OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



MARK SCHEME

B3.3 HOW ARE ORGANISMS IN AN ECOSYSTEM INTERDEPENDENT? (HIGHER)

SCORE	PERCENTAGE
/74	%

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Question			Answer/Indicative content	Marks	Guidance
1	a		Would have biggest bar at bottom, then next biggest with smallest at top ✓	1	DO NOT ALLOW if bars are not labelled
	b	i	(4 / 600) x 100 = 0.67% ✓	1	
		ii	Any one from Not all of the biomass is eaten e.g. roots ✓ Biomass is used in respiration (by other organisms) ✓	1 2 2	
		ii	Biomass is egested (by slugs / thrush) ✓		DO NOT ALLOW biomass egested by grass
	c	i	Any two fromActivity starts to rise in spring ✓Activity is at its peak in the summer months✓Activity falls in autu		
		ii	Any two from(Rise in spring) as more water is available✓(peak in summer) as this is when it iswarmer / when activity and more decomposer activity ✓		
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
2			[Level 3] Includes some indicatives points from all three areas. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Includes some indicative points from two areas. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Includes some indicative points from one area 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. (0 marks)	6	• Idea of replace / replant what is taken • Impact on food chain or web / damages ecosystem **ignore habitat** • Reduces biodiversity / fewer **species / extinction** **Indicative scientific points concerning world community may include:** • Provides medical resources • Provides oxygen ORA • Removes carbon dioxide ORA • Ref to Timber • Global warming /climate change **Indicative scientific points for local community may include:** • Fuel • Shelter • Income / **jobs** • Room to grow crops / livestock • Idea of slash and burn effects eg smoke /pollution / erosion / desertification / floods **Use the L1, L2, L3 annotations in RM** **Assessor; do not use ticks.** **Examiner's Comments** Good answers included points from three different areas. Examiners were looking to credit answers that referred to the ecosystem and biodiversity, answers that referred to the world community such as climate change and production of oxygen, and answers that referred to the local community such as erosion and local jobs. Most candidates scored at least four marks on this question.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
3			**Max 3 from**: idea that the size of the deer population depends upon (or is affected by) the size of the bison population / ORA (1) <u>competing / competition</u> for the same resources(e.g. food) (1) relevant example (2)	3	**accept** idea that if the size of the deer / bison population increases the other will decrease / ORA **do not credit** "eat / have the same food" without reference to competition *e.g:* if Neanderthals eat more bison, they will eat fewer deer, so deer population increases *(2 marks)* *e.g.:* if deer population increases, there will be less grass for the bison, so bison population decreases *(2 marks)* **Examiner's Comments** Candidates who could explain, within the context of the question, a meaning of the term interdependence and use the available food web to give examples scored the highest marks.
			Total	**3**	

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Question			Answer/Indicative content	Marks	Guidance
4	a		*Max 2 from one area* *For -* Carbon not (shown) entering / leaving the system; Energy is not (shown) entering or leaving the system; Idea of recycled / no waste; *Against -* Fossil fuels lock carbon away for a long time; Carbon entering the atmosphere faster than leaving it; Fossil fuels used up faster than replaced; Sunlight / energy entering or leaving system;	3	**Ignore** any reference to **energy** being recycled / not wasted. Do not credit “no recycling” **Examiner' Comments** Better responses to this question referred specifically to the diagram and gave arguments both for and against it being a closed loop system. Good answers referred to carbon being recycled by being released from the burning fossil fuels and then reabsorbed by plants through photosynthesis. Arguments against it being a closed loop system included fossil fuels taking a very long time to be produced and subsequently burnt and that carbon dioxide was being released faster than plants could reabsorb it.
	b		Outputs / losses = inputs / gains; OR Completely supported by what they produce;	1	**Ignore** closed loop **Examiner' Comments** Simply stating that outputs or losses equalled inputs or gains, was sufficient to score this mark.
			Total	**4**	

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Question			Answer/Indicative content	Marks	Guidance
5			[Level 3] Explanation of how build-up of insecticide occurs. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Idea that the higher up the food chain insecticides build-up in individuals. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Vague account that insecticides kill organisms other than insect pests. The effect of insecticides on the food web. 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. (0 marks)	6	• explanation of how concentration increase happens i.e. each step of food chain **eats more** of the individuals below them. • numbers at top of pyramid **fewer** so insecticides more concentrated • insecticides reach **lethal levels** **This question is targeted at grades up to A** **Indicative scientific points at Level 3 may include:** **Indicative scientific points at Level 2 may include:** • idea of bioaccumulation • insecticides gets more concentrated higher up the food chain • may build up • low dose does not kill insects • organisms may eat these (contaminated) pests **Indicative scientific points at Level 1 may include:** • insecticides kill organisms other than pests • may kill pollinators / useful insects • idea of disruption to food chain / web **Ignore reference to eutrophication** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments** This was the second level of response, six mark question. It was targeted at candidates up to grade A.

