OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B4.1 ECOSYSTEMS

SCORE	PERCENTAGE
/203	%

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Question			Answer/Indicative content	Marks	Guidance
1			Dead plants decompose / decay / rot (1) Action of decomposers / bacteria / fungi (1) Minerals / elements are recycled / more available to plants / more nitrates (1)	3	**allow break down ignore** degrade / corrode **ignore** nutrients **allow** any named mineral
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
2			[Level 3] Answer includes a correct description of the greenhouse effect **and** is able to link this to the decrease in population of hares. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Answer includes a correct description of the greenhouse effect **or** explains why warmer weather results in less hares surviving. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer includes reference to the greenhouse effect or global warming **or** identifies that the predictions are for less hares to survive (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about the warmer weather may include: • The greenhouse effect • Carbon dioxide being a greenhouse gas • Trapping more heat in the Earth's atmosphere • Less radiated out to space Indicative scientific points about the prediction of the hares include: • Warmer weather means less snow • Hares will be less well camouflaged • More eaten by lynx • Increased risk of disease due to warmer conditions • Flooding of habitats due to sea level rising • Lack of food due to inability to grow in the new climate Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	**6**	

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Question			Answer/Indicative content	Marks	Guidance
3		i	sun(light) / light (1)	1	**not** green plants
		ii	**any two from:** can be a herbivore and a carnivore / is an omnivore / feeds on both plants and animals / feeds on both green plant and caterpillar (1) when it feeds on green plants it is a primary consumer (1) when it feeds on caterpillar it is a secondary consumer (1)	2	
		iii	numbers increase (1) less are eaten (1)	2	**allow** its predator has gone
			Total	**5**	
4			(decomposition) produces ammonia (1) **ammonia** is converted to nitrates (1) by nitrifying bacteria (1)	3	**allow** produces ammonium ions
			Total	**3**	

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Question			Answer/Indicative content	Marks	Guidance
5			[Level 3] idea of how carbon dioxide contributes to the greenhouse effect AND effect on snowshoe hares and their habitat AND linked to a reason for numbers dropping / extinction Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] idea of how carbon dioxide contributes to the greenhouse effect AND effect on snowshoe hares and their habitat OR linked to a reason for numbers dropping / extinction Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] idea of how carbon dioxide contributes to the greenhouse effect OR effect on snowshoe hares and their habitat OR a reason for numbers dropping / extinction OR reference to the prediction by the scientists (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about carbon dioxide in the environment include: • the greenhouse effect • carbon dioxide being a greenhouse gas • trapping more heat in the Earth's atmosphere / less radiated out to space • global warming Indicative scientific points about the hares habitat include: • loss of habitat • not having as much camouflage • numbers may fall below critical level -reduced population Indicative scientific points about the hares extinction include: • this may result in -higher predation -lack of genetic variation -inability to find mates / lower reproduction rate Indicative scientific points about prediction by the scientists at Level 1 • predictions show that less hares will survive Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
6			population is the (number) of one species or organism while community is all the species or organisms (1)	1	**allow** population is the (number) of newts while community is all the species or organisms (1) **allow** population is the (number) of one species or organism while community is the number of populations (1) **ignore** community is the number of animals
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
7			[Level 3] Matches all 6 organism correctly to each of the three groups of detritivores, carnivores and decomposer in the food web **AND** identifies ways earthworms help improve the structure and fertility of the soil. Quality of written communication does not impede communication of the science at this level. (5–6 marks) [Level 2] Matches **one** organism correctly to each of the three groups of detritivores, carnivores and decomposer in the food web **OR** Identifies ways earthworms help improve the structure and fertility of the soil. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) [Level 1] Matches **one** organism correctly to each of two of the groups of detritivores, carnivores and decomposer in the food web **OR** Identifies **one** way that earthworms help improve the structure and fertility of the soil Quality of written communication impedes communication of the science at this level. (1–2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0marks)	6	This question is targeted at grades up to C Indicative scientific points about earthworms may include: • bury the plant material • aerate the soil • improve drainage • mix up layers • neutralise acid soils Indicative scientific points about types of organisms may include: • detritivores, = woodlice / earthworms • carnivores = fox / hedgehog / spider • decomposer = fungi Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
8			population is the (number) of one species or organism while community is all the species or organisms (1)	1	**allow** population is the (number) of newts while community is all the species or organisms (1) **allow** population is the (number) of one species or organism while community is the number of populations (1) **ignore** community is the number of animals
			Total	1	
9	a		Thames (1)	1	
	b		idea that it will increase monitoring of sewage / pollution idea that sewage / pollution can kill the animals and plants in the water / can spread disease (1)	2	**allow** to stop pollution / reduces pollution **accept** high level answer that sewage may cause eutrophication (1)
			Total	3	
10			C ✓	1 (AO1.1)	
			Total	1	
11			A ✓	1 (AO1.2)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
12	a		type of plant material ✓ will affect the rate of microbes decomposing ✓ OR Size/SA of plant material ✓ will affect the rate of microbes decomposing ✓ OR mass of plant material ✓ will affect the rate of microbes decomposing ✓ OR oxygen ✓ will affect the (aerobic) respiration of microbes ✓	2 (AO 3.1a)	**Second marking point is dependent on a correct factor being stated** **ALLOW** decay/breakdown/rot throughout **ALLOW** decomposers/saprophytes/bacteria/fungi throughout **ALLOW** amount of plant material **IGNORE** amount of compost / composter size Examiner's Comments This question was challenging for the candidates. The majority couldn't identify a correct control variable and explain the effect on microbe action. The most common answer was to keep the water the same, which was the independent variable. Exemplar 5 demonstrates an answer which did not gain credit. Exemplar 5 She should keep the water constant.

