GCSE
BIOLOGY
8461/2H

Paper 2 Higher Tier

Mark scheme

June 2021

Version: 1.0 Final Mark Scheme

JUN218461 2H/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.

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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, level of demand 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 marking 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.

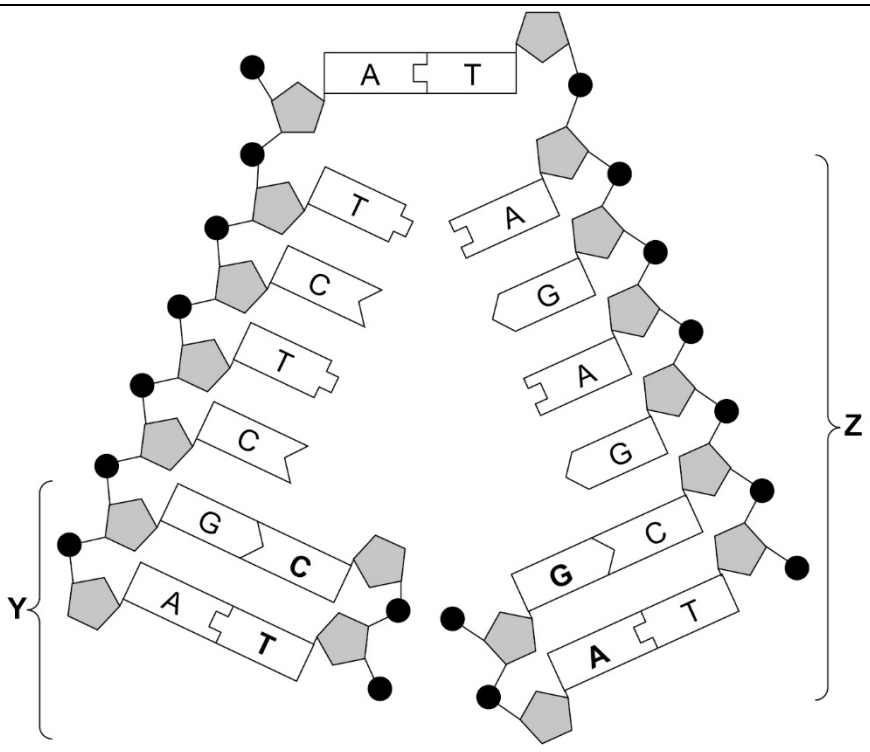
The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine 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	chromosome(s)	allow chromatid(s) / gene(s) / allele(s)	1	AO1 4.6.1.4
01.2	sugar	allow deoxyribose allow pentose do **not** accept ribose	1	AO1 4.6.1.5
01.3	base(s)	allow nitrogenous base(s) allow adenine **and** cytosine **and** guanine **and** thymine	1	AO1 4.6.1.5
01.4	 all four required for the mark		1	AO3 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	replication		1	AO3 4.6.1.5 4.1.2.2
01.6	protein	allow polypeptide	1	AO1 4.6.1.4
01.7	3×10^{-12} grams		1	AO2 4.6.1.2
01.8	meiosis		1	AO1 4.6.1.2
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(put beaker in a) water bath	allow (put beaker in an) incubator	1	AO1 4.7.2.3 RPA10
02.2	volume of the milk **or** type of milk	allow amount of milk allow named type of milk, eg cows' or semi-skimmed	1	AO1 4.7.2.3 RPA10
02.3	correct scale and axis labelled all points plotted correctly suitable curved line of best fit	scale must be at least 1 cm for 1 day allow a tolerance of ± ½ small square allow 4 or 5 correct plots for **1** mark ignore line joined point to point with straight lines	1 2 1	AO2 4.7.2.3 RPA10
02.4	similar shaped line drawn to left of 20 °C line on **Figure 4** same start pH	 allow a tolerance of ± ½ small square allow from student's line of best fit or student's plot for 0 days	1 1	AO2 4.7.2.3 RPA10
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3.1	any **one** from: • movement would release (extra) heat • movement would increase body temperature • movement would increase sweating		1	AO2 4.5.1 4.5.2.4
3.2	37.4 °C		1	AO2 4.5.1 4.5.2.4
3.3	blood is cooled at stomach / mouth (cooled) blood flows to the brain		1 1	AO2 4.5.1 4.5.2.4
3.4	via nerve(s) / neurones **or** via (nerve) impulse(s)	ignore type of neurone allow electrical signals allow via the nervous system	1	AO2 4.5.1 4.5.2.4
3.5	less sweating occurs so less heat is lost **or** less cooling	allow less sweat evaporates do **not** accept no sweating allow less heat used for evaporation of sweat / water	1 1	AO3 AO2 4.5.1 4.5.2.4
3.6	dilation of blood vessels in the skin		1	AO2 4.5.1 4.5.2.4
Total			**8**	

