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

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	Extra information	Mark	AO / Spec. Ref.
01.1	an allele expressed when a rabbit has only one copy of the allele		1	AO1 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	**hh**		1	AO2 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	<table><tr><td></td><td>**H**</td><td>**h**</td></tr><tr><td>**H**</td><td>HH</td><td>Hh</td></tr><tr><td>**h**</td><td>Hh</td><td>hh</td></tr></table> male gametes correct all three offspring genotypes correctly derived from gametes	 allow **1** mark for 2 correct	 1 2	AO2 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(on **Figure 2**) ring drawn around **HH** and / or **hh**		1	AO2 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	3	answer must be consistent with genotypes in question **01.3** if given allow 3 if question **01.3** is not answered	1	AO3 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	1		1	AO1 4.6.1.8

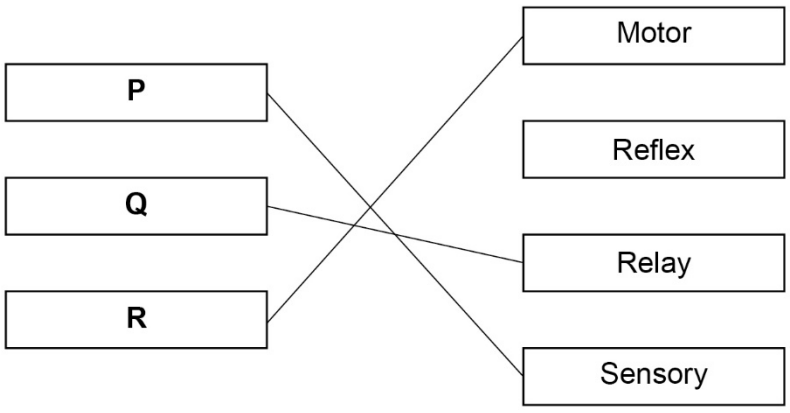
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	2 / two	allow half / ½ (of them) ignore ratios	1	AO2 4.6.1.8

Total Question 1	**9**

Question 2

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	receptor effector	in this order only	1 1	AO2 4.5.2.1

Question	Answers	Mark	AO / Spec. Ref.
02.3	**Letter** **Type of neurone**  do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	as a chemical		1	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	$\frac{18 + 17 + 13}{3}$ 16 (cm)	allow $\frac{48}{3}$	1 1	AO2 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	shorter time in each (successive) test **or** shorter distance in each (successive) test	ignore speed / it improved	1	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **one** from: • use more repetitions • test more students • use ruler with smaller / mm divisions • same starting position of ruler (above student **B**'s hand) • same distance between finger(s) and thumb • student **B** supports arm / hand / wrist / elbow on bench / table • use same hand (each time) • use of mechanical / electronic device to hold and drop ruler	allow use a ruler with a more precise scale allow use a ruler with a better resolution ignore use a more accurate ruler allow make sure student **B**'s hand is stationary allow use dominant **or** non-dominant hand each time allow drop ruler without warning allow drop ruler at random time intervals allow idea of controlling distraction / caffeine / sleep / alcohol allow use a computer program	1	AO3 4.5.2.1 RPA7

Total Question 2	**12**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	testis / testes / testicle(s)		1	AO1 4.5.3.4 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	**A** = 46 **D** = 23	 if no other mark awarded allow **1** mark for **A** = 92 **and D** = 46	1 1	AO1 4.6.1.2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	fertilisation		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	pollen		1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	mitosis		1	AO1 4.1.1.6 4.1.2.2 4.6.1.1 4.6.1.2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	sugar water		1 1	AO2 4.4.1.3 4.2.3.2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **one** from: • produces (genetic) variation (in offspring) • (seeds / fruits) can be dispersed (to new areas) • many seeds / offspring produced • offspring not competing (for light / water / ions) • can survive in a new environment • enables evolution	allow offspring are not (genetically) identical allow description of an advantage of variation eg not all killed by one pathogen / disease	1	AO1 4.6.1.1 4.6.1.3 4.6.2.2 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any **one** from: • fast • many offspring produced • (genetically) identical offspring • only one parent needed • offspring less vulnerable (as attached to parent) • offspring receive water from parent • can out-compete other species • can colonise local area • less energy is needed	 allow they are clones allow offspring receive named example of nutrient from parent allow pollinators / bees not required	1	AO1 4.6.1.1 4.6.1.3 4.6.2.2 4.6.3.1