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Question			Answer/Indicative content	Marks	Guidance
	b	i	any two from: A reaches the highest temperature ✓ A has a higher temperature for longer/at the start ✓ temperature increases quicker in A ✓ temperature falls quicker in A ✓ towards the end the temperature in A is lower ✓	2 (AO 2 × 2.2)	ALLOW ORA IGNORE A has a higher temperature IGNORE references to decay IGNORE comparisons to section B Examiner's Comments In this question the most common correct scoring point was that A reaches the highest temperature and increases quicker. Some candidates didn't make it a comparative answer with C, so did not gain credit. A small number of candidates referred to rate of decay instead of temperature or compared section A with section B.
		ii	Decay/breakdown/decompose/rot is fastest (in A) ✓	1 (AO 3.2a)	Examiner's Comments The majority of lower ability candidates did not score this question and linked watering more often to faster decay. Answer included seeing the effects of water on growth, also references to increases temperature on the plant material.
	c		(oxygen) is needed for microbes (that cause decay) ✓ for (aerobic) respiration ✓	2 (AO 1.2)	AW decomposers/saprophytes/ bacteria/fungi IGNORE references to enzymes Examiner's Comments In this question candidates linked oxygen and decay correctly but did not gain credit as couldn't demonstrate their knowledge and understanding of microbes requiring oxygen for respiration.
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
13		i	21800 (kg) ✓	1 (AO 2.2)	Examiner's Comments Over half of the candidates could correctly calculate the amount of biomass lost between plants and humans. The most common incorrect answer was 19800kg.
		ii	egestion/excretion/respiration ✓	1 (AO 1.1)	ALLOW named excretory product /faeces/urine/ uneaten parts/heat IGNORE movement/waste DO NOT ALLOW growth Examiner's Comments This again was a good differentiator, with most common credited answer being respiration. A lot of candidates referred incorrectly to the cattle eating them as a cause of biomass loss.
			Total	2	

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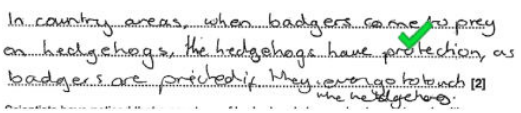
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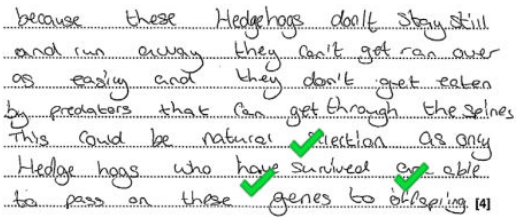
Question			Answer/Indicative content	Marks	Guidance
14	a		four / 4 ✓	1 (AO 1.2)	<u>Examiner's Comments</u> Over half of candidates achieved this mark and correctly identified the number of secondary consumers.
	b		badger number have increased ✓ more competition for food / less slugs to eat ✓	2 (AO 3.1b) (AO 3.2b)	IGNORE reference to hedgehog numbers dropping ALLOW badgers eat more slugs so less for hedgehogs ALLOW less food to eat IGNORE badgers are predators of hedgehogs IGNORE they both eat slugs <u>Examiner's Comments</u> The majority of candidates could identify there was a lack of slugs to eat for the hedgehogs. The higher ability candidates could link the increase in numbers, as the reason for the lack of food. Candidates that didn't score here just stated that the hedgehogs decrease which wasn't credit worthy, as the question asked for an explanation.

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Question			Answer/Indicative content	Marks	Guidance
	c	i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓	2 (AO 2 × 2.1)	ALLOW in country/advantage/where badgers live hedgehogs have defence against predators/badgers ALLOW hedgehogs have a reduced risk of being eaten <u>Examiner's Comments</u> More than half of candidates achieved at least one mark here. This question differentiated well between all abilities. Those candidates that didn't score did not link the hedgehogs to each conclusion properly. E.g. advantage/in country/where badges live to correct conclusion. Exemplar 9 was credited 1 mark for the advantage conclusion. Exemplar 9  In country areas, when badgers come to prey on hedgehogs, the hedgehogs have protection, as badgers are prickly. They can go to touch the hedgehogs. [2]

Question			Answer/Indicative content	Marks	Guidance
		ii	hedgehogs that run away are more likely to survive / less likely to get run over ✓ they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓	4 (AO 4 × 2.1)	**ALLOW** ORA for each marking point **ALLOW** reference to how change occurred e.g. mutation for running away **ALLOW** offspring produced / breed together **ALLOW** pass on advantageous gene **IGNORE** trait is pass on / genes are passed on <u>Examiner's Comments</u> A number of candidates achieved at least 1 mark, mainly that hedgehogs which run away are more likely to survive. A small number of candidates confused natural selection with genetic engineering. Exemplar 10 shows an answer credited 3 out of 4 marks. Exemplar 10  because these Hedgehogs don't stay still and run away they can't get ran over as easily and they don't get eaten by predators that can get through the selves This could be natural selection as only Hedge hogs who have survived are able to pass on these genes to offspring [4]
			Total	9	

Question			Answer/Indicative content	Marks	Guidance
15				4	ORA for all marking points
			idea of **less** plants/percentage of plants/% cover in shade/closer to the tree ✓	(AO 1.2)	ALLOW shows negative correlation
			less light (in shade/closer to the tree)✓	(AO 2.1)	IGNORE less sun IGNORE in shade **no** photosynthesis / **no** light
			less photosynthesis (in shade/closer to the tree)✓	(AO 3.1b)	ALLOW **less** light for photosynthesis (closer to the tree) 2 marks ALLOW photosynthesis **less** effective (closer to the tree)
			less food/raw materials produced **for growth** (in shade/closer to the tree)✓	(AO 3.2b)	<u>Examiner's Comments</u> A number of candidates achieved 1 mark on this question for the idea of less plants/% cover closer to the tree/shade or the reverse argument. Most candidates didn't link this to less light for photosynthesis. Less food for growth was the least credited marking point.
			Total	4	

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Question			Answer/Indicative content	Marks	Guidance
16	a		four / 4 ✓	1 (AO1.2)	Examiner's Comments This AO1.2 question required knowledge of scientific enquiry and procedures linked to interactions of organisms in a food web. Many candidates successfully identified four as the correct number. Lower ability candidates opted for the animals feeding on grass, thinking these were secondary consumers and incorrectly gave three as a response.
	b		badger number have increased ✓ more competition for food / less slugs to eat ✓	2 (AO 3.1b) (AO 3.2b)	IGNORE reference to hedgehog numbers dropping ALLOW badgers eat more slugs so less for hedgehogs ALLOW less food to eat IGNORE badgers are predators of hedgehogs IGNORE they both eat slugs Examiner's Comments This question assessed the analysis of information and drawing conclusions in AO3. Most candidates achieved full marks. Where candidates did not get full marks, this was usually due to forgetting to identify the increase in badger population or stating categorically that there would be no food or no hedgehogs, which did not gain a mark. Candidates need to refer to graphs or tables when given this information, to avoid making this type of error.

