



Mark scheme – Monitoring & Maintaining Health (H)


Question		Answer/Indicative content	Marks	Guidance
1		B	1 (AO 2.2)	
		Total	1	
2		B ✓	1 (AO2.1)	
		Total	1	
3		A	1 (AO 1.1)	
		Total	1	
4		D ✓	1 (AO1.2)	<p><u>Examiner's Comments</u></p> <p>This AO1.2 question required knowledge of scientific enquiry and procedures linked to interactions of diseases. Higher ability candidates were able to identify the link between HPV and cervical cancer, but some candidates assumed incorrectly that the vaccine prevents cervical cancer.</p>
		Total	1	
5		B ✓	1 (AO1.1)	<p><u>Examiner's Comments</u></p> <p>This question was designed to test recall of knowledge AO1.1. It was clear from the responses of the majority of candidates, that there was a lack of the knowledge of white blood cells and their ability to move out of capillaries by changing their shape.</p> <div style="display: flex; align-items: center; margin-top: 10px;">  <p>The ability of white blood cells to leave the circulatory system through the capillary walls should be taught in the context of white blood cells destroying pathogens.</p> </div>
		Total	1	
6		A ✓	1 (AO2.1)	
		Total	1	
7		D ✓	1 (AO1.1)	
		Total	1	
8		A ✓	1 (AO1.1)	
		Total	1	
9		B ✓	1 (AO1.1)	
		Total	1	

10			C ✓	1 (AO2.1)	
			Total	1	
11			B	1 (AO 1.2)	<u>Examiner's Comments</u> Recalling their knowledge of a scientific technique in this AO1.2 question, candidates generally answered this well. Some candidates were distracted by A and C.
			Total	1	
12			B	1 (AO 1.1)	
			Total	1	
13			B	1 (AO 1.2)	<u>Examiner's Comments</u> Recalling their knowledge of a scientific technique in this AO1.2 question; this was generally well answered by candidates. Some candidates were distracted by A and this may show a rushed approach to reading each option. Care must be taken to read technical terms very carefully.
			Total	1	
14			B	1 (AO 1.1)	<u>Examiner's Comments</u> In this AO1.1 question, many candidates incorrectly put A, indicating they are unsure of what an infection is, and also why cancer is not an infection. They do, however, seem to be aware of cancer being linked to uncontrollable cell division.
			Total	1	
15			B	1 (AO 1.1)	<u>Examiner's Comments</u> This is an AO1.1 question testing recall of HIV and interaction with cervical cancer. In general, candidates chose either B or C. Candidates who performed well overall chose the correct answer B.
			Total	1	
16			C	1 (AO 1.2)	
			Total	1	
17			mRNA prevented from carrying the code (for the protein to the ribosomes) ✓ this stops protein synthesis ✓	2 (AO 2.1 x2)	ALLOW translation cannot take place / ribosomes don't receive the code from mRNA IGNORE references to transcription ALLOW protein (that causes symptoms) is not made/less is made <u>Examiner's Comments</u> In this AO2.1 question a significant number of candidates thought that blocking the code meant the code would not be

				made at all (i.e. no transcription). A large number thought the method would somehow reduce the number of CAG repeats, and lower ability candidates thought this would get rid of the defective allele somehow. For candidates gaining 2 marks this was often for responses including ideas on 'preventing translation' so 'no protein synthesis or protein made'.	
			Total	2	
18		antigens are different shapes ✓ idea that antigen binding site/antibody needs to fit the antigen ✓	2 (AO2 x 1.1)	ALLOW idea of each antigen being specific ALLOW idea of antigen binding site/antibody complementary to antigen IGNORE 'lock and key' IGNORE antibody bind/bonds to antigen (in stem of question)	
			Total	2	
19	a	Any two from: anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2 (AO2 x 1.1)	DO NOT ALLOW incorrectly matched symptom to blood cell type ALLOW less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC ALLOW (recurring) nosebleeds / bruise easily due to lack of platelets	
	b	i	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ OR weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2 (AO2 x 2.1)	IGNORE fighting(off) pathogens
		ii	Area = $10 \times 10 = 100(\text{mm}^2)$ Volume = $100 \times 0.001 = 0.1(\text{mm}^3)$ ✓	1 (AO2.2)	

