

1. John grows tomatoes in his greenhouse.



(i) One morning John notices the leaves of his plant look different.

The tomato plant has a disease called blight.



Suggest the impact this may have on the plant.

[1]

(ii) Pesticides can be used to try to kill plant diseases such as blight on tomato plants.

State one way that a plant can naturally defend itself against pathogens.

2. When bacteria enter the body, they multiply. The body launches an immune response.

What is the name given to the proteins produced by the body to attack the multiplying bacteria?

Put a tick (✓) in the correct box.

Antibodies

Antigens

Antibiotics

Enzymes

[1]

3(a). Plants also need to protect themselves from disease.

Give two **physical** defences used by plants against disease.

1

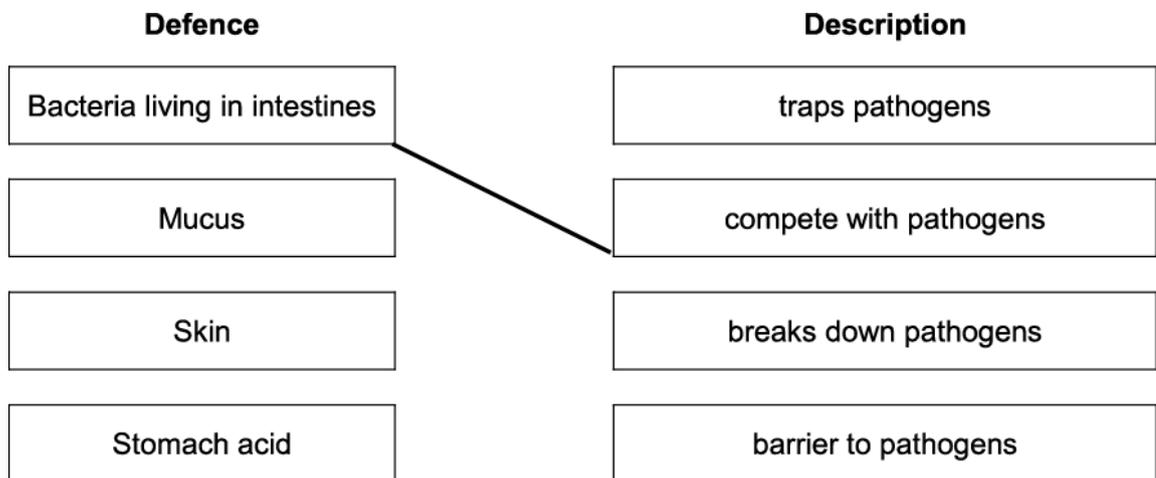
2

[2]

(b). Humans have defences that make it difficult for pathogens to enter.

Use **straight lines** to link each **defence** to its correct **description**.

One line has been drawn for you.



[2]

4(a). Human blood contains different components.

Write down the job of:

white blood cells _____

platelets _____

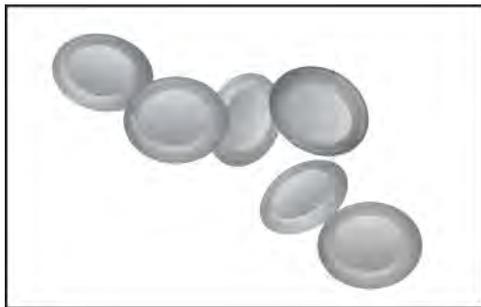
plasma _____

[3]

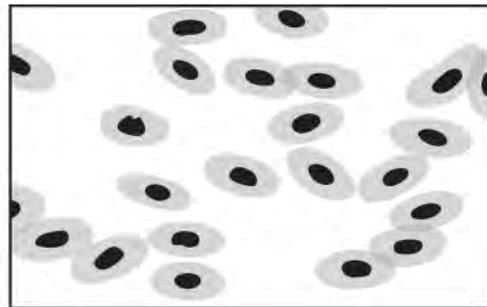
(b). Blood also contains red blood cells.

Look at the diagrams.

They show human red blood cells and frog red blood cells.



Human red blood cells



Frog red blood cells

Human red blood cells are better adapted to the job that they do than frog red blood cells.

Use the diagrams to suggest how.