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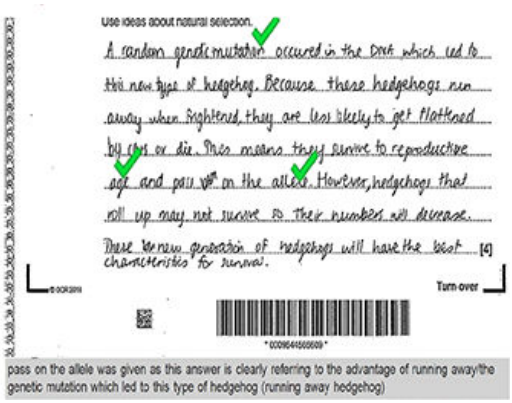
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Question			Answer/Indicative content	Marks	Guidance
	c	i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓	2 (AO 2 × 2.1)	ALLOW in country/advantage/where badgers live hedgehogs have defence against predators/badgers ALLOW hedgehogs have a reduced risk of being eaten Examiner's Comments This AO2.1 question was answered well overall. Candidates did not gain marks if they didn't correctly link their responses specifically to country or city areas. Just referring to roads was insufficient, however, candidates referring to many roads gained a mark as this distinguished the difference between city and country areas. The terms rural and urban were acceptable alternatives to country and city, in candidates' explanations. A common error was to say the rolling up was camouflage without explaining the answer.
		ii	hedgehogs that run away are more likely to survive / less likely to get run over ✓ to they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓	4 (AO 4 ×2.1)	ALLOW ORA for each marking point ALLOW reference to how change occurred e.g. mutation for running away ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is pass on / genes are passed on Examiner's Comments This application of knowledge of natural selection question usually resulted in candidates gaining at least two marks. This was usually for identifying that the hedgehogs that could run away had a higher survival rate and could go on to breed. Higher ability candidates were able to link this to the advantageous gene and some could refer to the process occurring over time. Fewer candidates scored the last two marking points because they referred not to the advantageous gene, but in general to genes, mutation (not mutated gene) or to the trait or characteristic or behaviour of running away, and, for the last

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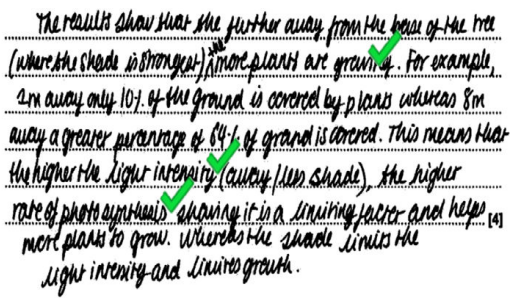
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Question			Answer/Indicative content	Marks	Guidance
					point, stating that because run away hedgehogs survived to breed, their numbers exceeded the numbers of roll up ones, simply because the roll up ones died. Examination technique needs candidates to focus on applying their knowledge to a new scenario, and to answer the question asked, not to talk in generic terms. Exemplar 1  Use ideas about natural selection A random genetic mutation occured in the DNA which led to this new type of hedgehog. Because these hedgehogs run away when frightened, they are less likely to get flattened by cars or die. This means they survive to reproductive age and pass on the allele. However, hedgehogs that roll up may not survive so their numbers will decrease. These new generation of hedgehogs will have the best characteristics for survival. [4] Turn over pass on the allele was given as this answer is clearly referring to the advantage of running away/the genetic mutation which led to this type of hedgehog (running away hedgehog) This candidate has been credited 3 marks. A mark is gained for identifying that a mutation has occurred to produce the running away hedgehog. They have gained a second mark for recognising they survive to reproductive age. Many candidates just referred to breeding or producing offspring which were deemed acceptable responses for that particular marking point. Also a third mark was gained for ‘pass on the allele’ has been given as they clearly understand that it is referring to the advantage of running away/genetic mutation for the advantageous gene. The candidate has not gained a mark for the new generation of hedgehogs as this does not reference the idea of the process repeating over several generations/overtime.
			Total	9	

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Question			Answer/Indicative content	Marks	Guidance
17				4	ORA for all marking points
			idea of **less** plants/percentage of plants/% cover in shade/closer to the tree ✓	(AO 1.2)	ALLOW shows negative correlation
			less light (in shade/closer to the tree) ✓	(AO 2.1)	IGNORE less sun IGNORE in shade **no** photosynthesis / **no** light
			less photosynthesis (in shade/closer to the tree) ✓	(AO 3.1b)	ALLOW **less** light for photosynthesis (closer to the tree) 2 marks ALLOW photosynthesis **less** effective (closer to the tree)
			less food/raw materials produced **for growth** (in shade/closer to the tree ✓	(AO 3.2b)	<u>Examiner's Comments</u> This question assessed four different assessment objectives. Candidates had to identify the trend from the graph and apply their knowledge and understanding to give a reason for the trend. They also had to interpret reasons for the trend and draw conclusions about how the shade was affecting the plants. Most candidates identified the trend. Higher ability candidates linked this to less light closer to the tree so reduced rate of photosynthesis. However, only the highest ability candidates concluded that this would result in less glucose/food production. Most candidates just referred to reduced growth, which on its own did not score a mark. Exemplar 2  The results show that the further away from the base of the tree (where the shade is stronger) the more plants are growing. For example, 2m away only 10% of the ground is covered by plants whereas 8m away a greater percentage of 64% of ground is covered. This means that the higher the light intensity (away from shade), the higher rate of photosynthesis showing it is a limiting factor and helps more plants to grow. Whereas the shade limits the light intensity and limits growth. [4] This candidate has been credited with 3 marks. A mark is gained for identifying the trend as a reverse argument. They have gained a second mark for recognising that

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Question			Answer/Indicative content	Marks	Guidance
					this is due to a higher light intensity further from the tree. A third mark was gained for linking the increase light intensity to an increased rate of photosynthesis. The candidate has not gained the final conclusion mark as they have only referenced the plant growth and not the food/raw materials produced to enable thegrowth to occur.
			Total	4	

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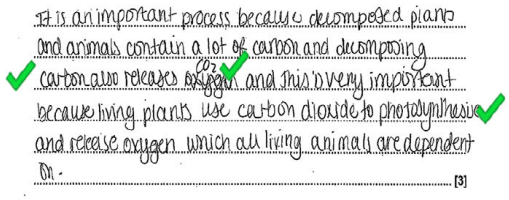
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Question			Answer/Indicative content	Marks	Guidance
18	a		< 3(mm) ✓ encourages more microbes from day 0 to 25 ✓ therefore, more rapid decay/decomposition ✓ OR 3 – 5(mm) ✓ encourages more microbes from day 26 to 50/overall ✓ therefore, more rapid decay/decomposition ✓	3 (AO 3.1a) (AO 3.2a) (AO 3.2b)	ALLOW > 5 given only 1 mark available for more rapid decay <u>Examiner's Comments</u> In this question assessing AO3, many candidates scored at least two marks. They had two opportunities from the data to gain the first marking point, but to gain the second marking point they needed to correctly match this to the day range, some did not do this. Far fewer candidates then went on to link this to the faster rate of decomposition.
	b		Any two from: (small pieces means) there will be a larger surface area of dead plants ✓ therefore, decomposers will be able to reproduce faster / feed faster ✓ therefore, decomposers will be able to respire faster ✓	2 (AO 2 × 2.2)	<u>Examiner's Comments</u> In this AO2 question, few candidates linked size to area and a number incorrectly thought large pieces had large surface area. Very few candidates were able to link the size to rates of respiration or reproduction.

