

Question number	Part	Step	Answer	Additional guidance	Marks
1	a	2	<b>C</b> getting regular exercise		<b>1 mark</b>
	b	4	Substitution: $\left(\frac{31000\ 000}{100}\right) \times 16\ (1)$ Evaluation: = 4.9 million (1)	Full marks for a correct final answer with no working Allow the working mark for reasonable alternative methods Accept 4 960 000, 4.96 million and 5 million	<b>2 marks</b>
	c	2–3	<ul style="list-style-type: none"> <li>(Prevalence of) mental health issues decreases as age increases/older people are less likely to have mental health issues. (1)</li> <li>More females than males have mental health issues/women are more likely to have mental health issues. (1)</li> </ul>	Allow reverse arguments	<b>2 marks</b>
2	ai	2	<b>A</b> diarrhoea		<b>1 mark</b>
	aii	3	<b>B</b> fungus		<b>1 mark</b>
	bi	4	<pre>           graph LR             TB[tuberculosis] --- TA[through the air]             TB --- TW[through water]             M[malaria] --- TBF[through body fluids]             M --- AV[by an animal vector]             M --- IF[in food]           </pre>	1 mark for each correct line No mark for that communicable disease if there is more than one line from the communicable disease	<b>2 marks</b>
	bii	2	Use a condom/protected sex/refrain from sexual activity.		<b>1 mark</b>

Question number	Part	Step	Answer	Additional guidance	Marks												
3	a	2	<table border="1"> <thead> <tr> <th>Defence system</th> <th>Physical barrier</th> <th>Chemical defence</th> </tr> </thead> <tbody> <tr> <td>saliva in the mouth</td> <td></td> <td>✓</td> </tr> <tr> <td>lysozyme in tears</td> <td></td> <td>✓</td> </tr> <tr> <td>skin</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Defence system	Physical barrier	Chemical defence	saliva in the mouth		✓	lysozyme in tears		✓	skin	✓		1 mark for each row No mark if there is more than one tick in a row	2 marks
	Defence system	Physical barrier	Chemical defence														
saliva in the mouth		✓															
lysozyme in tears		✓															
skin	✓																
b	5	<ul style="list-style-type: none"> <li>Mucus traps dirt/dust/pathogens/named pathogen(s). (1)</li> <li>Cilia beat/waft/move (to and fro) to move mucus (and trapped pathogens) to back/out of throat. (1)</li> </ul>		2 marks													
4	a	6–7	<ul style="list-style-type: none"> <li>(Small mesh tube) widens/opens blood vessel (1)</li> <li>restores/increases blood flow through the artery (to the heart). (1)</li> </ul>		2 marks												
	b	7	<p>Answers should include at least one <b>advantage</b> of surgery, e.g. it may be the only way to save the patient's life (in an emergency), often gives immediate relief from symptoms (such as chest pain) (1)</p> <p>And at least one <b>disadvantage</b>, e.g. infection/complications/risks during surgery/named complication, patients may also need to take medication for the rest of their lives, etc. (1)</p> <p>And should include some form of <b>conclusion</b>, e.g. better to avoid need for surgery through lifestyle changes/whether or not surgery is the best option depends on the individual patient and their situation/surgery may be the only option if someone is having a heart attack but should be a last resort due to the risks involved, etc. (1)</p>	Accept other reasonable advantages/disadvantages/conclusions	3 marks												
5	a	7	$\left(\frac{2500}{10}\right) \times 3$ <p>OR</p> $\left(\frac{3}{10}\right) \times 2500 (1)$ <p>= 750(kcal) (1)</p>	Full marks for correct final answer with no working	2 marks												

Question number	Part	Step	Answer	Additional guidance	Marks
	b	7	<p>male A (1)</p> <p>and then any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• Too much fat in diet/valid calculation (1)</li> <li>• so fat builds up in blood vessels/arteries. (1)</li> <li>• not enough exercise (1)</li> <li>• Exercise lowers blood pressure/helps to remove fat from blood vessels/arteries. (1)</li> </ul>	<p>Allow other correct disadvantages of too much fat/carbohydrate in the diet or lack of exercise related to increased risk of heart disease</p> <p>Allow references to an unhealthy diet</p> <p>Reference to veins rather than blood vessels/arteries in marking point 2 and marking point 4 should only be penalised once</p>	<b>3 marks</b>
	c	8	1.05 : 1	Full marks for correct final answer with no working	<b>2 marks</b>
6	a	7–8	<p>Description including any <b>three</b> of the following points in a logical order:</p> <ul style="list-style-type: none"> <li>• (Inactive pathogen) contains foreign/non-self antigens. (1)</li> <li>• White blood cells respond to/detect foreign antigens/reference to antibody production. (1)</li> <li>• reference to matching shape of antigens and antibodies/specificity (1)</li> <li>• reference to lymphocyte being activated by presence of antigen/dividing rapidly (to produce identical lymphocytes with same antibodies) (1)</li> <li>• correct reference to memory lymphocytes (1)</li> <li>• Next time the antigens are encountered the body can quickly make the correct antibodies/reference to (faster) secondary response. (1)</li> <li>• Secondary response is so rapid that the pathogens will be destroyed before the person gets ill. (1)</li> </ul>	At least one of the points in the description must refer to a more rapid secondary response OR a second exposure to the same (measles) pathogen for full marks	<b>3 marks</b>

