GCSE
COMBINED SCIENCE: SYNERGY
8465/2F

Foundation Tier Paper 2 Life and Environmental Sciences

Mark scheme

June 2024

Version: 1.0 Final

2 4 6 G 8 4 6 5 / 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.

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	electron		1	AO1 4.3.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$		1	AO1 4.3.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	alpha particles are less penetrating than beta particles		1	AO1 4.3.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **two** from: • (radon gas) is invisible • (radon gas) can be inhaled • radon gas will emit (alpha) radiation inside your body	ignore radon gas is colourless allow you can breathe in radon gas	2	AO3 4.3.2.4 4.3.2.5 4.3.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any **two** from: • the actual number of people with lung cancer is greater than the predicted number • the actual number of people with other lung diseases is greater than the predicted number • more people have lung cancer than other lung diseases • there is a bigger difference between the predicted number and the actual number of lung cancer cases than for other lung diseases • the scientists' predictions were not accurate	if neither mark awarded allow 1 mark for the actual number of people is greater than the predicted number	2	AO3 4.3.2 4.3.2.6 4.3.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	any **one** from: • so workers take precautions to protect themselves • so the workers can assess / understand the risk • so the workers can assess / understand the effect on their health • so the workers can choose a different job		1	AO3 4.3.2

Total Question 1	**8**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	incomplete combustion of hydrocarbons		1	AO1 4.4.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	red blood cells	allow (oxy)haemoglobin	1	AO1 4.2.1.4 4.4.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	bar drawn at 40% carbon monoxide and 64 arbitrary units of oxygen	allow a tolerance of ± ½ a small square ignore width of bar ignore shading	1	AO2 4.2.1.4 4.4.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(concentrations of oxygen =) 98 **and** 20 (change = 98 − 20) = 78	 allow correct use of incorrectly determined concentration(s)	1 1	AO2 4.2.1.4 4.4.1.6

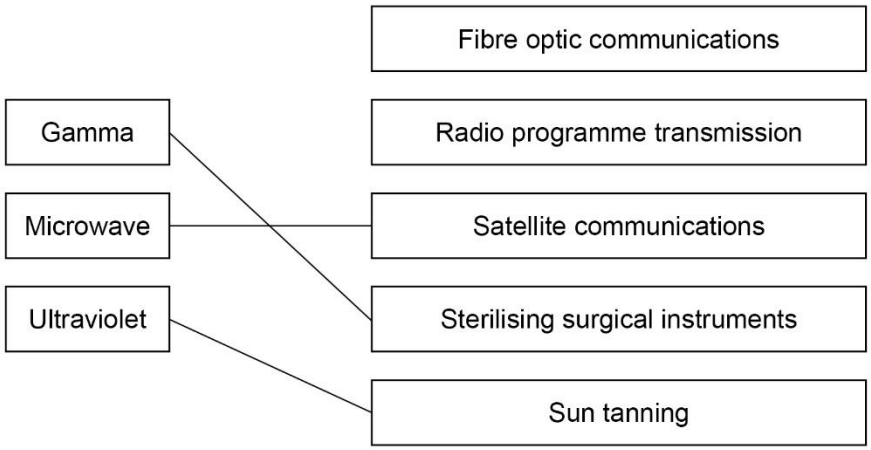
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(increasing carbon monoxide percentage) decreases the oxygen (in the blood)	allow ecf from question **02.3**	1	AO3 4.2.1.4 4.4.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	faster heart rate		1	AO2 4.2.1.4 4.4.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **one** from: • decreases the concentration of carbon monoxide • by letting carbon monoxide out (of the room)	allow by letting air / oxygen in (to the room) allow improves ventilation	1	AO2 4.2.1.4 4.4.1.6

Total Question 2	**8**

Question 3

Question	Answers	Mark	AO / Spec. Ref.
03.1	**Type of wave** / **Use**  do **not** accept more than one line from a box on the left	1 1 1	AO1 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	stopclock / stopwatch	ignore clock / watch / timer	1	AO1 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	a control variable		1	AO1 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	burns from the infrared heater		1	AO3 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	20 (°C)		1	AO3 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	the black surface had a greater temperature increase per second the black surface was a better absorber of infrared radiation		1 1	AO3 4.1.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	line starting at 20°C drawn between the existing lines on **Figure 3**		1 1	AO3 4.1.4.3