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Question			Answer/Indicative content	Marks	Guidance
	c		idea of recycling in nature ✓ named example of a recycled substance e.g. carbon/nitrogen ✓ example of reason why the recycling is important e.g. for photosynthesis / production of proteins in plants ✓	3 (AO 3 × 1.1)	ALLOW mineral being returned to the soil / environment IGNORE nutrients/minerals IGNORE water ALLOW carbon dioxide/nitrates/nitrogen compounds recycled <u>Examiner's Comments</u> Most candidates understood the concept of recycling nutrients and often correctly named examples. Only a few understood the importance of this, beyond the idea that the nutrients are needed. Occasionally did they say specifically why. Exemplar 3  It is an important process because decomposed plants and animals contain a lot of carbon and decomposing carbon also releases oxygen and this is very important because living plants use carbon dioxide to photosynthesise and release oxygen which all living animals are dependent on. [3] This candidate has been credited maximum marks. They have identified a named element that is recycled and indicated that this is released by decomposition. The description of it being further used by living plants is sufficient to demonstrate an understanding of recycling. They complete their response by explaining why the plants take in the carbon dioxide by referencing its use in photosynthesis. Although this last marking point was seldom seen, where it was, this was usually associated with plants photosynthesising and only very occasionally with plants producing proteins.
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
19	a	i	First check answer on answer line If answer = 0.9 %award 2 marks $\frac{200}{22000}$ x 100 ✓ = 0.9 ✓	2 (AO 2. × 2.2)	 ALLOW 0.91 / 0.909 <u>Examiner's Comments</u> Candidates found this AO2.2 question quite challenging, often over-complicating it. Many performed incorrect divisions, and a few candidates rounded up to 1, then were only able to gain the mark for showing their working out.
		ii	Any two from: egestion ✓ excretion ✓ respiration ✓ decomposition ✓ uneaten parts ✓	2 (AO 2. × 1.1)	 ALLOW faeces ALLOW undigested food ALLOW named excretory product / urine ALLOW heat IGNORE movement <u>Examiner's Comments</u> This recall AO1.1 question was generally answered well. Movement on its own did not score but some candidates correctly linked this to respiration and so gained the mark for respiration.

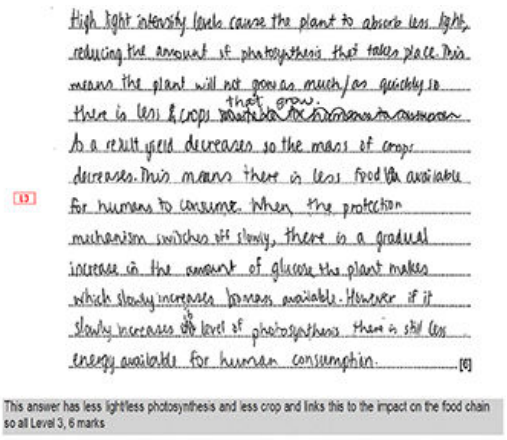
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Question			Answer/Indicative content	Marks	Guidance
	b		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed explanation including conclusions about how the mechanism affects photosynthesis and links this to less biomass available to humans in the food chain. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Explanation of how the mechanism affects photosynthesis or affects the biomass available to humans. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Demonstrates some knowledge of how the mechanism affects photosynthesis or affects the biomass available to humans. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	6 (AO 3. × 1.1) (AO 2. × 2.1) (AO 1. × 3.2b)	**AO1.1 Demonstrate knowledge of photosynthesis and biomass.** • Photosynthesis requires light energy • Mechanism reduces photosynthesis • Trapped by the leaves and used to produce food molecules • Photosynthesis required for plant growth • Plant biomass is a food source for animals including humans **AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass** • More light energy converted to heat, then less energy for photosynthesis • Less photosynthesis then plants can make less food / plants can grow less • Less plant biomass leads to less available food **AO3.2b Draw conclusions linking photosynthesis to biomass in food chains** • In low light intensities, light availability is the limiting factor • Less plant growth/crops therefore less food for cattle/less food for humans / in the food chain <u>Examiner's Comments</u> This Level of Response question assessed all three main assessment objectives. It was common to be limited to a low level mark due to repeating the stem of question regarding less biomass all through their response instead of linking the protection mechanism's impact to less light, less photosynthesis so less glucose/food made and consequently less food for cattle and humans. Candidates that did not appreciate that a reduction in light resulted in a reduction in photosynthesis, which also limited their answer to a low level.

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Question			Answer/Indicative content	Marks	Guidance
					There was little evidence of candidates planning their response. Taking time to consider how to answer a LoR, might encourage them to make notes and think through key areas. A common low level answer was to refer to the loss of energy due to the energy needed to switch on the mechanism. It was noted how many candidates did not link biomass to growth or production of food. However, those candidates that realised that the key to the answer was essentially linked to factors influencing photosynthesis, produced excellent responses. Exemplar 5  High light intensity levels cause the plant to absorb less light, reducing the amount of photosynthesis that takes place. This means the plant will not grow as much/as quickly so there is less crops that grow. As a result yield decreases so the mass of crops decreases. This means there is less food available for humans to consume. When the protection mechanism switches off slowly, there is a gradual increase in the amount of glucose the plant makes which slowly increases biomass available. However if it slowly increases the level of photosynthesis there is still less energy available for human consumption. [6] This answer has less light/less photosynthesis and less crop and links this to the impact on the food chain so all Level 3, 6 marks This candidate has been credited Level 3 maximum 6 marks. They have structured their answer in a concise manner but included all the relevant marking points. The candidate describes the protection mechanism's impact in reducing light andphotosynthesis. The candiates states that thedecrease in mass of crops and food made means there is consequently less food for the humans to consume. They continue to give a reason why there will still be less energy available even when the plants resume photosynthesis due to the mechanism switching off slowly.