[2]

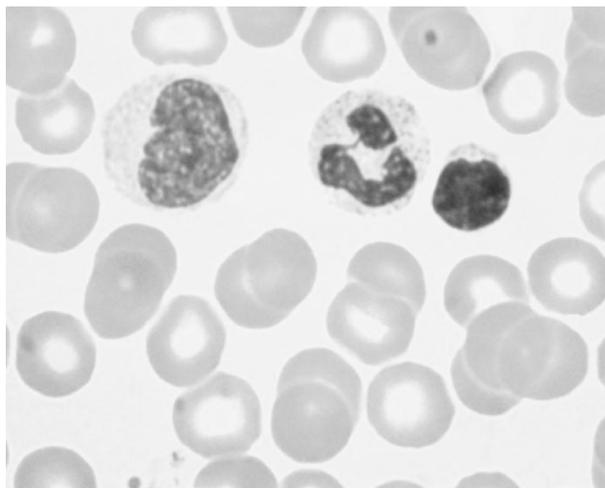
5(a). There are more red blood cells than white blood cells in the blood sample above.

Estimate the ratio of red blood cells to white blood cells.

----- [1]

(b). Blood is made up of cells, plasma and platelets.

The picture below is of blood cells as seen down a microscope.



Draw a labelled scientific drawing of a white blood cell in the space below.

Label the nucleus and cell membrane.

[4]

7(a). Jake accidentally cuts himself.

The cut becomes infected with bacteria.

Jake begins to feel ill. He has septicaemia (blood poisoning).

Septicaemia can kill.

Complete the sentences to explain what the bacteria are doing to make Jake feel ill.

Choose only words from this list.

antibiotics damage help oxygen stimulate toxins

The bacteria in Jake's cut multiply rapidly. They spread into his blood stream.

The bacteria _____ Jake's cells and release

_____ into his blood stream.

[2]

(b). For the first few hours, the bacteria divide into two every twenty minutes.

100 bacteria entered Jake's wound when he cut himself.

How many bacteria are in Jake's wound after 2 hours?

Show your working.

number of bacteria in Jake's wound after two hours. _____ [2]

(c). It is important for Jake to produce antibodies against these bacteria as quickly as possible.

Use the information from parts (a) and (b) to explain why.

[3]

8(a). Most women diagnosed with cancer of the ovaries will have an operation to remove their ovaries.

Before the operation, the doctor will discuss the risks of the operation with the patient.

Give **one** example of a risk to the patient.

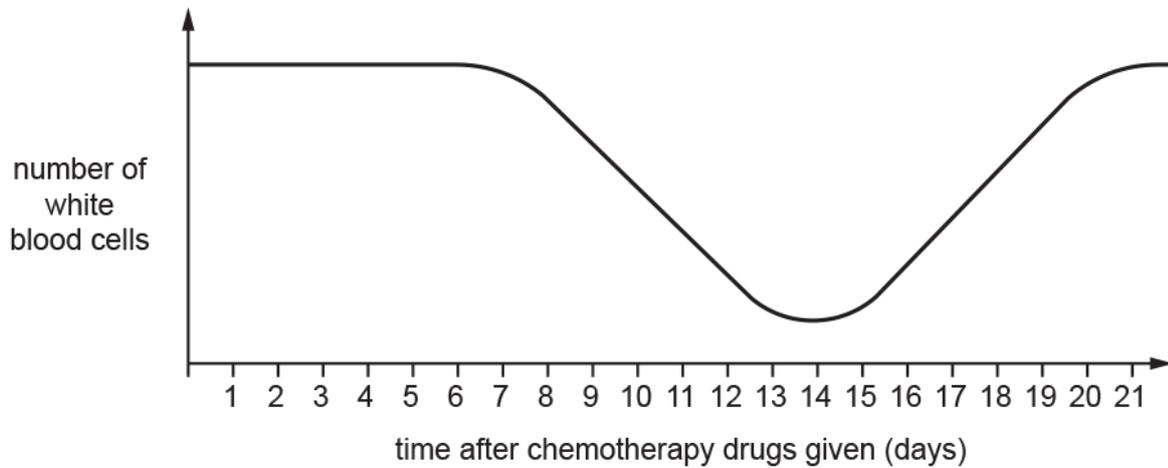
----- [1]

(b). After surgery the patient may be given chemotherapy drugs to kill any remaining cancer cells.

Chemotherapy also affects the number of white blood cells in a patient.

The graph shows what happens to the number of white blood cells during chemotherapy.

The patient receives the chemotherapy drugs on day 1.



(i) Describe what happens to the number of white blood cells after chemotherapy.

Use information from the graph in your answer.

----- [2]

(ii) Explain how white blood cells protect us from disease **and** how they are adapted for this function.

[3]

(iii) White blood cells are one component of the blood.

There are three other major components of the blood, which all have specific functions.