Question	Answers	Mark	AO / Spec. Ref.
4	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.7.2.1 4.7.2.2 4.7.2.3 4.2.2.1 4.2.3.1 4.2.3.2 4.4.1.1 4.4.1.3 4.4.2.1
	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 *in microorganisms* • digestion **or** large molecules to small molecules • enzymes **or** named example • respiration • production of carbon dioxide • release of mineral ions **or** named example such as nitrate / phosphate / magnesium *in plants* • carbon dioxide (from air) taken in by leaves • by diffusion • via stomata • carbon dioxide used in photosynthesis • making glucose / sugar / starch / cellulose **or** making other correctly named example • (named) ions taken in by roots • by active transport • nitrate ions for making amino acids / proteins / DNA / chlorophyll • phosphate for making DNA For **Level 2** processes in microorganisms and in plants should be considered		
Total		**6**	

<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>Factor</th><th>Biotic</th><th>Abiotic</th></tr>
<tr><td>Nitrates in the soil</td><td></td><td>✓</td></tr>
<tr><td>Rabbits eating the plants</td><td>✓</td><td></td></tr>
<tr><td>Shading by a building</td><td></td><td>✓</td></tr>
<tr><td>Soil pH</td><td></td><td>✓</td></tr>
<tr><td>Temperature</td><td></td><td>✓</td></tr>
<tr><td>Trampling by people</td><td>✓</td><td></td></tr>
</table>
all 6 correct = 3 marks
4 or 5 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks
</td><td></td><td>3</td><td>AO1
4.7.1.2
4.7.1.3
4.4.1.2</td></tr>
<tr><td>05.2</td><td>(grid and) coordinates

to achieve randomness</td><td>

ignore throwing quadrat

allow random coordinates for 2 marks

if no other mark awarded allow random walk or description of random walk for 1 mark</td><td>1

1</td><td>AO1
4.7.2.1
RPA9</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	*(mean per m^2 =)* 24 **or** 6×4		1	AO2 4.7.2.1 RPA9
	(calculation of area of lawn =) $(½ \times 16 \times 10) – (6 \times 3)$ **or** $80 – 18$		1	
	(area of lawn =) 62 m^2	allow correct calculation using total area (of triangle) – area of rectangle	1	
	(total number of daisies =) 24×62	allow correct calculation using an incorrectly calculated area of the lawn and / or mean	1	
	1488	allow answer based on incorrect area	1	
	(answer to 3 sig figs =) 1490	allow student's calculated answer rounded to 3 sig figs	1	
05.4	too few quadrats **or** quadrat too small	allow sample size too small	1	AO3 4.7.2.1 RPA9
	sample may not be representative of the lawn	allow quadrats may not have been placed randomly	1	
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1		ignore examples		AO1 4.5.2.1
	response / reaction	ignore action	1	
	automatic **or** no thinking **or** not conscious **or** involuntary	ignore reference to brain ignore quick	1	
06.2	receptor (in skin of finger / hand) detects stimulus / temperature change	allow receptor detects heat ignore pain	1	AO1 4.5.2.1
	(electrical) impulses pass along neurones	allow electrical signals pass along nerve cells ignore messages	1	
	(impulses pass from) sensory to relay to motor neurones		1	
	synapse between neurones where chemical crosses gap	allow neurotransmitter / acetylcholine for chemical allow by diffusion	1	
	(synapses) in spinal cord / CNS	ignore brain	1	
	muscle contraction (to pull hand away) **or** effector is a muscle		1	
06.3	coordination by endocrine system is:	allow converse points if clearly indicating nervous co-ordination answers must be comparative		
	slower		1	AO1
	longer-lasting		1	AO1
	(chemical / hormone) via blood instead of electrical / impulse / neurones		1	AO2 4.5.2.1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		ignore reference to days of menstrual cycle		
	FSH (release from pituitary) stimulates maturation of egg / ovum / follicle	allow FSH stimulates development / growth of egg	1	AO1 4.5.3.1 4.5.3.4
	oestrogen (release from ovary) inhibits FSH production **and** stimulates LH production		1	
	LH (release from pituitary) stimulates ovulation	allow LH stimulates release of egg	1	
	progesterone (release from ovary) inhibits FSH **and** LH production	allow (release from corpus luteum)	1	
	oestrogen **and** progesterone maintain the uterus lining	allow oestrogen **and** progesterone build up the uterus lining	1	
Total			**16**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	from light / sunlight absorbed by chlorophyll / chloroplasts	ignore sun unqualified if no other mark awarded allow by photosynthesis for **1** mark	1 1	AO1 4.7.2.1 4.7.4.3 4.4.1.1
07.2	krill / herring / copepod		1	AO2 4.7.2.1 4.7.4.1
07.3	algae		1	AO2 4.7.2.1 4.7.4.1
07.4	1 algae 2 krill **or** copepod 3 squid 4 mackerel (5 Human)	all correct for **1** mark	1	AO2 4.7.2.1
07.5	any **two** from: (losses due to) • non-eaten parts (of squid / krill) • <u>respiration</u> **or** <u>respiring</u> (in mackerel) • excretion (by mackerel)	 allow bones / shells allow eaten by other animals do **not** accept respiration produces / makes / creates energy allow loss of a named waste product such as CO_2 / urea ignore loss of waste unqualified ignore faeces	2	AO1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	2.3 **and** 0.1 (million)	allow in the range 2.25 to 2.3 for 2.3 (million)	1	AO2 4.7.5.3
	$\frac{2.3 - 0.1}{2.3} \times 100$ **or** $\frac{220}{2.3}$		1	
	95.65217.....	allow answer from correct substitution of incorrect values from **Figure 11**	1	
	96	allow student's calculated answer correctly rounded to the nearest whole number	1	