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Question			Answer/Indicative content	Marks	Guidance
	c	i	mRNA carries the code for proteins ✓ more protein will be made ✓	2 (AO 2 × 2.1)	ALLOW protein will be made faster Examiner's Comments This question assessed AO2.1. Many candidates were able to link mRNA to either more or faster protein synthesis, but very few referred to the term 'code' to link mRNA and protein synthesis.
		ii	First check answer on answer line If answer = 40 award 2 marks $\frac{20 \times 200}{100}$ ✓ = 40 ✓	2 (AO 2 × 2.2)	Examiner's Comments Candidates found this AO2.2 mathematics skills question quite challenging. 240 was a common incorrect response. Candidates need to have more practice at similar questions using percentages to develop their mathematical skills in this area.

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Question			Answer/Indicative content	Marks	Guidance
		iii	new method uses the plants **own** genes ✓ concern that plants with the insecticide/gene might be harmful to humans / might impact on food chains / might kill useful insects ✓	2 (AO 2.2) (AO3.2a)	ALLOW might have side-effects IGNORE ideas about cultural or religious or ethical objections or that it is playing God Examiner's Comments This question assesses both AO2 and AO3. Candidates were most likely to score a mark for the AO3 marking point, but it was rare for them to gain the AO2 mark. Many candidates described the effect of the gene on the plant, not consumers, or did not pick up on the possible problems of the insecticide itself. There were several responses written about the concern about genetic modification not being a natural process. This is an idea that mark schemes are unlikely to credit, preferring instead to focus on the effects of GM food on all consumers. Candidates also frequently missed out writing about the plants own genes and just focused on the AO3 marking point of the bacterial gene so missed the AO2 marking point. It was common for candidates to write about general dangers of bacteria and infections and not specifically the gene.
			Total	16	
20			B	1 (AO 1.1)	Examiner's Comments This question assessed knowledge and understanding of abiotic factors. Just over half of candidates did not achieve this mark and responded incorrectly with a named biotic factor.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
21			A	1 (AO 1.1)	Examiner's Comments This question was the most accessible question in the multiple-choice section A, with most candidates correctly answering A which represents evaporation.
			Total	1	
22			C	1 (AO 1.1)	
			Total	1	
23			B	1 (AO 2.1)	
			Total	1	

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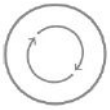
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Question			Answer/Indicative content	Marks	Guidance
24	a	i	feeds on seeds it is a primary (consumer) ✓ feeds on insects, then it is a secondary (consumer) ✓	2 (AO 2.1)	ALLOW eats seeds which are the producer/first trophic level ALLOW eats insects which are the primary consumer ALLOW it feeds on seeds and insects if no other marks scored. IGNORE references to herbivores/carnivores/predators Examiner's Comments This question was on application of knowledge and understanding of interdependence in food webs. Over half of all candidates were given at least one mark.
		ii	predator because it eats/kills pine martens ✓ competitor (with pine martens) because they eat flycatchers/same prey ✓	2 (AO 2.1)	ALLOW pine martens are foxes prey ALLOW foxes hunt pine martens ALLOW competitor because pine martens also eat flycatchers Examiner's Comments This question differentiated well on application of knowledge and understanding on interdependence. The main reason why the lower ability candidates did not score was due to them not identifying and stating the predator relationship and the competitor relationship.
		iii	insect(s) / Great tits	1 (AO 1.1)	Examiner's Comments This question was well answered by the candidates correctly identifying an organism in the second trophic level using their knowledge and understanding.

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Question			Answer/Indicative content	Marks	Guidance
	b	i	correctly chosen axes, labelled with units ✓ suitable scale for the number of bird boxes ✓ bars correctly drawn ✓ suitable key ✓	4 (AO 2.2)	height (m) must be on x-axis DO NOT ALLOW scale that use less than half the grid ALLOW +/- half a square IGNORE ?touching adjacent bars Examiner's Comments This was a good question which differentiated between the higher and lower ability candidates whereby they had to generate a bar chart from the information provided. Lower ability candidates struggled to choose the correct axis for the independent and dependant variable. A suitable scale and key were the highest marking points. Over a quarter of candidates were given full marks.  AfL Candidates should be encouraged to use the headings in a table to identify the independent and dependent variables. Convention is that the first column is most likely to be the independent variable. This should support them in choosing the correct axis, as the convention is that the independent variable goes on the x axis.

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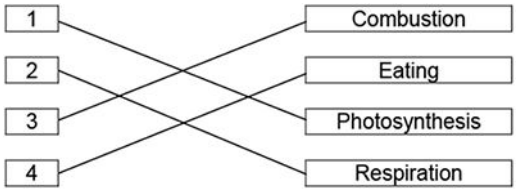
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Question			Answer/Indicative content	Marks	Guidance
		ii	**Any three from:** great tits (nest) higher (in the trees) / ORA ✓ this protects them from weasels who live mainly on the ground / ORA ✓ idea flycatchers (nest) at all heights ✓ as pine martens can move up and down/climb the tree ✓	3 (AO 3.2b)	**ALLOW** weasels can't reach them/great tits **ALLOW** fewer great tits lower down as weasels eat them = 2 **ALLOW** flycatchers can get killed anywhere in tree by pine marten **IGNORE** pine martens eat flycatchers and live in the trees Examiner's Comments Lower ability candidates could not analyse the information and draw conclusions. A number of candidates did not interpret the data correctly. Some compared the great tits with the flycatchers instead of identifying the predator prey relationship they had with the weasels or pine martins to explain the number of nests at different heights. A lot of candidates just stated that pine martins live in a tree, which is in the stem of the question.
			Total	12	