Question number	Part	Step	Answer	Additional guidance	Marks
	b	7–8	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are therefore not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;"><b>Indicative content AO1 (3 marks)</b></p> <p>Pre-clinical testing:</p> <ul style="list-style-type: none"> <li>• tested on human cells in the lab</li> <li>• tested on animals in the lab</li> </ul> <p>Clinical tests:</p> <ul style="list-style-type: none"> <li>• low doses of the drug tested on a small number of healthy volunteers</li> <li>• tested on a large number of people with the condition that the drug is intended to treat</li> </ul> <p style="text-align: center;"><b>Indicative content AO2 (3 marks)</b></p> <p>(tested on human cells)</p> <ul style="list-style-type: none"> <li>• to test effectiveness</li> <li>• to see if drug can be absorbed by cells</li> <li>• check for side effects/toxicity</li> </ul> <p>(tested on animals in the lab)</p> <ul style="list-style-type: none"> <li>• to find out the effect of the drug on a whole organism</li> <li>• check for side effects/toxicity</li> <li>• start to estimate correct doses</li> </ul> <p>(low doses of the drug tested on a small number of healthy volunteers)</p> <ul style="list-style-type: none"> <li>• to check safety/check for side effects</li> <li>• to help calculate correct dose</li> </ul> <p>(tested on a large number of people with the condition that the drug is intended to treat)</p> <ul style="list-style-type: none"> <li>• to confirm the correct dosage</li> <li>• to monitor how well drug works</li> <li>• to check for different side effects in different people and how common they are</li> </ul>		<b>6 marks</b>

Step	Marks	Descriptor
U	0	No awardable content.
3–4	1–2	<b>Level 1</b> <ul style="list-style-type: none"> <li>• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1)</li> <li>• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)</li> </ul>
5–6	3–4	<b>Level 2</b> <ul style="list-style-type: none"> <li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)</li> <li>• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)</li> </ul>
7–8	5–6	<b>Level 3</b> <ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)</li> <li>• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)</li> </ul>

**Step boundaries**

Step	Marks
U	0–2
1	3–4
2	5–8
3	9–10
4	11–12
5	13–14
6	15–16
7	17–20
8	21+

**Indicative grade boundaries**

Indicative grade	Marks
U	0–4
1	5–8
2	9–12
3	13–16
4	17–20
5	21+

Question number	Part	Step	Answers	Additional guidance	Marks
1	a	7	$\left(\frac{2500}{10}\right) \times 3$ OR $\left(\frac{3}{10}\right) \times 2500 (1)$ $= 750 (\text{kcal}) (1)$	Full marks for correct final answer with no working	<b>2 marks</b>
	b	7	male A (1) and then any <b>two</b> from: <ul style="list-style-type: none"> <li>• Too much fat in diet/valid calculation (1)</li> <li>• so fat builds up in blood vessels/arteries. (1)</li> <li>• not enough exercise (1)</li> <li>• Exercise lowers blood pressure/helps to remove fat from blood vessels/arteries. (1)</li> </ul>	Allow other correct disadvantages of too much fat/carbohydrate in the diet or lack of exercise, related to increased risk of heart disease Allow references to an unhealthy diet Reference to veins rather than blood vessels/arteries in marking point 2 and marking point 4 should only be penalised once	<b>3 marks</b>
	c	8	1.05 : 1	Full marks for correct final answer with no working	<b>2 marks</b>