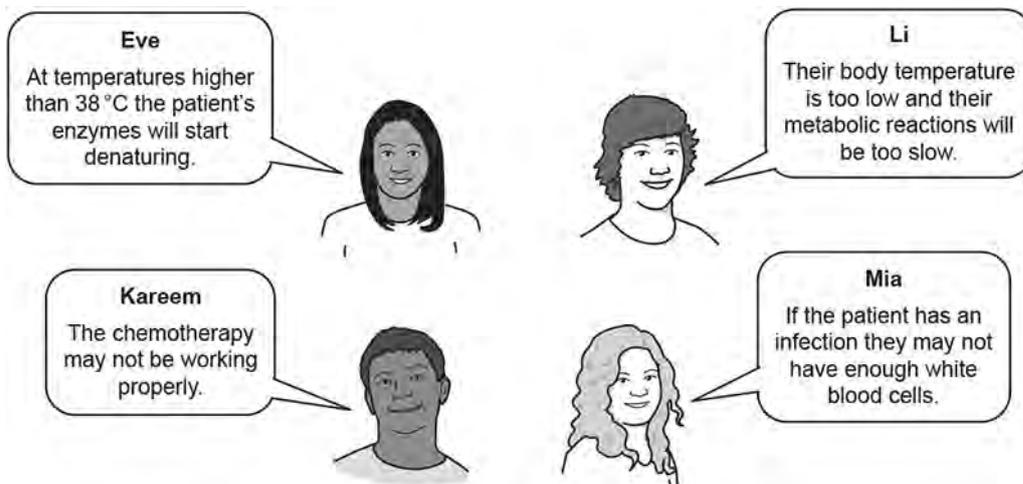
Draw a line to link each **blood component** to its **function**.

Blood component	Function
Plasma	Cell fragment that helps the blood clot at injury sites and helps seal wounds.
Red blood cell	Transports dissolved substances such as hormones, urea and food molecules.
Platelet	Contains haemoglobin and transports oxygen around the body.

[2]

(iv) A chemotherapy patient is told to go to accident and emergency if they feel ill and have a temperature above 38 °C.

Some students have a discussion about why this is important.



Which **two** students made the best suggestions?

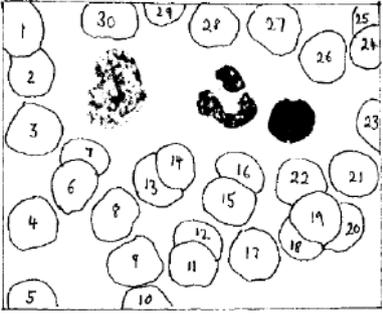
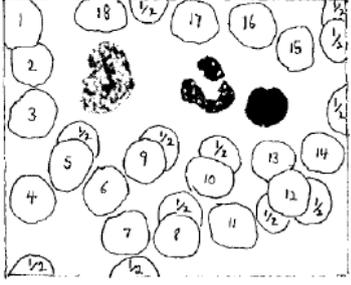
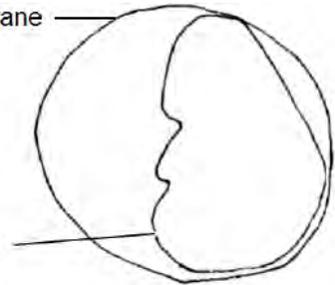
----- and -----

[2]

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance										
1		i	Less photosynthesis ✓	1	ALLOW less light absorbed / plant stops growing										
		ii	Any one from Physical e.g. cuticle / cell wall ✓ Antimicrobial chemicals ✓	1											
			Total	2											
2			Antibodies ✓	1	If more than one box is ticked, do not award the mark even if the correct box is also ticked										
			Total	1											
3	a		Leaf cuticle ✓ Cell wall ✓	2											
	b		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Defence</th> <th style="text-align: left;">Description</th> </tr> </thead> <tbody> <tr> <td>Bacteria living in intestines</td> <td>traps pathogens</td> </tr> <tr> <td>Mucus</td> <td>compete with pathogens</td> </tr> <tr> <td>Skin</td> <td>breaks down pathogens</td> </tr> <tr> <td>Stomach acid</td> <td>barrier to pathogens</td> </tr> </tbody> </table>	Defence	Description	Bacteria living in intestines	traps pathogens	Mucus	compete with pathogens	Skin	breaks down pathogens	Stomach acid	barrier to pathogens	2	Three lines correct = 2 marks One or two lines correct = 1 mark
Defence	Description														
Bacteria living in intestines	traps pathogens														
Mucus	compete with pathogens														
Skin	breaks down pathogens														
Stomach acid	barrier to pathogens														
			Total	4											
4	a		Fights infection Clots blood Transports (dissolved) substances / example of dissolved substance / cells	3	Idea of transport required not what it contains Ignore oxygen Examiner's Comments Most candidates were aware of the function of white blood cells, however, this was not the case with platelets and plasma.										
	b		No nucleus Concave / bi concave / large surface area	2	Examiner's Comments The simple cell structure of the nucleus was not recognised by many candidates, however the biconcave nature of red blood cells was better known, however over half the candidates failed to gain any marks in this part.										
			Total	2											