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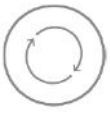
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Question			Answer/Indicative content	Marks	Guidance
25	a		 ✓✓	2 (AO 1.1)	**ALLOW** numbers matched to correct boxes All 4 lines correct = 2 marks 2 or 3 lines correct = 1 mark 1 or 0 lines correct = 0 mark Examiner's Comments This question differentiated well, and many candidates were able to demonstrate their knowledge and understanding of the carbon cycle.
	b	i	(no) microorganisms (in the soil) ✓ no decay (takes place) ✓	2 (AO 1.1) (AO 2.1)	**AW** microbes, decomposers, saprophytes, detritivores, bacteria, fungi **AW** decomposition, rotting, break down **ALLOW** not enough nitrifying bacteria to replace nitrates / no nitrates released by nitrifying bacteria = 2 **IGNORE** no organisms to recycle the minerals Examiner's Comments Very few candidates were able to apply their knowledge of microbes and decay to this question, and found it challenging to answer. Many candidates misinterpreted the question and talked about lack of oxygen for life or that Mars is too dry for life. This is demonstrated with Exemplar 4 which was given 0 marks. Exemplar 4 the conditions are different. as it is really hot on mars so the soil would dry out. [2]

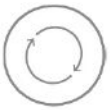
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Question			Answer/Indicative content	Marks	Guidance
		ii	plants release oxygen by photosynthesis ✓ organisms in the soil / microbes / animals release carbon dioxide by respiration ✓	2 (AO 2.2)	ALLOW correct word (or symbol) equations for photosynthesis linked to plants and respiration linked to organisms in the soil / microbes / animals AW microbes, decomposers, saprophytes IGNORE breathe out carbon dioxide IGNORE plants will respire and give out carbon dioxide ALLOW 1 mark for plants release oxygen/photosynthesise and microbes give out carbon dioxide/respire if no other marks are awarded. Examiner's Comments Candidates had to apply their knowledge and understanding of gases given off by plants in photosynthesis and organisms in carrying out respiration to explain why air would no longer needed to be added after a while. Most non-scoring responses were too vague and just stated gases as in the stem of the question.
			Total	6	
26			B	1 (AO 1.2)	
			Total	1	
27			B	1 (AO 1.1)	Examiner's Comments This AO1.1 question testing recall of mechanisms of energy losses in food chains, showed a clear area of misconception. In general, candidates chose either B or a significant number frequently put C and did not score.  Misconception Many candidates are unaware of the distinction between egestion and excretion.
			Total	1	

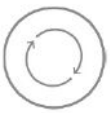
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Question			Answer/Indicative content	Marks	Guidance
28	a	i	feeds on seeds it is a primary (consumer) ✓ feeds on insects, then it is a secondary (consumer) ✓	2 (AO 2.1)	ALLOW eats seeds which are the producer/first trophic level ALLOW eats insects which are the primary consumer ALLOW it feeds on seeds and insects if no other marks scored. IGNORE references to herbivores/carnivores/predators Examiner's Comments This AO2.1 question was generally well answered by most candidates. Some candidates did not match the appropriate terminology to the seed and insect correctly and did not score.  Misconception A small number of candidates have the misconception that a secondary consumer refers to the number of steps away from the producer and wrote that the great tit was a secondary consumer of leaves.
		ii	predator because it eats/kills pine martens ✓ competitor (with pine martens) because they eat flycatchers/same prey ✓	2 (AO 2.1)	ALLOW pine martens are foxes prey ALLOW foxes hunt pine martens ALLOW competitor because pine martens also eat flycatchers Examiner's Comments Generally, candidates coped well with this AO2.1 question. A small number of candidates did not link the animal to the term and simply said foxes eat pine martens and flycatchers, but generally most understood the terms and used them correctly in the context of the food web.

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Question			Answer/Indicative content	Marks	Guidance
		iii	insect(s) / Great tits	1 (AO 1.1)	Examiner's Comments Almost all candidates scored on this AO1.1 question. On the rare occasion that an incorrect response was given it was for flycatcher.
	b	i	correctly chosen axes, labelled with units ✓ suitable scale for the number of bird boxes ✓ bars correctly drawn ✓ suitable key ✓	4 (AO 2.2)	height (m) must be on x-axis DO NOT ALLOW scale that use less than half the grid ALLOW +/- half a square IGNORE ?touching adjacent bars Examiner's Comments This AO2.2 question testing graphing skills was generally well answered. The majority of candidates drew a good chart with suitable scales and a key. A small but significant number did not label the axes with units  AfL Candidates, particularly those of lower ability, need practice at drawing graphs and representing information in ways that have strict rules about using rulers, the size of graphs and bars. This will maximise their opportunity to get full marks on questions like this one.

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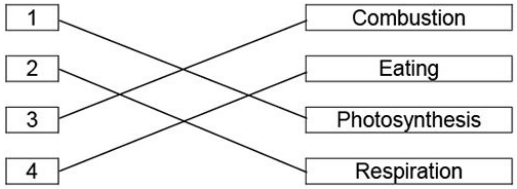
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Question			Answer/Indicative content	Marks	Guidance
		ii	**Any three from:** great tits (nest) higher (in the trees) / ORA ✓ this protects them from weasels who live mainly on the ground / ORA ✓ idea flycatchers (nest) at all heights ✓ as pine martens can move up and down/climb the tree ✓	3 (AO 3.2b)	**ALLOW** weasels can't reach them/great tits **ALLOW** fewer great tits lower down as weasels eat them = 2 **ALLOW** flycatchers can get killed anywhere in tree by pine marten **IGNORE** pine martens eat flycatchers and live in the trees Examiner's Comments Most candidates were able to link the preference for height of box in great tits to protection from a ground-dwelling predator in this AO3.2b question analysing information and ideas to draw conclusions. Although many candidates could link the location of the great tits due to the weasel predator being on the ground, only a few candidates were able to explain the results for the flycatchers.
			Total	12	

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Question			Answer/Indicative content	Marks	Guidance
29	a		 ✓✓	2 (AO 1.1)	**ALLOW** numbers matched to correct boxes All 4 lines correct = 2 marks 2 or 3 lines correct = 1 mark 1 or 0 lines correct = 0 mark Examiner's Comments Most candidates scored on this AO1.1. On the rare occasion where candidates made an error it was usually on photosynthesis or respiration.
	b	i	(no) microorganisms (in the soil) ✓ no decay (takes place) ✓	2 (AO 1.1) (AO 2.1)	**AW** microbes, decomposers, saprophytes, detritivores, bacteria, fungi **AW** decomposition, rotting, break down **ALLOW** not enough nitrifying bacteria to replace nitrates / no nitrates released by nitrifying bacteria = 2 **IGNORE** no organisms to recycle the minerals Examiner's Comments Lower ability candidates didn't realise they needed to identify decomposer or a named type of decomposer and instead repeated the term living organisms from the question, thereby missing the AO1.1 aspect of the question. Higher ability candidates were able to name decomposers or types of decomposers. A significant number did not write about the AO2.1 aspect of the question about decomposition, using terms such as replenish or recycle minerals. Some candidates wrote about the minerals being used up but didn't go on to say why they would not be replaced.

