GCSE
BIOLOGY
8461/2F

Paper 2 Foundation Tier

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 4 6 1 2 F / 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

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.

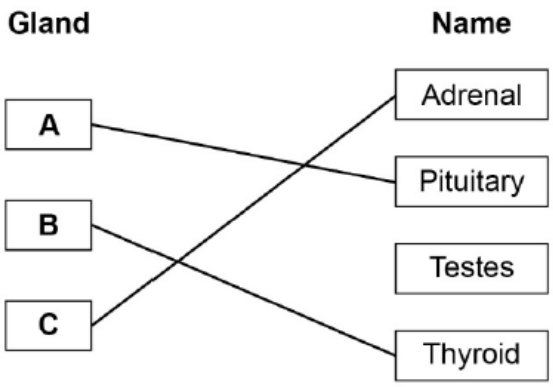
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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	the endocrine system		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	by the blood		1	AO1 4.5.3.1

Question	Answers	Mark	AO / Spec Ref.
01.3	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	D		1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	the liver		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	any **one** from: • lowers (blood) glucose • (makes) cells / liver / muscles take in glucose • (changes) glucose to glycogen	allow sugar for glucose allow controls (blood) glucose allow makes glycogen	1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.7	follicle stimulating hormone (FSH)		1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.8	oestrogen progesterone		1 1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.9	any **two** from: • oral contraceptive • injection • implant • (skin) patch • (some) IUDs	 allow the pill allow contraceptive rod allow IUS allow named methods allow coil with hormone	2	AO1 4.5.3.5

Total Question 1	**13**

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	(30 m) tape measure quadrat	must be in this order	1 1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	choose locations at random		1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	area mean	must be in this order	1 1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	multiply mean by area	allow multiply 2 by 150 allow multiply total (of five quadrats) by a fifth of the area allow multiply 10 by 30	1	AO1 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	count and record more samples		1	AO3 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.6	any **one** from: • water / moisture • light • temperature • oxygen in the soil • wind • minerals / ions	 allow humidity allow rain allow drought ignore sun unqualified allow shade (by eg building) ignore oxygen unqualified allow named ions allow fertiliser / salts ignore carbon dioxide ignore nutrients ignore (soil) pH	1	AO2 4.7.1.2

Total Question 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.1	any **one** from: • sun • light	ignore photosynthesis	1	AO1 4.7.2.1 4.7.4.3

Question	Answers	Mark	AO / Spec Ref.
03.2	<table><tr><th>Feeding relationship</th><th>Organism</th></tr><tr><td>Secondary consumer</td><td>lynx</td></tr><tr><td>Primary consumer</td><td>(snowshoe) hare</td></tr><tr><td>Producer</td><td>grass</td></tr><tr><td>Herbivore</td><td>(snowshoe) hare</td></tr><tr><td>Carnivore</td><td>lynx</td></tr><tr><td>Prey</td><td>(snowshoe) hare</td></tr><tr><td>Predator</td><td>lynx</td></tr></table> if no other mark awarded allow **1** mark for 3 correct answers	1 1 1	AO3 4.7.2.1 4.7.4.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	camouflaged / hidden **or** not (easily) seen	allow description eg blends in with surroundings	1	AO3
	from lynx / predator / carnivore		1	AO2
	not killed / eaten	allow less likely to be killed / eaten	1	AO2 4.7.1.2 4.7.1.3 4.7.1.4 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.4	any **two** from: • fewer lynx (to eat them) • more food / grass (available) • hares reproduce / breed / multiply	allow not many predators / lynx do **not** accept no lynx / predators allow a lot of food / grass	2	AO2 4.7.1.3 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.5	(number of lynx) increases		1	AO3 4.7.1.3 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.6	less food **or** fewer (snowshoe) hares (to eat) **or** fewer prey	ignore the lynx were hunted do **not** accept no food	1	AO2 4.7.1.3 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.7	any **two** from: • (lost in) respiration (of snowshoe hare) • egestion / faeces • excretion / urea / urine • not all eaten	allow as carbon dioxide allow not all digested allow not all (named) parts eaten if no other mark awarded, allow **1** mark for waste	2	AO1 4.7.2.1 4.7.4.3

Total Question 3	**13**

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	6000 (kJ/m^2/year)		1	AO2 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	$\frac{40}{16\,000} \times 100$ 0.25 (%)		1 1	AO2 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	cows move less indoors it is warmer indoors		1 1	AO1 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	cows are close(r) together	allow cows are in an enclosed space	1	AO2 4.7.5.2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	any **one** from: • D • G • H		1	AO3 4.6.3.7 4.1.1.6 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	DNA		1	AO1 4.6.3.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7	reproduction		1	AO2 4.6.3.7 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.8	any **two** from: • many animals will become ill • resistant bacteria passed from animal to animal • animals cannot be cured (by the antibiotic) • animals may be less productive / efficient • farmer may lose profit / money	ignore reference to crops allow many animals may die allow disease passed from animal to animal **or** other animals infected allow antibiotic will not work allow less meat / milk produced allow less growth allow cannot sell infected produce / animals	2	AO2 4.3.1.1 4.6.3.7 4.7.5.2