		<p>No (no mark) $1000 \div 0.1$ OR 1000×10 ✓ number of white blood cells/mm³ is $10 \times 10^3 / 1.0 \times 10^4 / 10000$ ✓ within the range of $6.0 - 16.0 \times 10^3$ ✓</p>	<p>3 (AO2 x 2.2) (AO3.2b)</p>	<p>ALLOW ECF from (ii) ALLOW number of white blood cells /mm³ = 10 000 ALLOW within the normal white blood cell range/ 6000 – 16000</p>
	c	<p>(Fanconi anaemia) (no mark) (3×10^6) is a low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ OR cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓</p>	<p>3 (AO3x3.2b)</p>	<p>if incorrect disorder then no marks IGNORE low numbers of all cells</p>
		Total	11	
20		<p>Any two from: antibodies are specific ✓ only (binds) to one drug/antigen (shape) ✓</p>	<p>2 (AO 1.1) (AO 1.1)</p>	<p>ALLOW they would not fit together with other drugs <u>Examiner's Comments</u> Although this AO1.1 question was mostly answered successfully there were common errors shown by lower ability candidates. Often lower ability candidates referred to specific antigen rather than specific antibody. Occasionally they would write about bacteria, and in some cases confused this with the lock and key hypothesis and ideas about enzymes.</p>
		Total	2	
21		<p>an allele is a form/version of a gene ✓ dominant means that it always expresses itself when present ✓</p>	<p>2 (AO 1.1)</p>	<p>ALLOW only needs one allele present to be expressed/shown in the phenotype ALLOW allele which is expressed instead of another</p>

				<p><u>Examiner's Comments</u></p> <p>This AO1.1 question proved to be very challenging, even for some higher ability candidates. Many candidates did not define the term allele at all, limiting their maximum mark to 1.</p>  <p>AfL</p> <p>Candidates should be encouraged to learn definitions. Many candidates didn't seem to really understand the term dominant, in a biological context, using words like stronger, override or overpower.</p>
		Total	2	
22		<p>(made by) white blood cells / lymphocytes ✓</p> <p>when stimulated by antigens / antigens detected ✓</p>	2 (AO 1.1)	<p>DO NOT ALLOW phagocytes</p> <p>IGNORE fight off/combat antigens</p> <p><u>Examiner's Comments</u></p> <p>Candidates have a very good understanding of this AO1.1 question recalling knowledge of antibody production. Most used the correct term lymphocyte and knew antibody production was in response to antigens.</p>
		Total	2	
23		<p>(control using) the same field and divide it into two ✓</p> <p>because different fields may have different types of soil / different minerals / different levels of light ✓</p>	2 (AO 3.3b)	<p>ALLOW any suitable improvement e.g. control light / pH / temperature / same location / use optimum concentration of each fungicide / a control</p> <p>explanation must link to suitable improvement e.g. light because photosynthesis would affect growth/yields</p> <p><u>Examiner's Comments</u></p> <p>This AO3.3b question was considering ways of improving experimental design. Many candidates were able to describe the need for a control, less were able to apply their ideas to the scenario in the question, often describing inappropriate ideas such as putting plants in greenhouses or closed systems.</p>
		Total	2	
24		<p>Any two from:</p> <p>a protein molecule ✓</p> <p>made by the immune system ✓</p> <p>destroys/kills pathogens / clumps them together / attaches to antigens ✓</p>	2 (AO 2 × 1.1)	<p>ALLOW made by WBC / found in WBC</p> <p>IGNORE germs and disease</p> <p>IGNORE attack or fight pathogens</p> <p><u>Examiner's Comments</u></p>