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Question			Answer/Indicative content	Marks	Guidance
		ii	plants release oxygen by photosynthesis ✓ organisms in the soil / microbes / animals release carbon dioxide by respiration ✓	2 (AO 2.2)	ALLOW correct word (or symbol) equations for photosynthesis linked to plants and respiration linked to organisms in the soil / microbes / animals AW microbes, decomposers, saprophytes IGNORE breathe out carbon dioxide IGNORE plants will respire and give out carbon dioxide ALLOW 1 mark for plants release oxygen/photosynthesise and microbes give out carbon dioxide/respire if no other marks are awarded. Examiner's Comments In this AO2.1 question, many candidates referred to plants only, indicating the importance of careful reading of the question that asked about organisms other than plants. Another frequent response from candidates that did not score was reference to 'breathing' out carbon dioxide and not specifically to respiration.
			Total	6	

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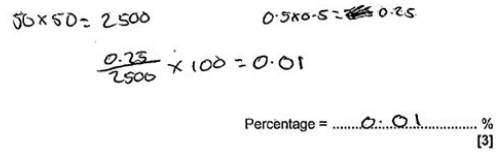
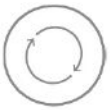
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Question			Answer/Indicative content	Marks	Guidance
30	a		(the salt) will draw water out of the plant cells by osmosis ✓	1 (AO 2.1)	ALLOW plant cells will lose water and become plasmolysed IGNORE flaccid / dries the plant out Examiner's Comments On this AO2.1 question, even higher ability candidates found it challenging. Quite a few understood that water would be lost but did not mention osmosis or refer to the cells being plasmolysed. Many responses considered cell turgidity and possible lysis. Some even thought salt water was beneficial for providing the cells with minerals.

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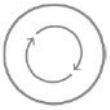
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Question			Answer/Indicative content	Marks	Guidance
	b	i	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 0.1 (%) award 3 marks = 2.5 ✓ $\frac{2.5}{2500}$ x 100 ✓ = 0.1 (%)✓	3 (AO 1.2) (AO 2.2) (AO 1.2)	ALLOW ECF on area of quadrats ALLOW ECF <u>Examiner's Comments</u> This AO1.2 and AO2.2 question was generally answered well. Some candidates incorrectly rounded their answer and others did not multiply the area of 1 quadrat by 10, therefore using 0.25 instead of 2.5 in their calculation. Very few candidates scored zero, as often candidates were able to get marks for error carried forward. This emphasises the importance of candidates showing their working out. Exemplar 2   AfL In this exemplar, it shows how ECF was applied to incorrect responses. ECF was applied to the percentage calculation method with incorrect value for the area of the quadrats, then ECF for the percentage calculation value. This highlights how important it is for candidates to show their working out as the candidate would not have scored any marks if all they had put was 0.01 on the answer line, as it would not have been possible to apply ECF.

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Question			Answer/Indicative content	Marks	Guidance
		ii	Any three from: the second student samples less area / ORA ✓ the second student did not sample at random / only sampled in the centre of the marsh / ORA ✓ the centre may contain different plants compared to the edges ✓ so, idea that the second student's results may be less representative / less accurate / ORA ✓	3 (AO 3.1b)	ASSUME SECOND SAMPLE IF NOT STATED ALLOW only 5 quadrats taken / less repeats / less sample size / less data collected ALLOW the second student will not have results from all over the marsh / ORA Examiner's Comments The majority of candidates gained some marks on this AO3.1b question, with a minority gaining maximum marks. Most candidates were able to recognise that second student's method was not random and not representative of the entire marsh. Fewer commented on the fact that 5 quadrats cover less area than 10. Very few candidates observed that the plants would probably be different in different areas of the marsh.  AfL Candidates should be prepared to evaluate by processing information, graphs and diagrams before attempting answers, as this will help them construct responses that will cover the marks available in the question.

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Question			Answer/Indicative content	Marks	Guidance
		iii	make sure the tide is not coming in / make sure that the marsh is stable enough / wash hands after the experiment ✓	1 (AO 3.3b)	ALLOW be aware of tide timetables/high tides ALLOW be safe as the tide is unpredictable ALLOW avoid falling into deeper marsh/slipping in mud IGNORE references to clothing Examiner's Comments This AO3.3 question targeted practical skills and specifically improvement of experimental procedures. Many candidates misunderstood 'risk assessment' and suggested things that could go wrong with experiment; 'losing the quadrats', 'damaging or killing plants/animals', etc. rather than health and safety.
	c		salt marshes are rare habitats ✓ they contain plants that do not live anywhere else ✓	2 (AO 3.2b)	ALLOW salt marsh plants are rare ALLOW plants can be lost / extinct ALLOW loss of habitat for the animals that live there Examiner's Comments This AO3.2b question required suitable conclusions to be drawn from the evidence in the question. Many candidates realised a marsh is a rare environment and that plants that grow there would be lost if the sand banks were built. As the question mentions increased biodiversity, lower ability candidates incorrectly considered other, more general reasons linked to the sand banks, with a frequent response being 'it would cause flooding' or that 'it would be expensive'.
			Total	10	
31			A ✓	1 (AO1.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
32			D ✓	1 (AO1.1)	
			Total	**1**	
33			minerals ✓	1 (AO1.1)	more than one answer ringed = no mark
			Total	**1**	
34			A ✓	1 (AO1.2)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
35	a		to let air / oxygen in ✓ for (aerobic) respiration ✓	2 (AO1 x 2.1) (AO1 x 1.1)	DO NOT ALLOW carbon dioxide DO NOT ALLOW anaerobic respiration
	b		to allow a valid comparison of the results✓	1 (AO3.1b)	
	c	i	correct plots ✓✓ smooth curved line between points ✓	3 (AO3 x 2.2)	ALLOW +/- half a square All correct = 2 marks 3 or 4 plots correct = 1 mark DO NOT ALLOW sketchy line / line thicker than half a square
		ii	increases up to 10 days/70^{o}C ✓ then decreases ✓	2 (AO3.1a)	ALLOW increases up to 9-11 days ALLOW increases by 44^{o}C
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 39 (^{o}C) award 2 marks 70-31 ✓ = 39 (^{o}C)✓	2 (AO2.2) (AO1.2)	
		iv	normal compost is made by aerobic respiration✓ aerobic respiration releases more energy than anaerobic respiration✓	2 (AO2 x 2.1)	2 correct ticks = 2 marks 1 correct ticks = 1 mark 3 ticks two correct = 1 mark 3 ticks one correct = 0 marks 4 or more ticks = 0 marks
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 8 (kg) award 3 marks 1500-1200 OR 300 ✓ 300/40 OR 7.5 ✓ = 8 (kg) ✓	3 (AO3 x 2.2)	 ALLOW one mark for clear evidence of rounding incorrect answer correctly to the nearest whole number
		ii	less carbon dioxide is produced ✓	1 (AO3.1b)	ALLOW less contribution to global warming / greenhouse effect / climate change
			Total	16	