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Question			Answer/Indicative content	Marks	Guidance
					Lower level answers simply referred to the effect of insecticide on the targeted insects and how their removal would influence the food chain. Better answers stated how the insecticide would be passed on through the food chain. The best answers referred to the build-up of insecticide to lethal levels due to top carnivores eating a larger number of organisms lower down the food chain.
			Total	6	
6	a		from top of diagram: D E A	3 2	Examiner's Comments Most candidates were able to give the 3 correct responses required. ignore ref to bacteria as detritivores ignore reference to decay linked to detritivores.
	b		Any 2 from:consumption / digestion / eats / breakdownwaste material / dead matter (1)increase the surface idea of recycling of carbon via respiration / production of carbon dioxide (1)		Examiner's Comments This was a challenging question. Responses had to include the importance of recycling carbon as well as describe a transfer process.
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
7			**Level 3 (5–6 marks)** Includes a correct reference to **closed loop** AND **explanation** AND **example** of human activity. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Includes a correct reference to **closed loop** AND **explanation.** OR includes a correct reference to **closed loop** AND **example** of human activity. OR includes a correct reference to **explanation** AND **example** of human activity. Quality of written communication partly impedes the communication of science at this level. **Level 1 (1–2 marks)** Includes a correct reference to **closed loop** OR **explanation** OR **example** of human activity. Quality of written communication impedes the communication of science at this level. **Level 0** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades D to A** **Relevant points include:** **Closed loop** • no waste • idea of output from one part becomes input for another part • sustainable • example given **Examples** of human activity • fishing • emission from burning fossil fuels • palm oil / soya plantations • slash and burn / deforestation • waste / pollution • any good example **Explanation** of how it becomes (open loop) • consequence of removing biomass • consequence of introducing waste • reason why not sustainable **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments** This question was anticipated that the vast majority of candidates would score at least two or three marks on this question and this did indeed prove to be the case. The stronger candidates went on to score the full six marks. Examiners were looking for a good explanation of what a closed loop system is; an example of how human activity can make this system go open loop; and finally an explanation of the consequences of going open loop. Good answers stated that a closed loop had no waste and that the output from one organism became the input for another organism; that deforestation or fertiliser run-off, were examples of humans affecting the environment; and finally the consequence

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Question			Answer/Indicative content	Marks	Guidance
					was that land became desertified or fish died because of lack of oxygen. Examiners were pleased to see some full and very good answers to this question.
			Total	6	

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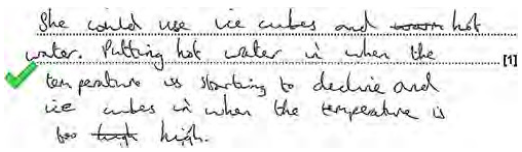
Question			Answer/Indicative content	Marks	Guidance
8	a		…competition. ☐ …evolution. ☐ …natural selection. ☐ …part of an ecosystem. ✓ …transfer of nutrients. ✓ …selective breeding. ☐ …interdependence. ✓	3	4 correct = 3 marks 3 correct = 2 marks 2 correct = 1 mark **Examiner's Comments** This was quite a difficult question, as candidates were not informed of the number of correct responses. Only the most able had the confidence and understanding to realise that there were four correct responses and scored full marks. Most candidates scored two marks on this question with very few failing to score at least one mark.
	b	i	512;	2	If answer is not 512 then working must show **256** = 1 mark OR **1024** = 1 mark **512** = 2 marks Examiner's Comments This should have been a simple mathematical problem however almost half of the candidates failed to score. This was even though examiners credited one mark for answers of 256 or 1024. Correct answers of 512 scored two marks.
		ii	*any one from:*quickly take advantage of available food /competition;decomposition rate can be enhanced /qui	1	NB do not give "quickly' for reference to reproduction only. **Examiner's Comments** Correct answers here included speeding up the rate of decomposition, or that microorganisms are very small in comparison to the organisms that they decay. Weaker candidates failed to relate their answer to decomposition.