Total Question 4	**11**

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1	fungi		1	AO1 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	the pH of the milk		1	AO2 4.7.2.3 RPA10

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	put the beaker in a water bath		1	AO2 4.7.2.3 RPA10

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.4	fatty acid		1	AO1 4.2.2.1 4.7.2.3 RPA10

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	all the fat had been digested		1	AO2 4.7.2.3 4.2.2.1 RPA10

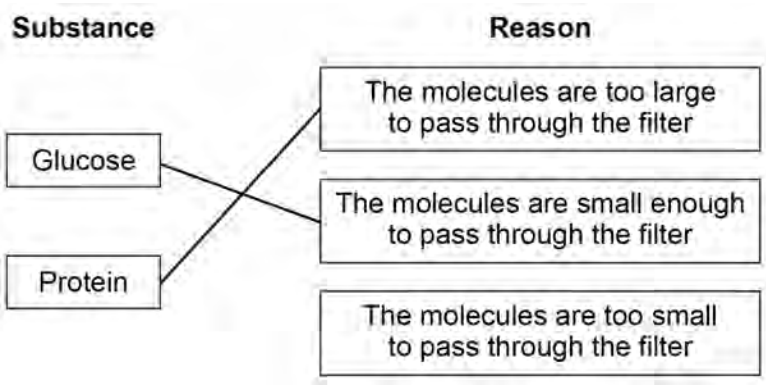
Question	Answers	Extra information	Mark	AO / Spec Ref.
05.6	any **one** from: • (there is) more (kinetic) energy • enzyme activity is higher • bacteria / microorganisms are dividing / reproducing faster	allow converse if clearly describing 5 °C allow particles move faster allow more collisions between particles allow enzymes work faster ignore enzymes work better allow number of bacteria / microorganisms increasing faster allow more bacteria / microorganisms ignore bacteria / microorganisms grow faster ignore it is warmer	1	AO2 4.7.2.3 4.1.1.6 4.2.2.1 RPA10

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.7	(30 °C, 2 days) 6(.0) **and** (30 °C, 3 days) 4.7	allow a tolerance of ±½ small square	1	AO2 4.7.2.3 4.2.2.1 RPA10
	(fall) 1.3 (pH units/day)	allow −1.3 (pH units/day) allow correct answer using student's incorrect readings in the range of 5.95 to 6.05 and / or 4.65 to 4.75	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.8	$\frac{1.3}{0.1}$	allow ecf from answer in question **05.7**	1	AO2 4.7.2.3 4.2.2.1 RPA10
	13	do **not** accept if a unit is given	1	

Total Question 5	**10**

Question 6

Question	Answers	Mark	AO / Spec Ref.
06.1	 do **not** accept more than one line from a box on the left	1 1	AO3 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	158.1 (dm^3)		1	AO2 4.5.3.3

Question	Answers	Mark	AO / Spec Ref.
06.3	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content	0	
	Indicative content **points for transplant:** • transplant is cheaper • numerical comparison, eg £18 000 cheaper in first year and £30 000 cheaper in subsequent years • less / no inconvenience, eg time **or** cost for hospital visits • less / no restriction on lifestyle • less / no restriction on diet or fluid intake • no danger of infection from eg puncturing skin or blood in contact with machine • less / no possibility of blood clots • no need to take anti-clotting drugs • transplanted kidney keeps water / urea / ions in blood at correct level at all times • feel well all the time **points against transplant:** • danger of rejection • need tissue match for transplant • donors in short supply • possibility of organ damage due to anaesthetic • possibility of infection in surgery • possibility of damage due to surgery • need to take immunosuppressant drugs • may suffer other infections due to suppressed immune system • may need repeat operation (after about 10 years) For **Level 3** students should refer to both points for and points against.		4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	4 × 5 000 = 20 000		1	AO2 4.5.3.3
	20 000 + 17 000	allow 25 000 + 17 000	1	
	(£) 37 000	allow (25 000 + 17 000) = (£) 42 000	1	

Total Question 6	**12**

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	a community		1	AO1 4.7.1.1

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

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	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.
07.4		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.
07.5	B		1	AO3 4.7.1.1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	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 7	**8**

Question 8

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

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

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

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.4	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.
08.5	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.
08.6	**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: o same age o sex o BMI o amount of sleep o volume / concentration / type of coffee o time interval between drinking and testing o 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 8	**10**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	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.
09.2	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.
09.3	(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.
09.4	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.
09.5	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.
09.6	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.
09.7	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.
09.8	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.
09.9	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 9	**15**