GCSE
BIOLOGY
8461/2H

Paper 2 Higher Tier

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 4 6 1 2 H / M S

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.

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

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2023 AQA and its licensors. All rights reserved.

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 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	a community		1	AO1 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	brambling and chaffinch		1	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	the brambling and the bullfinch cannot breed together to give fertile offspring		1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4		allow answers in terms of month numbers ignore seasons		AO3 4.7.1.1
	constant (from Jan) to Mar / (mid-)Apr	ignore straight	1	
	increases (from mid-)Apr to / and May		1	
	decreases from May / Jun to Dec		1	
		if no other marks awarded allow for **1** mark constant, **then** increase **then** decrease		

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	B		1	AO3 4.7.1.1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	D (because) present only May to Sep	allow D (because) present only May to Oct allow D (because) **not** present Oct to Apr / May allow D (because) present only in summer allow D (because) **not** present in winter allow D (because) not present for all the year allow D (because) only present for some of the year	1	AO3 4.7.1.1 4.7.1.4

Total Question 1	**8**

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	accommodation		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	B		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	E		1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	becomes fatter / thicker / wider	allow more convex / curved / rounded ignore larger / smaller	1	AO1 4.5.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	any **two** from: • (muscles in the iris) contract • reduce size of pupil • reduces (amount of) light entering	 allow (muscles in the iris) shorten ignore circular / radial muscles ignore (muscles in the iris) relax do **not** accept ciliary muscles contract allow constrict pupil allow reduce size of aperture / gap / hole allow reduces (amount of) light reaching retina	2	AO1 4.5.2.3

Question	Answers	Mark	AO / Spec Ref.
02.6	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO2
	Level 1: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	1–2	AO1
	No relevant content	0	
	Indicative content • identification of method eg ruler drop • correct details of method chosen eg hold ruler above thumb • repetitions – at least two more times • repeat with (at least 2 more) other students • tested without coffee **and** with coffee **or** with different amounts of coffee • calculate mean value with coffee and without coffee • compare results with and without coffee • correct control variables for method chosen, eg: ○ same age ○ sex ○ BMI ○ amount of sleep ○ volume / concentration / type of coffee ○ time interval between drinking and testing ○ control variable within method described For **level 2** reference to collecting results with and without coffee along with how the investigation is designed to create valid results is required		4.5.2.1 RPA7

Total Question 2	**10**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • variation of a named / described (desirable) characteristic • not all susceptible to the same disease / pathogen • maintain / increase gene pool	allow eg different flavour / colour allow different customer preferences	1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	any **one** from: • they have the same named /(desirable) characteristic(s) • they grow at the same rate • they ready to harvest at same time	allow eg all high yield **or** all disease-resistant **or** same (desirable) flavour	1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(a group of) cells are grown (into a new organism)	ignore clones	1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	any **one** from: different • water • minerals / ions • light • herbivores • disease • plant density • soil pH	 allow rain allow named example ignore nutrients ignore sun unqualified allow named example allow named example allow different temperature allow different environmental conditions	1	AO2 4.6.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	male gametes = **X** + **Y** female gametes = **X** + **X** offspring genotypes correctly derived from gametes	if neither mark awarded, allow **1** mark for male = **X** + **X and** female = **X** + **Y** allow correct for chromosome assignment in mp1 & mp2	1 1 1	AO1 AO1 AO2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	any **one** from: • half are XX and half are XY • equal probability of X or Y sperm fertilising an egg • (the Punnett square shows) 50% (chance of) male / female		1	AO2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **two** from: • temperature • type / amount of food • light • whether chickens are kept indoors or outdoors • amount of movement / space (allowed) • time of year	 allow (volume / amount of) water allow same stocking density allow same number of each type ignore same number unqualified allow mass at start allow age of chicken(s) allow same medication **or** all healthy	2	AO2 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any **one** from: • (more) valid / representative **or** reduce the effect of anomalies • (more) accurate mean	 allow can calculate a valid mean allow (more) accurate results allow (more) reliable mean / results	1	AO2 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.9	breed best of **A** and **B** (together)	allow cross / mate best of **A** and **B**	1	AO2
	select offspring with highest egg numbers **and** heaviest / fastest growing	allow select the best offspring for both desired characteristics	1	AO1
	breed (these) offspring together		1	AO1
	repeat over many / several generations	do **not** accept reference to repeated breeding of the original parents	1	AO1 4.6.2.3

Total Question 3	**15**

Question 4

Question	Answers	Mark	AO / Spec. Ref.
04.1	**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 4.2.3.2 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 • microorganisms / bacteria / fungi (cause decay) • (named) enzyme used in decay / digestion • digestion **or** large molecules to small molecules • respiration by microorganisms • production / release of carbon dioxide • carbon dioxide is released into the air • carbon dioxide taken in by stomata / leaves • carbon dioxide used in photosynthesis • making glucose / sugar / starch / cellulose / other named example • release of nitrate (ions) into the soil • nitrate (ions) taken in (by roots) • nitrate (ions) taken in by active transport • nitrate (ions) for making amino acids / proteins / DNA / other named example For **Level 2**, the response needs to refer to both breakdown and use of nitrogen and carbon compounds		