Question	Answers	Mark	AO / Spec Ref.
07.7	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.7.5.3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content figures may be given without units (million tonnes) throughout **points for:** • small fish are not caught so can live long enough to reproduce • biomass / stocks have generally increased after these laws introduced • ’77-’81 law (total ban) resulted in increase in biomass, eg 0.1 to 0.48 **or** to 0.9 by ’84 • ’84 law (mesh size) resulted in increase in biomass, eg 0.9 to 1.8 (by ’90) • ’97 law (quotas) resulted in increase, eg 1.15 to 1.25 • ’98 law (ban in breeding season) resulted in increase, eg 1.25 to 2.5 **points against:** • could be a cause other than the law **or** correlation does not necessarily indicate causal relationship **or** other factors • laws superimposed so can’t necessarily tell the effect of each • each law results in an increase followed by a decrease • quotas lead to dead fish being thrown back into sea For **Level 3** points both for and against must be considered together with appropriate use of data		
Total		**17**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	mutation means less oxygen for (aerobic) respiration	allow haemoglobin **or** red blood cell carries oxygen for (aerobic) respiration do **not** accept no oxygen for respiration	1	AO2 4.6 4.6.1.5 4.2.2.3
08.2	4 ÷ 17 0.235(29...)	allow 4:13 allow 0.24 **or** 24% allow ratio 1 : 3.25	1 1	AO2 4.6.1.5 4.2.2.3
08.3	father / **8**'s gametes correct: H^A + H^A mother / **9**'s gametes correct: H^A + H^S	allow **1** mark for both sets of gametes if parents not identified	1 1	AO2 AO2
	correct derivation of offspring genotypes: H^AH^A H^AH^A H^AH^S H^AH^S	allow correctly derived offspring genotypes from incorrect parental gametes	1	AO2
	correct phenotype for each derived genotype		1	AO2
	0.25 / ¼ / 25% / 1 in 4 / 1:3	allow **only** a probability consistent with student's derivations	1	AO3 4.6.1.6 4.6.1.7 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **three** from: *points for:* • $\mathbf{H^AH^S}$ do not get malaria • $\mathbf{H^AH^S}$ survive sickle cell anaemia *points against:* • $\mathbf{H^AH^A}$ may die from malaria • $\mathbf{H^SH^S}$ may become (severely) ill with sickle cell anaemia • Judgement: if parents $\mathbf{H^AH^S}$ then some offspring survive both malaria and sickle cell anaemia **or** if parents $\mathbf{H^AH^S}$ then some offspring may become (severely) ill with malaria and some become (severely) ill with sickle cell anaemia	to gain full marks both point(s) for and point(s) against must be given	3	AO3 4.6.2.1
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**Classification group** Kingdom Phylum Class Order Family Genus Species	all 4 correct = **2** marks 2 or 3 correct = **1** mark 0 or 1 correct = **0** marks	2	AO1 4.6.4
09.2	Geospiza fortis	ignore underlining or attempted italics or upper and lower case letters	1	AO2 4.6.4
09.3	offspring have similar beak depths to parents	ignore same beak depths ignore positive correlation / described	1	AO3 4.6.2.1
09.4	parents of a given beak depth produce offspring with several beak depths	allow spread of results for a given parental beak depth about line of best fit allow range of phenotypes for a given parental beak depth	1	AO3 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	colonisers of Isabela have a range of beak depths	allow colonisers of Daphne have a range of beak depths	1	AO2
	due to different combinations of alleles of several genes **or** due to different alleles of one gene **or** due to mutation		1	AO1
	large range of (sizes / species of) seeds / food (on Isabela) **or** large(r) seeds (on Isabela)	allow small range of (sizes / species of) seeds / food on Daphne **or** allow small(er) seeds on Daphne	1	AO2
	more competition for seeds / food (on Isabela)	allow less competition for seeds / food on Daphne ignore competition unqualified	1	AO2
	birds with larger beaks get enough food to (survive and) reproduce (on Isabela)	allow birds with smaller / medium beak sizes get enough food to (survive and) reproduce on Daphne	1	AO2
	(survivors) pass on (beneficial) alleles to offspring	allow pass on genes / mutation ignore pass on chromosomes / characteristics	1	AO1 4.6.2.1 4.6.2.2 4.7.1.1 4.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	Isabela is a large island with more species of plants **or** Isabela is a large island with more variety in seed / food sizes **or** Isabela is a large island with more plants / seeds / food		1	AO3 4.7.1.1 4.7.1.3
	less competition for seeds / food **or** enough seeds / food for both bird species		1	
Total			**13**	