Question number	Part	Step	Answer	Additional guidance	Marks
2	a	7–8	Description including <b>three</b> of the following points in a logical order: <ul style="list-style-type: none"> <li>(Inactive pathogen) contains foreign/non-self antigens. (1)</li> <li>White blood cells respond to/detect foreign antigens/reference to antibody production. (1)</li> <li>reference to matching shape of antigens and antibodies/specificity (1)</li> <li>reference to lymphocyte being activated by presence of antigen/dividing rapidly (to produce identical lymphocytes with same antibodies) (1)</li> <li>correct reference to memory lymphocytes (1)</li> <li>Next time the antigens are encountered, the body can quickly make the correct antibodies/reference to (faster) secondary response. (1)</li> <li>Secondary response is so rapid that the pathogens will be destroyed before the person gets ill. (1)</li> </ul>	At least one of the points in the description must refer to a more rapid secondary response OR a second exposure to the same (measles) pathogen for full marks	<b>3 marks</b>
	bi	8	A description that contains the following points: <ul style="list-style-type: none"> <li>Whooping cough is caused by a bacterium. (1)</li> <li>Antibiotics inhibit cell processes (in bacteria)/break down cell walls of bacteria/kill the bacteria. (1)</li> </ul>		<b>2 marks</b>
	bii	8	Any <b>two</b> from: <ul style="list-style-type: none"> <li>(Sinus infection) may be caused by a virus (rather than bacteria). (1)</li> <li>Antibiotics have no effect on viruses. (1)</li> <li>Antibiotics only destroy bacterial cells. (1)</li> </ul>		<b>2 marks</b>
3	a	8	<b>D</b> feeling positive about yourself and being able to cope with stress		<b>1 mark</b>
	bi	8	<b>C</b> Ebola		<b>1 mark</b>
	bii	8	Use a condom/protected sex/refrain from sexual activity.		<b>1 mark</b>
4	a	9	<ul style="list-style-type: none"> <li>Clear zone shows no bacterial growth. (1)</li> <li>The greater the area of the clear zone, the more effective the antibiotic. (1)</li> </ul>		<b>2 marks</b>
	bi	9	To kill bacteria/microorganisms on the loop/to sterilise the loop/to avoid contaminating the dish (with other bacteria/microorganisms).		<b>1 mark</b>
	bii	9	To avoid contaminating it with bacteria/microorganisms from the air/so bacteria/microorganisms from the air cannot land on it.		<b>1 mark</b>

Question number	Part	Step	Answer	Additional guidance	Marks
	c	9	<ul style="list-style-type: none"> <li>Antibiotic C is the most effective (against this bacterium) (1)</li> <li>because it gave the largest clear zone/prevented bacterial growth most effectively/over the widest area. (1)</li> </ul>		<b>2 marks</b>
5	ai	9	$\left(\frac{2.22 - 0.93}{0.93}\right) \times 100 (1)$ = 139 (%) (1)	Full marks for correct final answer with no working Allow 138.7 as final answer	<b>2 marks</b>
	a ii	9	<ul style="list-style-type: none"> <li>Smokers breathe in carbon monoxide, which binds to red blood cells (in place of oxygen) (1)</li> <li>so more blood is needed to deliver adequate oxygen to heart muscle. (1)</li> </ul>		<b>2 marks</b>
	b	10	<ul style="list-style-type: none"> <li>reference to new blood vessels bypassing blockage (1)</li> <li>blood flow to heart muscle cells/tissue restored/improved (1)</li> </ul>		<b>2 marks</b>
6		11–12	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are therefore not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;"><b>Indicative content AO1 (3 marks)</b></p> <ul style="list-style-type: none"> <li>White blood cell W (in <b>Figure 7</b>) is a phagocyte.</li> <li>T-helper cells stimulate phagocytosis/production of phagocytes.</li> <li>White blood cell X (in <b>Figure 7</b>) is a lymphocyte.</li> <li>T-helper cells stimulate production of lymphocytes/antibodies.</li> <li>Phagocytes engulf/surround and digest/destroy pathogens.</li> <li>Lymphocytes produce antibodies against pathogens.</li> <li>Antibodies stick to pathogens that enter the body and help to destroy them.</li> </ul> <p style="text-align: center;"><b>Indicative content AO2 (3 marks)</b></p> <ul style="list-style-type: none"> <li>T-helper cells are prevented from stimulating (production of) lymphocytes/antibodies.</li> </ul>		<b>6 marks</b>



Question number	Part	Step	Answer	Additional guidance	Marks
			<ul style="list-style-type: none"> <li>• No phagocytes are stimulated to engulf and digest pathogens/cold viruses.</li> <li>• There is no signal from T-helper cells to stimulate action by lymphocytes.</li> <li>• Lymphocytes do not produce antibodies against pathogens/cold viruses.</li> <li>• Pathogens/cold viruses that enter the body cannot be destroyed by the immune system (as they usually would).</li> <li>• This inability of the immune system cells to work can lead to a common cold causing a serious illness.</li> </ul>		

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9–10	3–4	<b>Level 2</b> <ul style="list-style-type: none"> <li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)</li> <li>• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)</li> </ul>
11–12	5–6	<b>Level 3</b> <ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)</li> <li>• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)</li> </ul>

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U	0–6
5	7–8
6	9–10
7	11–13
8	14–17
9	17–19
10	20–23
11	24–27
12	28+

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3	7–10
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