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	any **one** from: • use more temperatures • measure pH at smaller time intervals • use a data logger (for continuous monitoring) • measure pH at same time of day • same type of milk • repeat (at each temperature) and calculate a mean **or** repeat (at each temperature) and eliminate anomalies • cover / uncover all beakers	allow example, such as same fat content of milk ignore same pH probe / meter ignore extend beyond 4 days ignore age of milk	1	AO3 4.7.2.3 RPA10

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	points for days 1, 2 and 3 correctly plotted	allow a tolerance of ± ½ small square allow 2 correct plots from days 1, 2 and 3 for **1** mark do **not** accept an incorrect plot for day 0 / 4	2	AO2 4.7.2.3 RPA10
	correct curved line of best fit	ignore line joined point to point with straight lines ignore extrapolation do **not** accept a single straight line	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	tangent drawn to the 15 °C curve at 2 days	do **not** accept if there is an incorrect tangent at 2 days	1	AO2 4.7.2.3 RPA10
	$\frac{6.5 - 4.5}{4}$	allow a tolerance of ± ½ small square	1	
	0.5		1	
	$\frac{0.5}{0.3} = 1.67$	allow any number of decimal places allow answer to student's incorrectly calculated rate divided by 0.3 do **not** accept if a unit is given	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	enzymes more active **or** more bacteria produced	allow enzymes work more quickly ignore enzymes work better	1	AO2
	lipids broken down more quickly	allow fats broken down more quickly	1	AO2
	<u>fatty acids</u> produced more quickly (which changes pH)	ignore glycerol do **not** accept incorrect products of lipid breakdown, eg amino acids or glycogen **alternative route** allow more (kinetic) energy (at higher temperature) (1) molecules move faster **or** more (successful) collisions **or** lipids broken down more quickly (1) <u>fatty acids</u> produced more quickly (which changes pH) (1)	1	AO1 4.2.2.1 4.7.2.3 RPA10

Total Question 4	**17**

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1		allow answers in terms of insulin for hormone **A** and / or glucagon for hormone **B** allow answers in terms of blood glucose (concentration) for substance **Q**		AO3 4.5.3.7 4.5.3.2 4.5.3.1
	if (concentration of substance) **Q** becomes high (hormone) **A** is released / used		1	
	if (concentration of substance) **Q** becomes low (hormone) **B** is released / used		1	
	hormone(s) / **A** / **B** brings (concentration of) substance **Q** back to ideal / normal		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	(thyroxine) increases (basal) metabolic rate	allow (thyroxine) increases metabolism allow (thyroxine) increases respiration allow (thyroxine) increases reactions in cells	1	AO1 4.5.3.7 4.4.2.1 4.4.2.3
	<u>respiration</u> releases energy	allow <u>respiration</u> releases heat do **not** accept energy being produced / made / created allow <u>respiration</u> is exothermic	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	(kidney) tubules less permeable to water		1	AO1
	(so) less water is reabsorbed	allow (so) less water taken back into the blood	1	AO1
	(so) more water in urine causing increased rate of production (of urine)	allow (so) more water in urine causing increased volume (of urine)	1	AO2
	(so) more water in urine causing lower concentration of dissolved substances (in urine)	(so) more water in urine causing more dilute urine	1	AO2 4.5.3.3

Total Question 5	**9**

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1		ignore reference to animals		AO2 4.7.1.2 4.7.2.2 4.4.1.2 4.4.2.1
	(0 to 6h): in the dark so (only) respiration occurs	allow no / limited light so (only) respiration occurs allow night(time) so (only) respiration occurs	1	
	(respiration) produces carbon dioxide		1	
	(8 to 12h): in the light so photosynthesis (rate) is faster than respiration (rate)	allow in the light so more photosynthesis than respiration allow day(time) so more photosynthesis than respiration do **not** accept no respiration	1	
	idea of net / overall uptake of carbon dioxide	allow uptake of carbon dioxide by photosynthesis is greater / faster than output by respiration	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2		answers must be comparative allow converse argument		AO3 4.7.2.4 4.7.3.4 4.7.3.3
	field of maize only takes in carbon dioxide for 6 months of the year (compared to all year)	allow maize takes in carbon dioxide for a shorter amount of time	1	
	(and) field of maize takes in less carbon dioxide per day than rainforest		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	for comparison		1	AO2
	(because) different areas started with different numbers (of species)	do **not** accept (because) different areas started with different numbers of trees	1	AO3 4.7.2.4 4.7.3.1 4.7.3.4 4.7.3.6 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	any **one** from: • number of tree species increased rapidly at first • the number of tree species increases more slowly later • rate of increase of number of tree species decreases with time • beyond about 50 years there were more tree species than in the original rainforest • there was (great) variability of number of tree species from one study area to another at the same time	ignore answers referring to numbers of trees unqualified allow it takes 45 to 55 years for the forest to recover (the number of species) ignore biodiversity increases	1	AO3 4.7.2.4 4.7.3.1 4.7.3.6 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.5	more / different types of food available	ignore more food available	1	AO2 4.7.2.4 4.7.3.1 4.7.3.6 4.7.3.3
	more / different types of habitat / shelter **or** nest sites available	allow more / different habitats	1	