Total Question 3	**10**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	bars plotted at 420 **and** 340 bars correctly labelled	allow a tolerance of ± ½ a small square allow bars touching ignore width of bars ignore shading	1 1	AO2 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	increase		1	AO3 4.5.2.4

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Process in the kidneys** / **Name of process** Removes water from the blood → Filtration Takes excess water out of the body → Excretion Takes water back into the blood → Reabsorption (Coordination) do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.3.3

Question	Answers	Mark	AO / Spec. Ref.
04.4	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.5.3.3
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content **in favour of a kidney transplant** • no need for regular / long hospital visits • could last for rest of lifetime • flexible lifestyle eg as can go on holidays • may not live near a hospital **or** reference to transport costs • no risk of infection from frequent piercing of skin **or** no risk of infection from blood exposed to equipment • no need for controlled diet • maintains correct concentration of substances in blood / body • cheaper in long term **against a kidney transplant** • may be rejected • need to keep taking anti-rejection drugs **or** immunosuppressants • (suitable) donor may not be available **or** donor may need tissue matching • risk from surgery (anaesthetic or infection) • recovery from surgery may take a long time • may need replacing eventually For **Level 2**, points for and against a kidney transplant must be given.		

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	bases		1	AO1 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	3 / three		1	AO2 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	mutation		1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	*figures from graph* 40 and 1 *correct equation* $\frac{40 - 1}{12}$ *correct answer* 3.25 (cases per million people per year)	 allow $\frac{39}{12}$ 	 1 1 1	AO2 4.6.3.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	resistant		1	AO1 4.6.3.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • discovery of a new antibiotic / drug / treatment • vaccination • isolation of patients • better / improved education about MRSA • better hygiene	 allow social distancing allow increased awareness of MRSA allow examples such as more / better hand washing (in hospitals)	1	AO2 4.6.3.7

Total Question 5	**8**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	sunlight		1	AO1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	worm **or** snail		1	AO3 4.7.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3			1	AO3 4.7.4.2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	1%		1	AO2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	faeces movement		1 1	AO1 4.7.4.3 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	(fish) 3 (snails) 12 (worms) 23	all correct = **2** marks 1 or 2 correct = **1** mark	2	AO2 4.7.2.1

Total Question 6	**8**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	100 – 60 – 3 37 (%)	allow 100 – 63	1 1	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	*(conclusion 1)* (chicken manure) produces more biogas **or** (chicken manure) produces biogas at a faster rate *(conclusion 2)* more biogas produced (in the first week) **or** the line / graph is steep (in the first week) *(conclusion 3)* no (more) biogas produced (after 4 weeks) **or** not much more biogas produced (after 4 weeks)	allow correct pairs of data for chicken and cow eg 600 for chicken and 400 for cow allow use of figures from graph for chicken / cow to illustrate 'more' allow the line / graph levels off (after 4 weeks)	1 1 1	AO3 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	increases increases stays the same	in this order only	1 1 1	AO3 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	any **one** from: • transport costs money • fish fat costs money • fish fat has an unpleasant smell • fish fat attracts animals	 allow it is too far to transport allow it takes too long to transport allow uneconomic	1	AO3 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	so plants / crops grow faster / better (because manure) releases / contains minerals / ions / salts	 allow named mineral / ion(s) / salts allow (because manure): • retains water in soil • improves drainage • insulates / keeps warm • suppresses weed growth • improves soil structure ignore nutrients / nitrogen / food / carbon dioxide if no other marks awarded allow 'it is a fertiliser' for **1** mark	1 1	AO2 4.7.2.3

