identical</td><td>✓</td><td></td><td></td></tr>
<tr><td>in humans, at the end of cell division each cell contains 23 chromosomes</td><td></td><td>✓</td><td></td></tr>
<tr><td>involves DNA replication</td><td></td><td></td><td>✓</td></tr>
</table>
3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks
</td><td></td><td>2</td><td>AO1
4.1.2.2
4.6.1.2</td></tr>
<tr><td>05.2</td><td>any two from:

• 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</td><td>ignore references to one parent only

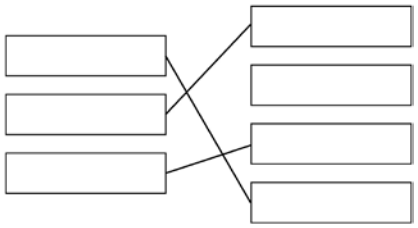
allow asexual is faster

allow offspring are clones

allow no vulnerable embryo stage
allow no need for animals

must imply local area</td><td>2</td><td>AO3
4.6.1.1
4.6.1.3</td></tr>
</table>

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

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 even distribution of hormone in B (so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)	allow reference to auxin allow more hormone at bottom do **not** accept more hormone at the top allow B does not have an uneven distribution of hormone allow (more) cell elongation or cell division on top of A allow converse for lower surface	1 1 1	AO1 4.5.4.1 AO1 4.5.4.1 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 ≥ ½ width of graph paper label: biomass in g/m^2	1	AO2 4.7.4.1 4.7.4.2
	bar widths correct	± ½-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		an answer of 99 scores **3** marks		AO2 4.7.4.3
	$\frac{840 - 10}{840} \times 100$	allow equivalent calculation	1	
	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		ignore causes of death for algae and plants		
	bacteria decay organic matter / sewage / algae / dead 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 active site 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		**max 3** marks if own symbols used with no key **max 3** marks if alternative diagram to Punnett square used		AO2 4.6.1.6
	male gametes correct: d (and d)	allow **1** mark if gametes are correct but gender not identified	1	
	female gametes correct: D and d		1	
	correct derivation of offspring genotypes from given gametes	allow 2 × 2 **or** 2 × 1 derivation	1	
	Dd identified as low-fat **and** dd identified as high-fat in offspring	if DD offspring are produced, must also identify as low-fat	1	
08.8	find female with low(est) fat in milk **and** high(est) milk yield	allow choose from 7, 9, 12, 13 which has the highest yield	1	AO3 4.6.2.3
	find male whose female offspring have high(est) milk yield **and** low(est) fat in milk **or**	allow choose from 16 or 18 whose female offspring has the highest yield	1	AO3 4.6.2.3
	find female with lowest fat in milk **or** cow 13 (1) **or** find male whose female offspring have high(est) milk yield (1)	allow female with high(est) milk yield allow male whose female offspring have lowest fat in milk / male 16		
	cross the best (for both features) female with the best male		1	AO2 4.6.2.3
	select best offspring (for both features) from each generation and repeat for several generations		1	AO2 4.6.2.3
Total			**16**	

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>09.1</td><td><table><tr><th>Classification group</th><th>Name</th></tr><tr><td>Class</td><td>Mammalia</td></tr><tr><td>Order</td><td>Primates</td></tr><tr><td>Family</td><td>Lemuroidea</td></tr><tr><td>Species</td><td>catta</td></tr></table></td><td>all 4 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks</td><td>2</td><td>AO1
4.6.4</td></tr>
<tr><td>09.2</td><td>Lemur catta</td><td>ignore capitalisation / non-capitalisation of initial letters

ignore italics / non-italics
ignore underlining / non-underlining</td><td>1</td><td>AO2
4.6.4</td></tr>
<tr><td>09.3</td><td>carried by (favourable) currents on masses of vegetation</td><td>allow description of currents from Figure 13
ignore swimming</td><td>1</td><td>AO2
4.6.3.2</td></tr>
</table>

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**	