Total Question 3	**11**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	stomata guard cells	must be in this order	1 1	AO1 4.2.2.3 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(A) chloroplast (B) vacuole (C) cytoplasm		1 1 1	AO1 4.1.3.2 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(magnification =) $\frac{32}{0.08}$ (×) 400		1 1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	to reduce water loss from the pepper to slow down decay of the pepper		1 1	AO3 4.1.3.3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	osmosis	allow diffusion (of water)	1	AO1 4.1.3.3

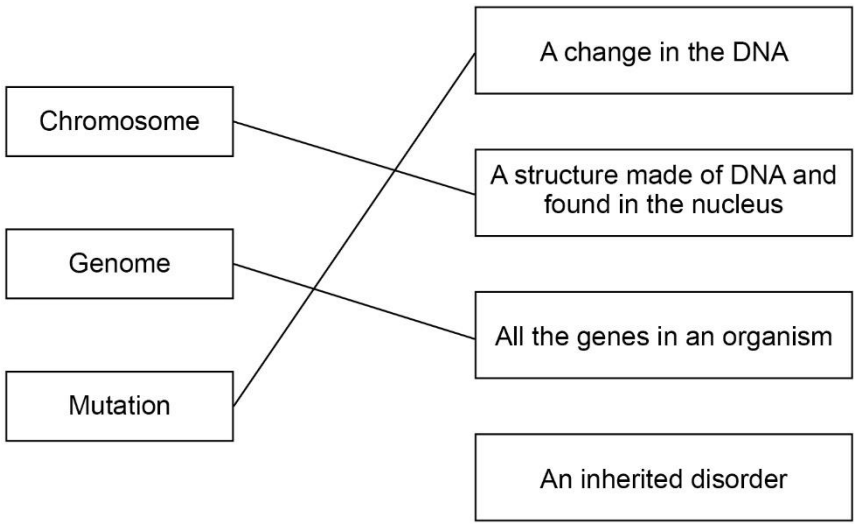
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	2.7 (arbitrary units)	allow a tolerance of ±½ a small square	1	AO2 4.1.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	the cells can expand		1	AO3 4.1.3.2 4.1.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8		idea of less only needed once		
	less light absorbed **or** fewer chloroplasts **or** less chlorophyll		1	AO2 4.2.2.8 4.2.2.5
	(so) less photosynthesis		1	AO1
	(therefore) less glucose / cellulose / starch / protein produced **or** (therefore) fewer amino acids produced		1	AO1

Total Question 4	**15**

Question 5

Question	Answers	Mark	AO / Spec. Ref.
05.1	**Term** / **Meaning**  do **not** accept more than one line from a box on the left	1 1 1	AO1 4.4.3.1 4.4.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	X and Y as male gametes XX, XX and XY offspring	 derivation must match location of gametes allow 2 correct for **1** mark	1 2	AO2 4.4.3.2 4.4.3.3

X	XX	XX
Y	XY **or** YX	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the side effects of genetic modification are not known		1	AO3 4.4.4.6 4.3.3.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	the modified gene in an embryo could be passed on to future offspring		1	AO3 4.4.4.6 4.3.3.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	HIV infection can be treated with antiretroviral drugs		1	AO3 4.4.4.6 4.3.3.8 4.3.3.2

Total Question 5	**9**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	exothermic		1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	anaerobic (respiration)	allow fermentation	1	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any **two** from: • time • mass / 5 g(rams) of yeast • volume / 20cm^3 of sugar solution • concentration of sugar solution	allow 1 hour allow 10 minutes (to reach temperature) allow amount of yeast if neither awarded allow amount of sugar for **1** mark allow (thin) layer of oil if no mark awarded allow volume of solutions for **1** mark and allow concentration of solutions for **1** mark	2	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	increased	allow went / goes up	1	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	temperature is a continuous variable		1	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	(label y-axis) volume of gas (produced) in cm^3		1	AO2 4.2.1.1
	plotting	allow a tolerance of ±½ a small square allow 3 or 4 plots correct for **1** mark	2	
	line of best fit		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	correct answer from the student's line drawn on Figure 10	allow tolerance of ±½ a small square if no line of best fit is drawn, allow an answer in the range 1.05 to 1.15 (cm^3)	1	AO2 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	the yeast was dead	allow the enzymes (in yeast) had been destroyed / denatured do **not** accept the enzymes were killed	1	AO3 4.2.1.1

Total Question 6	**12**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	a long chain of amino acids		1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	biuret (reagent / solution)	allow add Biuret A **and** Biuret B allow add copper sulfate (solution) **and** potassium / sodium hydroxide (solution)	1	AO1 4.2.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	a heart attack cannot be passed on (to another person) **or** (heart attacks are) not caused by pathogens / microorganisms / microbes / virus(es) / bacteria / fungi	allow cannot catch a heart attack do **not** accept (heart attacks are) not inherited	1	AO2 4.3.1.1

