GCSE
BIOLOGY
8461/2F

Paper 2 Foundation Tier

Mark scheme

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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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

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

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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 their 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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 errors / 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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown.

Full marks are not awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. 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 1

Question	Answers	Mark	AO / Spec Ref.
01.1	(stimulus) → receptor → coordinator → effector → (response) allow receptor → coordinator for **1** mark allow coordinator → effector for **1** mark	2	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	any **two** from: • fast / rapid • a response / reaction • automatic / involuntary **or** not under conscious control • protects (from danger / harm)	ignore action allow not coordinated by the conscious part of the brain **or** allow does not involve thought / thinking ignore not coordinated by the brain	2	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	blinking in sudden bright light		1	AO2 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	muscle		1	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	B		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	A		1	AO1 4.5.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.7	balance		1	AO1 4.5.2.2

Total Question 1	**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	kingdom		1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	genus species		1 1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	3 million years ago		1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	black-backed jackal	ignore jackal do **not** accept golden jackal	1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	any **two** from: • drought • ice age • global warming • volcanic activity • asteroid collision • (new) predators • (new) disease / pathogen • competition for food • competition for mates • lack of habitat or habitat change	if none of these awarded, allow **1** mark for climate change ignore weather if neither of these, allow catastrophic event **or** natural disaster for **1** mark allow named example allow hunters allow named example allow lack of food allow lack of mates ignore competition unqualified ignore environment change ignore isolation ignore pollution	2	AO1 4.6.3.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.6	any **one** from: • wolves ate humans • wolves get left-over food from humans • humans gave food to wolves		1	AO3 4.6.2.3 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.7	breed the least / less aggressive wolves		1	AO2
	breed (least / less aggressive) offspring	ignore repeat breeding of the original pair(s)	1	AO1 4.6.2.3

Total Question 2	**10**

Question 3

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.1	gene (for antigen)	allow DNA / allele for antigen ignore DNA / allele unqualified	1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.2	(pure) antigen(s)		1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	the viruses may cause an infection		1	AO3 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.4	any **three** from: • (sun) light • water • ions / minerals / salts • oxygen in the soil • space	ignore sun allow moisture / rain allow a named example allow **two** named ions for **2** marks ignore nutrients / food ignore carbon dioxide	3	AO1 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.5	crop plants grow better **or** crop plants have higher yield	ignore reference to competition	1	AO2 4.6.2.4 4.7.5.4 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.6	any **one** from: • may kill / harm / poison **other** plants • may pollute streams / rivers / soil • may kill / harm / poison humans / animals	ignore it is poisonous unqualified allow may alter taste of (GM) maize allow may reduce biodiversity ignore reference to cost	1	AO2 4.6.2.4 4.7.3.1 4.7.3.6

Total Question 3	**8**

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	(A) optic nerve (B) lens		1 1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	contract		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	thicker		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	iris		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	any **one** from: • (sent as) impulses • along sensory neurone(s)	allow (sent as) electrical signals ignore messages	1	AO1 4.5.2.1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	the light rays do not meet / focus / converge on the retina	allow the light rays meet / focus / converge before the retina allow the light rays do not meet / focus / converge at the back of the eye allow lens is too thick allow eyeball is too long	1	AO3 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7	any **one** from: • (hard / soft) contact lenses • (laser) surgery • replacement lens (in the eye)	ignore spectacles / glasses	1	AO1 4.5.2.3

Total Question 4	**8**

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1	pancreas		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	the body cells take in a low amount of glucose from the blood		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	any **two** from: • (same) diet • (same diet for same) duration • (same / 30-minute) time before being given glucose • (same) volume of water and drug **X** • (same) volume of glucose (solution)	if neither point given allow time allow (same) amount of water and drug **X** allow 2 cm^3 of drink allow (same) amount of glucose (solution) allow 1 cm^3 glucose (solution) if neither bp4 nor bp5 awarded, allow **1** mark for (same) volume / amount of drink	2	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.4	20 **and** 30 (30 – 20 =) 10 (minutes)	allow an answer in the range 28 to 32 for group **A** allow an answer consistent with values for **A** between 28 and 32	1 1	AO3 AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	any **two** from: (with drug **X**) • lower **throughout** • lower maximum (concentration) • slower increase (in concentration) • slower decrease (in concentration) • returns to original (concentration) (sooner)		2	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.6	use different concentrations of drug **X**		1	AO3 4.5.3.2