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Question			Answer/Indicative content	Marks	Guidance
36			D ✓	1 (AO1.1)	
			Total	1	
37			D ✓	1 (AO2.1)	
			Total	1	
38			D ✓	1 (AO2.2)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
39	a		bacteria in the compost kill disease causing fungi: ; the compost is sterile and so is aseptic: ; the compost provides carbon dioxide for photosynthesis: ; the compost provides minerals for the plants: ✓	1 (AO1.1)	more than one box ticked = 0 marks
	b		normal bin has holes to allow in air / oxygen ✓ (making normal compost) so aerobic respiration occurs ✓	2 (AO2.1) (AO1.1)	**ALLOW** converse arguments for bokashi bin **ALLOW** aerobic bacteria carry out respiration **IGNORE** bacteria work aerobically
	c		used the same pile of dead plant material for both composters / used same plant type / used equal mass in both composters ✓	1 (AO2.2)	**ALLOW** used the same time interval for both composters **ALLOW** used the same water/moisture content for both composters **ALLOW** idea of same external conditions e.g. put both in same place / external temperature kept the same / kept in the same environment **IGNORE** references to fair testing
	d	i	Axes – both correctly labelled, including units✓ Axes - even scales occupying more than half of the grid ✓ Plotting - all points correctly plotted ✓ Line - lines labelled or a key ✓ Line - points with curve of best-fit lines ✓	5 (AO5 x 2.2)	Must have time on x-axis and temperature on y-axis **ALLOW** +/- half a square at least 8 points correctly plotted **IGNORE** extrapolated lines

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Question			Answer/Indicative content	Marks	Guidance
		ii	temperature increased as compost decomposed / bacteria released heat by respiration ✓ temperature starts to drop as decomposition slows down/complete / bacterial respiration slows ✓	2 (AO2 x 2.1)	ALLOW rise in temperature due to energy released by respiration ✓ ALLOW bacterial activity slows (if respiration already mentioned) ALLOW temperature starts to drop as enzymes in respiration denature at high temperatures
		iii	idea that decomposition in bokashi (method) bin much slower ✓ anaerobic respiration releases less heat/energy than aerobic respiration ✓	2 (AO2 x 2.1)	Enter text here.
	e	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 27 (%) award 3 marks 400 / 1500 x 100 ✓ 26.6 (%) ✓ = 27 (%) ✓	3 (AO2.2) (AO2.2) (AO1.2)	If answer = 26.6 (%) award 2 marks ALLOW ECF for correct rounding
		ii	idea that the gas given off is carbon dioxide ✓ less greenhouse gas produced / less likely to result in global warming / less contribution to greenhouse effect ✓	2 (AO2.2) (AO3.1b)	ALLOW for 2 marks less carbon dioxide produced which is a greenhouse gas ALLOW correct formula ALLOW explanations of the greenhouse effect IGNORE references to environmental damage/not environmentally friendly/pollution/not good for the environment
			Total	18	

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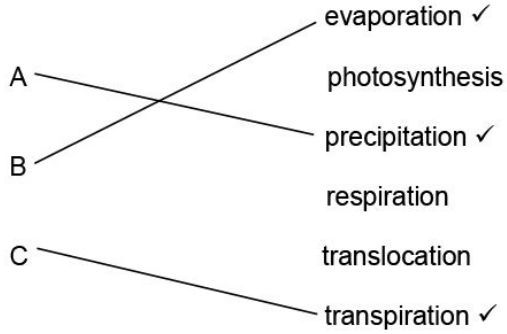
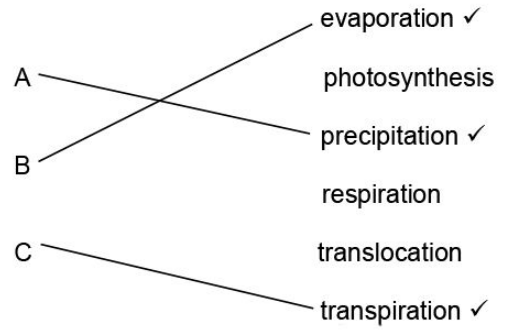
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Question			Answer/Indicative content	Marks	Guidance
40	a	i	Three/3 ✓	1 (AO2.2)	
		ii	(sun)light / the sun ✓	1 (AO1.1)	
		iii	Award one mark for: (an organism) that lives on/in on a (host) organism ✓ Idea parasite benefits at the expense to its <u>host</u> ✓ Award two marks for: An organism that feeds on a living organism / An organism that causes harm to a living organism ✓✓	2 (AO2 x 1.1)	IGNORE an organism that feeds on another organism unless qualified
	b		**Any three from:** biological control ✓ nematodes will eat cutworms ✓ less cutworms ✓ less stevia eaten ✓ increase the yield ✓	3 (AO3 x 2.1)	ALLOW predators of the cutworms added ALLOW more crop
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
41	a			3 (AO3 x 1.1)	Each correct line = 1 mark DO NOT ALLOW more than 1 line from each letter
	b		prevents lake drying out / replenishes lake water / washes minerals into the lake ✓	1 (AO1.1)	ALLOW idea of lack of water in lake causing harm to organisms that live in the water / will provide organisms with sufficient/enough water to live in ALLOW idea of providing organisms with dissolved oxygen IGNORE will provide organisms with more water IGNORE nutrients
			Total	4	
42	a			3 (AO3x1.1)	Each correct line = 1 mark DO NOT ALLOW more than 1 line from each letter
	b		prevents lake drying out / replenishes lake water / washes minerals into the lake ✓	1 (AO1.1)	ALLOW idea of lack of water in lake causing harm to organisms that live in the water / will provide organisms with sufficient/enough water to live in ALLOW idea of providing organisms with dissolved oxygen IGNORE will provide organisms with more water IGNORE nutrients
			Total	4	

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