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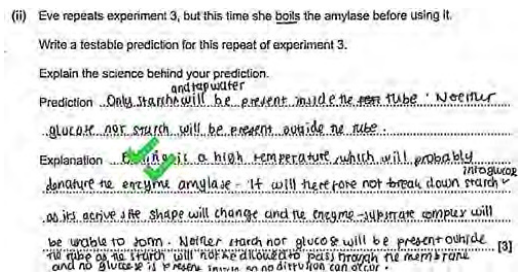
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Question			Answer/Indicative content	Marks	Guidance
		iii	*any two from:* mutation; environmental change; natural selection; isolation;	1	2 correct = 1 mark **Examiner's Comments** This should have been an easy recall question. However it was clear that candidates had failed to learn the four standard answers to this question, namely mutation, environmental change, natural selection, or isolation. All too often answers referred to artificial selection or reproduction.
			Total	**7**	
9			amino acids (1) enzymes (1)	2	**Examiner's Comments** A surprisingly large number of candidates failed to recognise amino acids and enzymes as nitrogenous compounds. Many other options were unfortunately selected, with no particular pattern.
			Total	**2**	

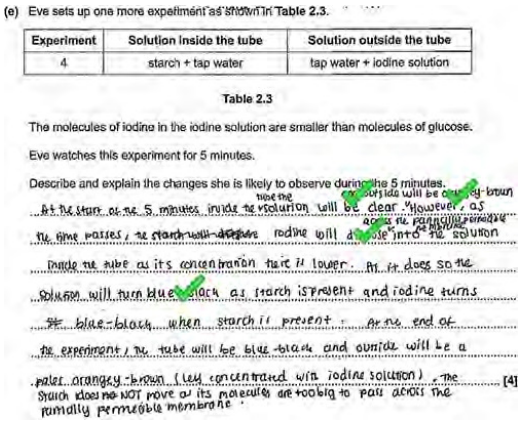
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Question			Answer/Indicative content	Marks	Guidance
10	a		add Benedict's solution ✓ look for a red-brown precipitate ✓	2 (AO 2.2)	ALLOW glucose testing strip with correct colour change DO NOT ALLOW red solution Examiner's Comments Candidates were very unsure of the correct reagent to use and the resulting colour to test for glucose. (Benedict's (reagent) with the resulting red precipitate). Exemplar 3  She could use ice cubes and ~~warm~~ hot water. Putting hot water in when the temperature is starting to decline and ice cubes in when the temperature is ~~too~~ high. [1] This response although not specifying 'water bath', does have an acceptable description of one, possibly reflecting the method that they have used in the laboratory. It gained 1 mark. ALLOW go through the tubing/membrane RESULTS
	b	i	glucose (molecules) can diffuse through the tubing/membrane ✓ starch (molecules) too large to diffuse/move/fit through the tubing/membrane ✓ amylase breaks down starch ✓ starch is broken down into (molecules of) sugar ✓	4 (AO 3.2b × 4)	NO MARKS FOR DESCRIBING THE ALLOW maltose/glucose Examiner's Comments One of the problems encountered here was that candidates did not follow the rubric (conclusion) and described the results. Another problem here and also in (ii) & (e) was the incorrect references to osmosis when diffusion was required.

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Question			Answer/Indicative content	Marks	Guidance
		ii	*Prediction*: the tests for glucose will be negative ✓ **Any two from:** *Explanation*: the amylase/enzyme has been denatured ✓ has (permanently) changed the shape (of the active site) ✓ by the high temperature /boiling ✓ no longer works/cannot bind ✓	3 (AO 2.1) (AO 1.1 ×2)	<u>Examiner's Comments</u> The first mark required a testable prediction to be stated. Very few candidates did so, some merely stating that glucose would not be present. A considerable number also stated that boiling the enzyme would make the reaction work at a faster rate and did not link the information about amylase and the effect that high temperature would have on it. Exemplar 4  (ii) Eve repeats experiment 3, but this time she boils the amylase before using it. Write a testable prediction for this repeat of experiment 3. Explain the science behind your prediction. Prediction Only starch will be present inside the tube and tapwater. No glucose nor starch will be present outside the tube. Explanation Enzymes is a high temperature which will probably denature the enzyme amylase - it will therefore not break down starch into glucose as its active site shape will change and the enzyme-substrate complex will be unable to form. Neither starch nor glucose will be present outside the tube as no starch will have diffused past through the membrane and no glucose is present inside so no diffusion can occur. [3] This response answers the explanation part well but the prediction is not testable. It gained 2 marks.
	c		**Any four from:** at the start, the solution outside the tube will be pale brown/red ✓ at the start, the solution inside the tube will be colourless ✓ the solution inside the tube will start to turn black / blue/black ✓ starting from the edges ✓ because iodine can diffuse through the tubing/membrane (molecules small enough)✓	4 (AO 2.2 × 4)	**Must be clear whether inside or outside of tube** **DO NOT ALLOW** 'through osmosis' **Examiner's Comments** The table in this question clearly had two places, inside the tube and outside the tube. Also it required the candidate to take