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>07.4</td><td>
<table>
<tr><th>Statement</th><th>Risk</th><th>Benefit</th></tr>
<tr><td>The drug could be toxic</td><td>✓</td><td></td></tr>
<tr><td>The drug could keep hearts for transplantation functioning for more time</td><td></td><td>✓</td></tr>
<tr><td>The drug could treat coronary heart disease</td><td></td><td>✓</td></tr>
<tr><td>The drug could stop other drugs working</td><td>✓</td><td></td></tr>
</table>
allow 1 mark for two or three correct
0 marks for one correct

do not accept more than one tick per row
</td><td>2</td><td>AO3
4.3.3.7
4.3.1.3</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	a placebo does not contain the drug	allow the placebo is a control allow the patient won't know if it is a placebo or the drug	1	AO2 4.3.3.7
	(so) shows whether the effects of the drug are real / imagined / psychological		1	AO3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	scientists not involved in the drug trial assess whether the results are valid		1	AO3 4.3.3.7
	the process of peer review reduces the chance of bias		1	

Total Question 7	**9**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(method **A**) universal indicator (solution / paper)	allow wide range indicator do **not** accept litmus indicator / paper	1	AO3 4.4.1.8
	(method **B**) pH meter / probe	ignore datalogger	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	each method gives values to a different resolution		1	AO3 4.4.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	reproducible		1	AO3 4.4.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	**X**		1	AO3 4.4.1.6 4.4.1.7 4.4.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	(river water **X** is) acidic	MP1 is dependent on question **01.4** being awarded	1	AO3 4.4.1.6 4.4.1.7
	(because) sulfur dioxide turns to (sulfuric) acid in moist air		1	AO2
	(which causes) acid rain	allow (so) acid rain enters rivers ignore rainwater / precipitation enters rivers	1	AO2

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	AO1 4.4.1.8
	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 • filter river water • using a funnel and filter paper • to remove suspended solids • measure initial mass of empty evaporating basin • using a balance • measure 50 cm^3 of river water • using a measuring cylinder • transfer the river water to the evaporating basin and heat gently • using a Bunsen burner and water bath **or** using an electric heater • remove from heat when all liquid has evaporated • measure final mass of evaporating basin plus solids • using a balance • subtract initial mass from final mass of evaporating basin		

Total Question 8	**12**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	divide area into grid	allow place tape measures at right angle	1	AO1 4.4.2.4 4.4.2.5
	use random number generator (to produce coordinates)	allow description of obtaining random numbers do **not** accept throwing quadrats	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(animal) diversity increases		1	AO2 4.4.2.4 4.4.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	linear	allow a straight line ignore (directly) proportional do **not** accept a positive correlation	1	AO2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	more plant species in living grass (than in plastic grass)	allow converse if clearly describing plastic grass allow higher biodiversity in living grass (than in plastic grass)	1	AO2 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	record the number of plants of each species as well as the number of species repeat using three different transects that cross the two types of grass		1 1	AO3 4.4.2.4

Question	Answers	Mark	AO / Spec. Ref.
09.6	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	Level 1: Points are identified, and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content **Plastic grass will decrease biodiversity** • blocks light o no / fewer producers / plants o so fewer consumers / pollinators / decomposers • blocks animal access to surface o so worms / insects cannot access food o so fewer consumers • plastic / microplastics enter the food chain (in rivers / oceans) o so animals in danger of choking on plastics o so microplastics may build up in animals (in the food chain) • fewer decomposers because no / less soil o so less nutrients in the soil o so fewer plant (species) • cannot be recycled so enters landfill o (landfill) reduces / destroys habitats o increased pollution o so increased consequences of pollution **Plastic grass may increase biodiversity** • different plants may be able to grow (in plastic grass) o so more food for consumers o so more consumers / pollinators / decomposers • (slow to decompose) so leaves are present for longer o so may provide shelter for animals o so more (types of) consumers For **Level 3**, answers must explain different effects of plastic grass on biodiversity.		4.4.2.2 4.4.2.3 4.4.2.5 4.4.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	less genetic variation is a greater risk if the ecosystem changes		1	AO1 4.4.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.8	any **two** from: • do not mow / cut (some) areas of grass • plant hedge(rows) • plant trees • plant wider range of seeds / plants • reduce use of pesticides / herbicides • add a pond	allow leave area fallow allow add nesting boxes / materials **or** add bird / bat / insect boxes	2	AO2 4.4.2.7

Total Question 9	**16**