OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



MARK SCHEME

B2.6 HOW CAN WE TREAT DISEASE? (FOUNDATION)

SCORE	PERCENTAGE
/53	%

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Question			Answer/Indicative content	Marks	Guidance
1		i	Animals ✓ human cells grown in the laboratory ✓	1	two correct ticks = 1 mark three or more ticks = 0 marks Examiner's Comments The most common error on this question arose from candidates only ticking one box instead of two, therefore those candidates were unable to gain the mark. Those candidates that did tick two boxes often correctly identified testing ‘animals’ as one of the first stages in testing new drugs. The most common incorrect answer was identifying that testing 'humans with the disease’ was part of these initial testing stages.

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Question			Answer/Indicative content	Marks	Guidance
		ii	**[Level 3]** Answer gives correct reason for three groups AND discusses ethical issues. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer gives correct reason for two groups OR one group and discusses ethical issues. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer gives general statements for drug testing. 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	This question is targeted at grades up to CIndicativ *Reasons for group A / healthy volunteers + drug:* • to test for safety • side effects/examples of side effects • effectiveness/if drug works *Reasons for group B / people with Ebola + drug:* • to test for safety • side effects/examples of side effects *Reasons for group C / people with Ebola + placebo:* • a placebo (is a similar substance that) has no drug in it • to show results without drug • control group • to compare with group • placebo (only) used if there is no existing treatment for Ebola *Ethical issues with group C / placebo:* • should not knowingly withhold a drug that could help them • people in this group likely to die/suffer • people in this group will not benefit from the new drug • because case fatality rate/death rate for Ebola is high *General statements* • drug trials test for safety/side effects • drug trials test for effectiveness • placebos can be used and do not contain active ingredients • use a placebo to see if there is a placebo/psychological effect

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Question			Answer/Indicative content	Marks	Guidance
					• use of blind/double blind trials Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This was the second of the six-mark extended writing questions. Candidates were asked to consider some information about plans to test a new drug in humans. This question discriminated well between candidates, with marks scored across the 0-6 range. A large proportion scored in Level 2 and it was pleasing to see candidates scoring in Level 3. The most common correct answers arose from the identification of the use of groups A and B. Many candidates identified that giving healthy volunteers the drug would allow side effects to be identified. Many also identified that giving people with Ebola the drug would allow the scientists to see if the drug actually worked. Many candidates scored in Level 2 for those reasons. It was also common to see candidates discussing the ethical issues of using a placebo with Ebola patients with candidates identifying that the placebo would not help them and as a result they could die. Very few candidates correctly identified the reason for giving group C the placebo. Whilst a number of candidates understood that placebos were a "fake drug", very few grasped the reasons for using them in drug trials. Centres should ensure that when teaching about placebos and drug trials they highlight the fact that they provide a control group for the other results to be compared against. Common errors made included giving ethical reasons for groups A and B receiving their corresponding treatments.
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
2	a		idea that numbers of bacteria in the body will be much less / less damaged caused;	1	**accept** reverse argument that if treatment not commenced the numbers of bacteria will become greater **Examiner's Comments** Was even better answered than 5b, with the idea that the bacteria were reproducing rapidly being presented in a number of ways.
	b		some bacteria may not be killed; bacterial resistance to the antibiotic is more likely;	2	**Examiner's Comments** Was however not so well answered as hardly any used the idea of bacteria developing resistance to the antibiotic; where a mark was scored it was almost always on the idea that remaining bacteria could multiply all over again and make Tony ill again.
	c		idea that bacteria became resistant to the original antibiotic; bacteria that survive one of other antibiotics; will be killed off by the second antibiotic; idea of preventing development of new resistant strain;	3	**accept** references to “superbug” for idea of resistance **Examiner's Comments** Revealed that few candidates appreciated the nature of resistance to antibiotics. There were many weak answers along the lines of “the first one was not powerful enough, the other two were stronger” etc. Another major misconception shown here was that Tony or Gordon became resistant to the antibiotics. Some candidates though that the bacteria became immune to the antibiotics and gave imaginative descriptions of how this affected their antibodies. This perhaps indicates a level of confusion about what antibiotics are and how they work.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
3	a		Fewer side effects; Can take with high blood pressure / doesn't cause high blood pressure; C has unpleasant side effects; overdose not likely to be fatal;	3	Ignore NO side effects She can't take drug A / D with high blood pressure. Assume "it" means drug B unless indicates otherwise. Examiner's Comments Most candidates were able to recognise the reasons for prescribing one particular antidepressant in terms of side effects, and commonly scored at least 2 marks out of the 3 available.
	b		The drugs are very expensive. ☐ The benefits of taking the antidepressants outweigh the risks. ✓ The risk of serious side effects is low. ✓ All of the side effects are serious. ☐ Overdoses are always fatal. ☐	2	remove one mark for each additional incorrect answer Examiner's Comments Most candidates could identify explanations as to why patients are prepared to take the risk of side effects and scored well.
			Total	5	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>a</td><td></td><td>200.96 / 201.06 / 201.14 / 201.1 / 201 (2)</td><td>2</td><td>correct answer = 2 marks
3.14 × 8 × 8 / ? × 8 × 8 / ? × 8^2 = 1 mark