Total Question 6	**11**

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	as volume of follicles rises oestrogen concentration (in blood) rises (for 7 / 8 days)	allow (positive) correlation between oestrogen concentration and volume of follicles (for 7 / 8 days) **or** oestrogen concentration is in proportion to follicle volume (for 7 / 8 days) do **not** accept an increase of oestrogen concentration causes an increase of follicle volume	1	AO3 4.5.3.4 4.5.3.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	(volume of one follicle) $= \frac{4}{3} \times 3.14 \times 11^3$	allow $= \frac{4}{3} \times \pi \times 11^3$	1	AO2
	= 5572.(4533)	allow 5575(.279…)	1	AO2
	(total volume of follicles) = 39 000 (mm^3)		1	AO3
	$\frac{39\,000}{5572} = 6.99…$	allow use of an incorrect volume (from Figure 12) and / or an incorrectly calculated volume of one follicle	1	AO2
	7	do **no**t accept 7.0	1	AO2 4.5.3.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	(lack of FSH causes) lack of oestrogen (production)	allow lack of FSH causes lack of follicle development / growth / maturation	1	AO2 4.5.3.4
	breast development is dependent on oestrogen (from follicles)	allow (female) secondary sexual characteristics are dependent on oestrogen (from follicles)	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	gametes correct: **H + h and H + h**		1	AO2 4.6.1.6 4.6.1.7
	correct derivation of offspring genotypes: **HH Hh Hh hh**	allow correct for gametes stated in mp1	1	
	correct phenotype for each genotype	allow correct for genotypes stated in mp2 do **not** accept if no **hh** offspring	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5		allow annotated genetic diagram for all marks		AO3 4.6.1.6
	mother (has **hh** so) passes on **h**		1	
	father (has **Hh** so) passes on **H** or **h** with equal probability		1	
	(so) child will be **Hh** / hetero-zygous with 0.5 probability and produces FSH		1	

Total Question 7	**14**

Question 8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.1	(A) → E → D → C → B → (F)	must be in this order	1	AO3 4.6.1.2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.2	(start) 16	allow 8 pairs	1	AO3
	(end) 8	the answer must be half the value of the number at the start	1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.3	(meiosis) forms gametes	allow (meiosis) forms sex cells allow (meiosis) forms eggs **and** sperm	1	AO1 4.6.1.2
	(two gametes) fuse / fertilise		1	
	(so) keeps chromosome number constant (from generation to generation) **or** (so) prevents doubling / increase in chromosome number (in each generation) **or** (so) gives normal / correct chromosome number (for embryo / new cell)	allow gives correct chromosome number (for offspring)	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.4	random chromosome from each pair (of chromosomes) moves to one end of the cell **or** goes into each new cell **or** gamete	ignore half the chromosomes ignore half the DNA allow other processes for creating variation ignore mutation	1 1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.5	base(s)	allow organic / nitrogenous base(s) ignore adenine / cytosine / guanine / thymine	1	AO1 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.6	12 / twelve	allow 6 pairs **or** six pairs	1	AO3 4.6.1.5

Total Question 8	**10**

Question 9

Question	Answers	Mark	AO / Spec Ref.
09	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.6.3.1 4.6.3.2 4.6.3.3 4.6.3.4 4.6.3.5 4.6.3.6 4.6.3.7 4.6.4
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	

	Indicative content **Fossil evidence:** • fossils show evidence of life in the past • fossils show change over time • fossil record shows development of species over time • fossils show evidence of extinction • fossil record shows how organisms from the past are related to species alive today • gaps in fossil record • gaps in fossil record are being filled in with new evidence • ref to evolutionary trees • description of how fossils are formed **Genetics:** • ref to Mendel's breeding experiments with plants • Mendel's description / idea of units / factors of inheritance • dominant and recessive units / alleles / genes • observation of chromosome behaviour during cell division • chromosome behaviour and Mendel's units work in similar ways • structure of DNA worked out • gene mechanism in determining protein synthesis worked out • (genetic) variation in a species • (variation) due to mutation or change in gene (structure) • individuals with advantageous characteristics more likely to survive • individuals with advantageous characteristics more likely to reproduce • (survivors) pass on (advantageous) alleles / genes • eg of evolution (such as antibiotic resistance in bacteria) • new species arise when sufficient changes occur to prevent (successful) reproduction For **Level 3**, the response must include details about fossils and about the mechanisms of genetics For **Level 2**, the response should include descriptions about fossils and / or genetics		

Total Question 9	**6**