					<p>This AO1 recall question did identify some areas for improvement. Candidates struggled with using correct terminology, referring to disease instead of pathogen and attacking and fighting instead of describing the mode of action of antibodies. Few candidates stated that an antibody is a protein.</p>  <p>When developing examination technique, candidates should be encouraged to use mark schemes to appreciate the importance of detail and terminology appropriate to GCSE level of study.</p>
			Total	2	
25		i	<p>stem cells are not differentiated/can still specialise ✓</p> <p>they could become rod cells ✓</p>	<p>1 (AO 1.2)</p> <p>1 (AO 2.1)</p>	<p>ALLOW stem cells are unspecialised / can grow into any type of cell / have ability to differentiate</p> <p>Examiner's Comments</p> <p>Most candidates were able to describe what a stem cell is assessing AO1.1, and many had the AO2.1 idea that they could become rod cells. Some missed the AO2.1 mark by referring to damaged or mutated cells, instead of the rod cells.</p>
		ii	<p>idea it would not be detected as foreign cells (by the immune system/WBC) ✓</p> <p>OR</p> <p>idea it would not be rejected (by the body) ✓</p>	1 (AO2.2)	<p>ALLOW accepted (by the body) / (body) more likely to accept</p> <p>Examiner's Comments</p> <p>This AO2 question was generally answered well. Lower ability candidates stated that stem cells from another person "wouldn't work". Marks are scored more frequently when candidates avoid general terms, and responses are specific to the question asked.</p>
			Total	3	
26	a		<p>spread by wind ✓</p> <p>spores ✓</p> <p>enters leaves through the stomata ✓</p>	3 (AO 1.1)	<p>ALLOW spread by water/ air / contact</p> <p>ALLOW enters leaf pores</p> <p>IGNORE holes in leaf / wounds / roots / stem</p> <p>Examiner's Comments</p> <p>On this AO1.1 recall question, most candidates were able to describe a method of spread. Fewer were able to recall the term spore. A much smaller number of candidates knew that the point of entry was stomata, however, responses referring to entry through damage, cuts or wounds and via the roots were more common but did not score.</p>
	b	i	kills the spores / fungus ✓	1 (AO 2.1)	ALLOW kills/burns/eradicates the (barley) powdery mildew

					<p><u>Examiner's Comments</u></p> <p>Many candidates did not score on this AO2.1 question because of the lack of reference to the specific organisms in the question. A common mistake is to give generic responses using terms like disease and infection. Rather unexpected, but throughout this question about a fungus a lot of candidates referred to bacteria and viruses.</p>
		ii	<p>the spores left by the fungus growing on the barley cannot infect wheat / the fungus does not grow on wheat / wheat is not a host for the fungus ✓</p> <p>(after two years) there will be less spores/fungus population / the spores/fungus will die ✓</p>	2 (AO 2.1)	<p>AW barley powdery mildew for fungus AW pathogen for fungus ALLOW wheat resistant to barley powdery mildew</p> <p><u>Examiner's Comments</u></p> <p>This AO2.1 question was approached more like a recall question by many candidates. A substantial number described crop rotation ideas about depletion/replacement of nutrients. Again, many candidates wrote about killing infections or diseases rather than spores or fungi.</p>
			Total	6	
27		i	<p>Any two from: pregnancy testing ✓</p> <p>detecting diseases/cancer ✓</p> <p>treating disease/cancer ✓</p>	2 (AO2 x 2.1)	<p>ALLOW specific diseases e.g. malaria ALLOW pathogen identification</p> <p>ALLOW vaccine development ALLOW drug testing</p>
		ii	<p>they divide rapidly / rapid mitosis / divide indefinitely / can produce many cells ✓</p>	1 (AO2.1)	
			Total	3	
28			<p>low dose of the drug does not seem to have any effect ✓</p> <p>because the effect is very similar to the placebo ✓</p> <p>high dose of the drug lowers blood cholesterol level most and would be the best way to administer the drug ✓</p>	3 (AO3 x 3.1b)	
			Total	3	
29			<p>Any four from: (inject) methamphetamine/drug into mice ✓</p> <p>lymphocytes made/collected ✓</p>	4 (AO 4 x 1.2)	ALLOW WBC made/collected