Examiner's Comments

This mathematical question proved more demanding. Many candidates struggled to use the formula provided to generate a correct answer and failed to identify that r was the radius of the zone of inhibition. Common mistakes observed included $?^2$ or r × 2. Candidates who understood the formula gained two marks.</td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><td>The greater the clear area, the more bacteria have died.</td><td>✓</td></tr><tr><td>The bacteria may be resistant to antibiotic C.</td><td>✓</td></tr><tr><td>Antibiotic A is the least effective.</td><td></td></tr><tr><td>Water kills more bacteria than any antibiotic.</td><td></td></tr><tr><td>Antibiotic C must be water.</td><td></td></tr><tr><td>Antibiotic B is the most effective.</td><td>✓</td></tr></table></td><td>3</td><td>if more than 3 ticks, delete one mark for each extra tick

Examiner's Comments

Candidates were asked to use data to draw conclusions from the results. Candidates who did not score in part a, were not disadvantaged in this question as the correct answers could be identified despite an incorrect answer to part a. A range of marks were observed for this question. A common error made by candidates was the identification that ‘water kills more bacteria than any antibiotic’ and that ‘antibiotic C must be water’.</td></tr>
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Question			Answer/Indicative content	Marks	Guidance
	c		fair comparison of the antibiotics (1) so there is the same amount of antibiotic (1)	2	**allow** fair test ora **Examiner's Comments** This question proved more difficult. Candidates found it difficult to explain why it was important that all the paper discs were the same size. Many candidates scored one mark for using the term 'fair test', but struggled to express what they meant by this term and could not relate it to the investigation. Centres should be encouraged to address this problem. Very few candidates stated that using the same size paper discs allowed a fair comparison of the antibiotics and even fewer candidates were able to relate the size of discs to the same amount of antibiotic used in each test.
	d		to check they're safe / in case they are harmful / may have side effects / may cause allergic reactions / to see if they work (1)	1	do not allow vague statements e.g. 'it might not be good for you' / 'it might have an effect' **Examiner's Comments** The vast majority of candidates answered this question well. They were able to explain that new antibiotics were tested both for safety and effectiveness. These reasons were expressed in many ways.
			Total	8	