Total Question 5	**9**

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	tropism		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	auxin		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	nitrate ions water		1 1	AO1 4.2.3.2 4.5.4.1

Question	Answers	Mark	AO / Spec Ref.
06.4	**Level 3**: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO2
	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	AO1
	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 • one pot of seedlings placed in box with slit • one pot of seedlings in dark • one pot of seedlings in full light • measure heights of shoots • remeasure heights of shoots • record a feature of appearance of seedlings • detail of how bent shoots were measured eg use thread or straighten them out • calculate mean height increase for each group • compare results (for each group of seedlings) • control variable(s) ○ same temperature ○ same volume of water ○ same soil type ○ same age of seedlings ○ same species / type of plant ○ same time left for For **Level 3**, a method comparing the growth of plants in light from one direction with plants in full light / darkness along with a control variable is required		4.5.4.1 RPA8

Total Question 6	**10**

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	to compare (with the other tubes) **or** to show the effect of chemical **Q**	ignore as a control do **not** accept control variable allow to show the difference	1	AO2 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	$\frac{100}{0.01}$ 10 000 / 10^4 (times)		1 1	AO2 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	0.1 arbitrary units		1	AO3 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	reduced / no (root) growth at high(er) concentrations	allow no (root) growth in tube 6 / 100 allow answer in terms of specific tubes / concentrations ignore the higher the concentration, the fewer roots grow unqualified	1	AO3 4.6.2.5

Question	Answers	Mark	AO / Spec Ref.
07.5	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1–2	AO3
	No relevant content	0	
	Indicative content *Taking cuttings:* • quicker ○ (because) do not have to wait as long for flowers / fruits / seeds (to form) • all offspring identical (in appearance) **or** all have large / brightly-coloured flowers ○ (because) all have the same alleles / genes / DNA • asexual reproduction **or** not sexual reproduction **or** cloning ○ (so) no fusing of gametes ○ (so) no mixing of alleles / genes from two parents ○ (so) offspring are identical (in appearance) • involves mitosis ○ (which) copies genetic material / chromosomes • does not involve meiosis ○ (which) gives different genetic material / chromosomes • avoids variation in flowers ○ due to pollination / cross pollination (from other geraniums) ○ (as) no mixing of alleles / genes from two parents • increased profitability ○ less resources needed ○ quicker turnover ○ consistent quality of plants / flowers		4.6.1.1 4.6.1.3 4.6.2.1 4.6.2.5

Total Question 7	**9**

Question 8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.1	**r r**	allow homozygous recessive	1	AO2 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.2	male gametes correct: **R** and **r** all four offspring genotypes correctly derived from gametes (given)	 allow **1** mark for 2 or 3 correct	1 2	AO2 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.3	correct ratio from **Figure 11**	allow 3 : 1 if no answer to **08.2**	1	AO3 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.4	having (two) different alleles (of a gene)	ignore example(s) do **not** accept having two different genes	1	AO1 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.5	any **two** from: • other scientists not aware of his work **or** work published in obscure journal • other theories accepted at the time • not considered to be a scientist **or** not eminent **or** not respected • Mendel's (mathematical) approach was novel concept • peas gave unusual results compared with other species • new discoveries made Mendel's work relevant	allow work lost for many years allow eg theory of blending inheritance ignore religion allow he was **only** a monk allow he was not believed allow his work was not understood **or** no other scientist had similar ideas allow his results were not corroborated (at the time) allow Mendel only worked on pea plants allow insufficient results / research allow specific discoveries	2	AO2 4.6.3.3