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Question			Answer/Indicative content	Marks	Guidance
					into account the start as well as the final observations. Very few candidates described the situation at the start, and limited the marks available. Most marks that were credited were for the colour change from brown to (blue) black inside the tube. There was some confusion as to the correct colour change that should occur. Exemplar 5  (e) Eve sets up one more experiment as shown in Table 2.3. Experiment: 4 — Solution inside the tube: starch + tap water — Solution outside the tube: tap water + iodine solution Table 2.3 The molecules of iodine in the iodine solution are smaller than molecules of glucose. Eve watches this experiment for 5 minutes. Describe and explain the changes she is likely to observe during the 5 minutes. At the start of the 5 minutes inside the tube the solution will be clear. However, as the time passes, the starch will diffuse iodine will diffuse into the solution Inside the tube as its concentration start it lower. As it does so the solution will turn blue black as starch is present and iodine turns it blue-black when starch is present. At the end of the experiment, the tube will be blue-black and outside will be a pale orangey-brown (less concentrated with iodine solution). The starch does not move as its molecules are too big to pass across the partially permeable membrane. [4] This response answers all four of the five available mark points available and gained 4 marks
			Total	13	

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Question			Answer/Indicative content	Marks	Guidance
11		i	**1** (cellular) respiration **2** photosynthesis **3** (cellular) respiration **4** decomposition	3 (AO 1.1 × 3)	check for answers written on diagram four correct = 3 marks three correct = 2 marks one or two correct = 1 mark IGNORE anaerobic in mp1 & 3 & decay In mp 4 Examiner's Comments ALLOW correct formula for carbon dioxide Most candidates were aware of the different processes in this version of the carbon cycle, however the correct terminology for process 4 (decomposition), was often wrongly stated.
		ii	**Any three from:**some microorganisms remove carbondioxide from the ocean/water when they photosynthesise all microorganisms add carbon dioxide (to the ocean/water) when they respire ✓ some microorganisms/decomposers add carbon dioxide (to the ocean/water from respiration) when they decompose dead organisms ✓	2 (AO 1.1 × 2)	points 1, 2 & 3 Must be carbon dioxide not carbon in mark IGNORE decay/rot/breakdown IGNORE microorganisms/them releasing carbon dioxide when dying Examiner's Comments Candidates were required to link the processes in the diagram (respiration, decomposition & photosynthesis) to the production or use of carbon dioxide. The role of respiration and decomposition was explained by some candidates but very few recognised the role of photosynthesis in this situation.
		iii	**Any two from:**dead organisms (sediment and then) are returned into fossil fuels ✓ which are burnt/combusted (by humans) releasing carbon (dioxide) into the atmosphere ✓ formation of fossil fuels takes millions of years ✓	2 (AO 1.1 × 2)	ALLOW examples of fossil fuels Examiner's Comments This question was asking about the production of fossil fuels and their subsequent combustion. Some higher ability candidates recognised the link.

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Question			Answer/Indicative content	Marks	Guidance
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
12		i	number of iguanas decrease ✓ due to a shortage of food ✓	2 (AO 2.1 x 2)	 ALLOW they will starve DO NOT ALLOW (they will have) no food <u>Examiner's Comments</u> It was pleasing to see that candidates were able to interpret food webs to consider the impact of events on the population of groups of species. The majority of candidates correctly stated that this event would result in the reduction in numbers of iguanas, some candidates did not score this mark for stating there would be no iguanas left. Many candidates took the idea of reduced numbers forward to explain that this resulted from a lack of food, or even in some cases an increase in competition for food. Those that lost this second mark generally did so for making absolute statements, for example, there will be no food left. Centres could help candidates to decode the questions more successfully by drawing their attention to the words used in the stem of the question, in this instance, the use of the word decrease when discussing the effect of El Nino on algae population should cue candidates into moving away from absolute statements. It is also worth using this as an opportunity to consider that the food web only shows some of the feeding relationships and how this therefore determines the answers that will therefore be acceptable.
		ii	FIRST CHECK THE ANSWER ONANSWER LINE if answer = 1.5 (m) award 2 marks iguana drawing measures 10 cm 10 × 15 = 150 ✓ 150 cm ÷ 100 = 1.5 (m) ✓	2 (AO 2.2 x 2)	 ALLOW working mark if measured incorrectly derived from length (cm) ÷ 100

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Question			Answer/Indicative content	Marks	Guidance
		iii	(1.5 ÷ 100) × 80 = 1.2 (m)	2 (AO 1 x 2.2)	ALLOW ECF from (c) (ii)
		iv	The marine iguanas that decreased in size the most on average lived for a greater length of time ✓ The marine iguanas that did not decrease in size survived for approximately 2 years less than the marine iguanas that decreased in size by up to 60 mm ✓	2 (AO 3.2b x 2)	<u>Examiner's Comments</u> Questions 1(c)(ii), (iii) and (iv) were well answered by candidates. These were questions targeting maths skills and most candidates were credited some if not all the marks for these questions.
			Total	7	

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