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Question	Answer/Indicative content	Marks	Guidance
5	**[Level 3]** Explanation of resistance and how it can be avoided OR full description using general points. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **[Level 2]** Use of idea of resistance and how it can be avoided, from general points. Quality of written communication partially impedes communication of the science at this level. (3–4 marks) **[Level 1]** Makes basic points about antibiotics Quality of written communication impedes communication of the science at this level. (1–2 marks) **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	• some bacteria will be more resistant to the antibiotic than other bacteria due to mutation or variation • these will survive and breed • non-resistant ones will die out • because of rapid reproduction bacteria will soon be all resistant • should make sure all bacteria killed (by finishing course or use new antibiotic) **Indicative general points:** • idea that bacteria can become resistant to antibiotics • antibiotics do not work on viruses • only work against bacteria and fungi • stay on when necessary • complete course of treatment • new antibiotics are required to replace the ones that bacteria are now resistant to • bacteria mutate **Indicative basic points:** • bacteria can change / evolve • (new antibiotics) to avoid side effects eg allergy • work against / kill bacteria / fungi • different antibiotics needed for different diseases • antibiotic stops being effective / stops working **beware** answers where **people** become resistant **accept** microbes or pathogens but **ignore** reference to viruses **ignore** immune **Use the L1, L2, L3 annotations in Scoris;** **This question is targeted at grades up to E** **Indicative scientific points explaining resistance:**

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Question			Answer/Indicative content	Marks	Guidance
					do not use ticks. Examiner's Comments Candidates would be well advised to read the whole question and ensure that they answer all sections of the question in order to maximise their marks. Many candidates knew that antibiotics killed fungi and bacteria and many knew that they do not work on viruses. Some candidates knew that bacteria could become resistant to antibiotics but few were able to link this to the bacteria mutating. It was disappointing to see that many of the candidates who had addressed how streptomycin should be used by doctors had not considered the reasons as to why it is important to regularly discover new antibiotics.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
6		i	**Any two from:** a placebo contains no active drug (so treatment is effectively witheld) × cancer would not be treated / disease could get worse × it is not ethical to withhold treatment ×	2 (AO 3.2a × 2)	**DO NOT ALLOW** could affect the person's health Examiner's Comments Candidates found this AO3 question difficult. They did not seem to realise that the lack of active drug in a placebo would mean the cancer would get worse, or that withholding treatment would be unethical. Most answers centred around the idea that the researchers wanted to compare how the pairs of drugs would work (relative to each other) so didn't need to bother with a placebo.
		ii	The combination of drugs given to Group A was the most effective ✓	1 (AO 3.2b)	Examiner's Comments Most candidates were able to correctly conclude that the drugs given to Group A were the most effective. This question assessed objective AO3.
		iii	Tests for both ✓ Tests for safety ✓ Tests for both ✓	3 (AO 1.1 × 3)	**IGNORE** any row containing more than one tick Examiner's Comments This question assessed AO1. Most candidates scored at least one mark on this question, with the majority scoring two marks for identifying the purpose of preclinical trials and trials involving healthy humans. Candidates were less able to correctly identify why clinical trials on humans with a disease are carried out.
			Total	6	

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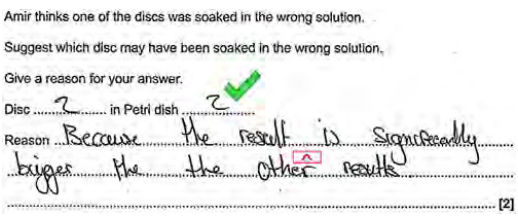
Question			Answer/Indicative content	Marks	Guidance
7		i	**Any three from:** use aseptic technique(s) ✓ put on gloves before starting ✓ disinfect/sterilise the bench with alcohol before starting ✓ work next to a Bunsen burner (to create an updraft) ✓ pass the neck of the jar through a flame before dipping wire loop in ✓ pass the wire loop through a flame (and allow to cool) / sterilise the loop before dipping into sample jar ✓ idea of not taking lid fully off Petri dish / putting it back on quickly ✓ secure the Petri dish lid with Sello/sticky tape (following the inoculum spread) ✓	3 (AO 3.3b × 3)	**DO NOT ALLOW** "clean", as this may not be sterile **DO NOT ALLOW** "seal the Petri dish" <u>Examiner's Comments</u> Responses to this question suggested that most candidates were familiar with this kind of practical procedure, most likely through having done it themselves in a hands-on practical activity. Many candidates were able to give two or three correct examples of aseptic techniques. Some candidates needed to use scientific language such as 'disinfect' or 'sterilise' to score marks, rather than imprecise and everyday terms such as 'wipe', 'wash' and 'clean'. **AfL** The word 'clean' (as in "clean the wire loop") was not sufficient to score a mark. When learning about aseptic techniques and about the spread of diseases, there is an important distinction to make between 'clean' and 'sterile', because apparatus, surfaces, water, food, cooking utensils and hands can all look clean but be contaminated with pathogens, as most pathogens are too small to see.