Total Question 8	**8**

Question 9

Question	Answers	Extra information	Mark	AO / Spec Ref.
09.1	a change in: • DNA • base code **or** nucleotide sequence • base (in DNA) • gene / allele • part of a chromosome • number of chromosomes • genetic code / material	ignore genetic information / variation ignore reference to amino acids or proteins	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
09.2	any **three** from: • variation (between members of a species) • better adapted survive • (better adapted or survivors) reproduce • pass on (favourable) allele(s) / gene(s) / mutation(s)	allow in terms of an example ignore mutation allow survival of the fittest allow converse ignore passing on genetic material **or** chromosomes **or** characteristic	3	AO1 4.6.2.1 4.6.2.2 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
09.3	Alfred Wallace and Charles Darwin		1	AO1 4.6.2.2 4.6.3.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
09.4	hoverfly looks like a wasp	allow pattern of the markings is similar (on the hoverfly and wasp) ignore predator / animal thinks the hoverfly is a wasp	1	AO3 4.6.3.2 4.7.1.1 4.7.1.4
	predator / animal avoids **wasps** so it does not get stung		1	
	(so) predator / animal does not attack / eat hoverfly	allow correctly named predator ignore bite / harm	1	

Total Question 9	**8**

Question 10

Question	Answers	Extra information	Mark	AO / Spec Ref.
10.1	lack of oxygen for (aerobic) respiration	do **not** accept ref to respiration in dead plants	1	AO3
	(so) less / no energy (released)	do **not** accept energy produced / made / created	1	AO2
	(for) microorganisms / bacteria / fungi / microbes / decomposers **OR** low pH denatures enzymes (1) (so) less / no (chemical) reactions / metabolism / respiration **or** less **/** no energy released (1) in microorganisms / bacteria / fungi / microbes / decomposers (1)	allow low pH / acidity reduces enzyme activity do **not** accept energy produced / made / created	1	AO2 4.2.2.1 4.4.2.1 4.7.1.2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
10.2	34 g/m^2/year		1	AO2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
10.3	DNA		1	AO1 4.6.1.5 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
10.4	protein		1	AO1 4.4.1.1 4.4.2.1 4.4.2.3 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
10.5	increase in temperature	allow global warming allow heat (energy) is trapped ignore reference to greenhouse gases	1	AO3
	(because) carbon dioxide is released (from the peat bog)		1	AO2
	(because) carbon dioxide is produced by burning / decay of peat	ignore methane is released from burning / decay of peat allow fewer plants to take in carbon dioxide (for photosynthesis)	1	AO2
	(because) methane is released (from the peat bog)		1	AO2
				4.4.2.1 4.7.2.3 4.7.3.3 4.7.3.5

Total Question 10	**10**

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	any **one** from: • collect more samples each time • collect samples more frequently • use a bigger bucket / sample • do not return tadpoles until after the fourth sample • sample at the same time of day • randomise collecting positions • collect at range of depths • standardised sweeps with a net instead of a bucket	 allow suggested time interval allow a method to avoid double counting tadpoles	1	AO3 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	6	if no answer on line, allow answer in **Table 1**	1	AO2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.3	correct linear scale and axis labelled weeks	scale must use at least half available space	1	AO2 4.7.2.1 RPA9
	all points plotted correctly	allow a tolerance of ±½ small square allow 4 or 5 correct plots for **1** mark	2	
	curved line of best fit	ignore line drawn point to point	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.4	correct value at 0 and 4 weeks from line on student's graph, eg 60 and 22	allow a tolerance of ± ½ small square	1	AO2 4.7.2.1
	correct calculation eg $\frac{22}{60} \times 100$		1	
	36.7	allow 37 or 36.6... allow correct calculation using values from the student's graph if no line drawn on Figure allow a calculation based on values of 60 and 24 for up to full marks if line drawn on Figure but data from table used (60 and 24) only mp2 and mp3 can be awarded	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.5	any **two** from: • disease / (named) pathogens • being eaten **or** predators • lack of food • low oxygen (concentration in water) • change in temperature • change in pH • (some of the) pond dried out • toxic chemical	 allow competition for food ignore competition unqualified allow eutrophication allow lack of space allow named example such as sewage / fertiliser ignore pollution ignore waste	2	AO2 4.7.1.2 4.7.1.3

Total Question 11	**11**