		<p>fuse with tumour cells ✓</p> <p>hybridoma cells made ✓</p> <p>hybridoma make antibodies against methamphetamine/drug ✓</p>		<p>ALLOW fuse with cancer/myeloma cells</p> <p>Examiner's Comments</p> <p>This AO1.2 question allowed candidates to demonstrate their knowledge of a scientific technique. There were some excellent maximum mark responses by higher ability candidates and most were able to gain 1 or 2 marks. Whilst some candidates knew this process, many forgot what the role of the antibodies specific to this question was, talking in generic terms and mixing up this example with others. Those that did know this process often wrote about fusing antibodies not lymphocytes with cancer cells, however, many scored the mark for knowing the term hybridoma. Those that scored zero often got confused and wrote about genetic engineering in terms of cutting and splicing DNA.</p> <p>Exemplar 4</p> <p>techniques.</p> <p>A mouse is injected with the methamphetamine. Lymphocytes within the mouse do not replicate enough so they bind to the methamphetamine to form hybridomas. This then replicate to form monoclonal antibodies which are large amounts of antibodies to fight off this methamphetamine. [4]</p> <p>This candidate has been credited with 3 marks. They have identified specifically that it is methamphetamine that is injected rather than generic antigens. They have identified that lymphocytes are involved, but not gained a mark as they haven't recognised the need to harvest these. Likewise they have incorrectly linked the fusing of these to methamphetamine rather than tumour cells, so have missed that marking point. However, they have recognised that a hybridoma is formed, so get that marking point.</p> <p>Although this last marking point was seldom seen due to many candidate responses describing antibody production in generic terms, here the candidate has identified that the production of large amounts of antibodies is specifically for the methamphetamine so gets a third mark.</p>
		Total	4	
30	a	<p>idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓</p> <p>filter paper/antibiotic disc is placed in (the centre of) each</p>	<p>4 (AO4 x 1.2)</p>	

		<p>dish with the (sterile) forceps ✓</p> <p>Petri dishes are incubated ✓</p> <p>idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓</p>		<p>ALLOW idea of repeats</p> <p>ALLOW idea of setting up a control</p>
	b	<p>Lake Bellandur– no mark</p> <p>Any two from: more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓</p> <p>Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓</p> <p>this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓</p> <p>(antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA ✓</p>	<p>1 (AO2 x 3.2a)</p>	<p>Incorrect or no lake given then no marks</p> <p>ALLOW bacteria are more resistant (antibiotic) DO NOT ALLOW more resistant to bacteria IGNORE immune</p> <p>ALLOW only 28 species are killed</p> <p>ALLOW idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution</p>
		Total	6	
31		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5-6 marks) What the results of the test tell the patient. AND Correctly interprets the information in the graph. AND Includes an analysis of usefulness of having the test.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p>	<p>6 (AO 3 x 2.2) (AO 3 x 3.2a)</p>	<p>AO2.2 Applies knowledge and understanding to interpret the results of the test and the information in the graph</p> <ul style="list-style-type: none"> the test can tell them if they have the allele and are therefore likely to get the disease the test will tell them the number of repeats they have the graph will tell them the mean age that symptoms first develop in somebody who has a certain number of repeats symptoms develop earlier with an increased number of CAG repeats / ORA lower number of CAG repeats means a much larger age range in which symptoms first develop / ORA <p>AO3.2a Analyses information and ideas to make judgements and draw conclusions.</p>