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Question			Answer/Indicative content	Marks	Guidance
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 380 (mm2) award 3 marks 3.14×11^2 OR 3.14×121 OR $\pi \times 11^2$ ✓ = 379.94 ✓ = 380 (mm^2) ✓	3 (AO 2.2 × 3)	Award 2 marks for correct answer not given to 3 s.f. (i.e. 379.94) Examiner's Comments This calculation was generally well answered, but some candidates did not score the third mark because they did not give their (otherwise correct) answer to three significant figures.

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Question			Answer/Indicative content	Marks	Guidance
		iii	Disc 2 in Petri dish 2 ✓ **Plus any one from:** the area of the clear zone is much higher / outside the range of results for this disc in the other dishes / it is an outlier ✓ the area of the clear zone is in the range of results for disc 1 in the other dishes ✓ the area of the clear zone suggests it was soaked in antibiotic A ✓	2 (AO 3.2b) (AO 3.1b)	ALLOW Disc B in Petri dish 2 ALLOW same as disc 1 in dish 2 <u>Examiner's Comments</u> Many candidates needed to make clear which specific parts of the data they were referring to in order to score the reason mark. Exemplar 3  Amir thinks one of the discs was soaked in the wrong solution. Suggest which disc may have been soaked in the wrong solution. Give a reason for your answer. Disc 2 in Petri dish 2 Reason Because the result is significantly bigger the the other results [2] This candidate has identified the correct disc and dish for 1 mark, but does not get the mark for their reason. The candidate needed to refer to the other results 'for this disc' or 'for this antibiotic', or even 'in this row', rather than referring non-specifically to "the other results".
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
8		i	low dose is less risky / reduces the risk / is safer ✓ Plus any two from: (reduces risk of) side-effects from a high dose / high dose could be toxic / overdose / kill ✓ high dose could prevent patient from being able to seal/clot wounds / lead to excess blood loss and/or risk of infection ✓ it is easier to add more warfarin (bit by bit) than it is to take it out of the blood if too high a dose ✓	3 (AO 2.1 × 3)	<u>Examiner's Comments</u> Most candidates were able to make a sensible suggestion about what could happen if the dose was too high, with many scoring a mark for a mention of side effects or overdose. However, this question also draws on ideas about risk from IaS4 in asking candidates to explain why it is better to start with a low dose, and relatively few candidates scored marks for this aspect.
		ii	different people have different genetic variants/alleles/mutations ✓ some variants/alleles/mutations will affect how the body reacts to warfarin / how warfarin is broken down in the body / (how well warfarin fits into) blood clotting enzyme active site ✓	2 (AO 1.1) (AO 2.1)	DO NOT ALLOW different genes

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Question			Answer/Indicative content	Marks	Guidance
		iii	genetic testing/test(s) ✓ for variants/alleles/mutations that affect how the body reacts to warfarin / how warfarin is broken down in the body / (how well warfarin fits into) blood clotting enzyme active site OR to develop personalised medicine for the patient ✓	2 (AO 1.1) (AO 2.1)	DO NOT ALLOW genes Examiner's Comments Questions 4 (b) (ii) and 4 (b) (iii) were not well answered. In part (ii), candidates were not able to communicate understanding that differences in the genome are caused by mutations, which create new alleles/genetic variants, or to apply their understanding to suggest that these could affect how the body would interact with warfarin. In part (iii), candidates did not seem to recognise the term 'gene technology', or could not apply their understanding of it to this context to select examples of gene technology that might be helpful. AfL Two examples of gene technology are introduced in Section B1.3 of the specification. These are: • genetic testing for particular alleles/genetic variants and the development of personalised medicine based on test results; • genetic engineering. The first of these would be helpful to doctors in the context described in question 4 (b).
			Total	7	

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