Total Question 7	**11**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1		allow skeleton **or** hard parts for bones throughout ignore compression ignore reference to oxygen		AO2 4.6.3.5
	any **two** from:		2	
	• (ichthyosaur died and) is buried in sediment / sand / mud / silt	do **not** accept (icthyosaur died and) is buried in rock(s)		
	• (only) soft parts decayed / eaten **or** bones were not decayed / eaten			
	• bone(s) / remains replaced by minerals	allow mineralisation of bones allow bone(s) left imprint in mud / sand / sediment (that then hardened to rock) ignore bones turned to stone / rock		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2		allow conversion to metres at any stage		AO2 4.6.3.5
	120 × 17		1	
	2040 (mm)		1	
	2.04 (metres)	allow correct conversion of incorrectly calculated length	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3		in this order only		AO1 4.6.3.5 4.6.4
	phylum		1	
	family		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **two** from: • ice age • global warming • volcanic activity • asteroid collision • new predators • (new) disease / pathogen • competition for mates • lack of habitat **or** habitat change	 } if neither of these, allow climate change for **1** mark 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 mates ignore competition unqualified ignore environment change allow competition between **ichthyosaurs** for food ignore isolation ignore pollution ignore lack of food	2	AO1 4.6.3.6

Total Question 8	**9**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	to remove all / the water	allow to make sure there is no water left allow to make sure the soil is (completely) dry ignore to remove water unqualified	1	AO3 4.7.1.2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$\frac{71}{252} \times 100$		1	AO2 4.7.1.2 4.7.2.1
	28.1(746…)		1	
	28 (%)	allow student's incorrectly calculated percentage using mass data for 20 metres, rounded to nearest whole number	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	as distance increases the percentage of water increases	allow positive correlation allow as one increases the other increases allow as one decreases the other decreases ignore directly proportional	1	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	any **two** from: • repeat (at each distance) **and** calculate a mean • test at intermediate / further distances • test around more / different trees • test at different angles around the (same) tree	 allow repeat (at each distance) **and** remove / identify anomalies allow test more areas	2	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	any **three** from: • light (intensity) • temperature • type of soil • pH (of soil) • minerals / ions (in soil) • wind (intensity / direction) • oxygen in soil	 if neither awarded allow shade for **1** mark ignore sun allow acidity / alkalinity (of soil) allow salts **or** named examples of ions, such as nitrate allow fertiliser ignore nitrogen / nutrients ignore (availability of) space ignore carbon dioxide	3	AO2 4.7.1.1 4.7.1.2 4.7.2.1 RPA9

Total Question 9	**10**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	growth (response) due to gravity	ignore direction of growth	1 1	AO1 4.5.4.1

Question	Answers	Mark	AO / Spec. Ref.
10.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.4.1 RPA8
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • place a seedling in box with slit • place a seedling in darkness **or** in all-round light • measure initial heights of shoots • measure final heights of shoots **or** measure shoots with a ruler **or** measure the growth of shoots • record a named feature of appearance of seedlings • detail of how bent shoots are measured eg use thread or straighten them out • repeat with several seedlings • calculate mean height increase for each condition • compare results (for each condition) *control variable(s)* ○ same number of seedlings (per pot / condition) ○ same temperature ○ same volume of water ○ same soil type / volume ○ 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 control variables is required.		

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	there is an uneven distribution of the hormone		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	leaves / plant receive(s) / absorb(s) more light (so) more photosynthesis (which produces) more glucose	 allow (which produces) more starch / carbohydrate / sugar allow (which produces) more (named) organic material / other named organic substance if no other marks awarded allow **1** mark for any two of the mark points with no reference to 'more'	1 1 1	AO2 4.5.4.1 4.4.1.1 4.4.1.3

Total Question 10	**13**