	<p>Level 2 (3-4 marks) What the results of the test tell the patient.</p> <p>OR Correctly interprets the information in the graph.</p> <p>AND Includes an analysis of usefulness of having the test.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1-2 marks) What the results of the test tell the patient.</p> <p>OR The answer correctly interprets the information in the graph.</p> <p>OR Includes an analysis of usefulness of having the test.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>		<ul style="list-style-type: none"> the person may decide not to have children and therefore will not pass on the allele there is a wide range of ages that a person of a certain age can first show symptoms it does not show how bad the symptoms are or how long the person will live for some people would rather not know when, or if, they are likely to become ill it's useful to be aware and prepare for when the first symptoms will show less useful/reliable/predictable test of when the first symptoms will show with a lower number of CAG repeats. less useful as there is no cure only limited treatment for symptoms <p><u>Examiner's Comments</u></p> <p>There were a lot of good responses to this Level of Response question covering AO2 and AO3. Many candidates understood what was going on regarding the test and graph, and were able to evaluate the usefulness of these, in some cases in a very well-developed response. Most candidates understood that the test could tell the patient how many CAG repeats they have, and this information, together with the graph, may tell them when symptoms may present. Higher ability candidates appreciated that the information from the graph had limitations. There was, however, some confusion about what the test and graph were for in lower ability candidates. Some were using the graph to decide if they were old enough to take the test so they could find out if they had a history of Huntington's disease. Quite a few suggested the test and graph would allow them to be cured. Quite a few incorrectly explained how somebody's age determined the number of repeats they would have and that this would decrease as they got older. A common misconception was that if 'caught' early, the disease could be prevented or cured. Some candidates seemed to have read the next part of the question (Q22(c)) about potential treatments and adapted their Level of Response answer, despite it saying a cure was not possible in the stem of the question.</p> <p>Exemplar 1</p> <p><i>It's useful because there is no cure so people with the disease die after 10-15 years so by knowing if you're doing the test and seeing how many CAG bases you have or alleles you can make the decision to not have children so they can't get the disease Huntington's disease. The graph is useful because it shows the mean age of patients when they first develop symptoms. Symptoms are lower which means if you see how many CAG repeats you have you'll be prepared for them. However it may not be useful as it could stress people out or scare people if they see how many CAG repeats they have.</i></p>
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				<p>This exemplar represents an excellent example of how to gain maximum marks. The candidate has clearly identified that the gene test identifies how many CAG bases are present. They also identify that the test will show if the allele is present and links this to a usefulness of making decisions about having children. The graph analysis is also evidenced in the recognition that it identifies the mean age when first symptoms develop and there is a link to the usefulness of being able to prepare, avoid stress and also mentioned about being scared. Communication is clear, concise and as all aspects of the AO2 and AO3 assessment targeted by the question have been covered it gains maximum 6 marks.</p>
		Total	6	
32		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease. AND Analyses the information to explain the link between a lack of LDL protein and heart disease.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease.</p> <p>OR</p> <p>Demonstrates a knowledge of the importance of the blood supply to the heart.</p>	<p>6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)</p>	<p>AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle.</p> <ul style="list-style-type: none"> • blood in the coronary artery supplies heart muscle • oxygen / glucose is supplied to the muscle • this is needed for the muscle to contract/for respiration <p>AO2.1 Apply knowledge and understanding of the requirements of the heart muscle</p> <ul style="list-style-type: none"> • without oxygen / glucose the heart muscle cannot <u>respire</u> • <u>energy</u> from respiration is needed for the muscle to contract <p>AO3.1a Analyse information and ideas to interpret the effects of lack of LDL receptor protein.</p> <ul style="list-style-type: none"> • without LDL receptor protein there will be more cholesterol in the blood / cholesterol levels will be too high to be removed/broken down • increased build up of cholesterol in the coronary artery will increase the risk of heart disease / decrease blood flow to the heart muscle

		<p>AND Analyses the information to explain the link between a lack of LDL protein and heart disease.</p> <p>OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease.</p> <p>AND Analyses the information to explain the link between a lack of LDL protein and heart disease.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Demonstrates a knowledge of the importance of the blood supply to the heart.</p> <p>OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease.</p> <p>OR Analyses the information to explain the link between a lack of LDL protein and heart disease.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit</i></p>		
		Total	6	