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
5	a	10 : 1 / 8 : 1 ✓	1	 <p>If all red blood cells are estimated as whole cells as shown above, then ratio is 10 : 1</p>  <p>If partial or overlapping red blood cells are estimated as half cells as shown above, then ratio is 8 : 1</p>
	b	Correct cell drawn AND taking up 50% or more of space ✓ Continuous, unfeathery lines, no shading ✓ Label lines drawn with a ruler ✓ Nucleus AND cell membrane correctly labelled ✓	4	Drawing should take up approximately 50% of space e.g. cell membrane —————  nucleus —————
		Total	5	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
6	<p>Level 3 (5–6 marks) Includes some basic and some higher components with an explanation of what they do. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Include some structural components with an explanation of what they do. Quality of written communication partly impedes communication of science at this level.</p> <p>Level 1 (1–2 marks) Include some basic structural component(s) OR one component explained Quality of written communication impedes communication of science at this level.</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to G Indicative scientific points may include:</p> <p><i>Specific</i></p> <p>Higher</p> <ul style="list-style-type: none"> • hormones – chemical messengers • glucose – for respiration • carbon dioxide – from respiration • urea – waste • plasma (explained) carries substances <p>Basic</p> <ul style="list-style-type: none"> • red blood cells – haemoglobin – transport oxygen • white blood cells – destroy micro-organisms • platelets – clot blood • plasma (identified) – liquid part of blood <p><i>General</i></p> <ul style="list-style-type: none"> • Level 2 and 3 should include an explanation of what the components do. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> <p>Examiner's Comments</p> <p>This six-mark extended-writing question differentiated well with many candidates showing that they had learned the basic structures associated with blood. However a number of candidates were confused with the functions of the red and white blood cells.</p>
	Total	0	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
7	a	damage; toxins	2	<p>accept any indication of correct choice eg lines from words</p> <p>Examiner's Comments</p> <p>This was a well answered question, many candidates knew both damage and toxins.</p>
	b	idea of doubling; 6400	2	<p>accept doubling even if does not start from 100, for 1 mark or allow 1 numerical mistake with correct method for 1 mark</p> <p>Doubling must be bacteria numbers not time</p> <p>correct answer scores 2 marks</p> <p>Examiner's Comments</p> <p>This question asked the candidates to calculate the number of bacteria present in Jake's cut after 2 hours and required them to be able to show how they arrived at their answer. Very few of the candidates were awarded 1 mark for demonstrating that they knew that doubling had occurred and this mark was awarded for their working. Centres need to remind candidates that showing the working is important and may lead to marks being awarded even if the answer is incorrect.</p>
	c	bacteria multiply rapidly ; dead / damaged cells and / or toxins will increase rapidly ; antibodies kill bacteria / lock onto; the sooner the antibodies are produced, the less damage will be caused	3	<p>first, second, fourth points must be qualified</p> <p>ignore grow ignore spread ignore "fight" reject antibodies engulf (and kill) bacteria</p> <p>Examiner's Comments</p> <p>This question required candidates to use the information from parts (a) and (b) to explain why it was important to produce antibodies quickly. It was disappointing to see that many had not followed the guidance in the stem of the question.</p>
		Total	7	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance	
8	a	<p>Any one from:</p> <p>infection ✓</p> <p>death ✓</p> <p>bleeding ✓</p> <p>damage to other cells, tissues or organs ✓</p>	1 (AO 2.1)	<p>IGNORE won't be able to have children / the operation could go wrong / cancer could spread / scarring</p> <p><u>Examiner's Comments</u> This AO2 question was designed to test how candidates applied their understanding of the Ideas about Science chapter B7. Candidates, including those who obtained higher marks overall, found this question difficult. The majority suggested the risk to be the inability to have children or that the cancer could spread.</p>	
	b	i	<p>Any one from:</p> <p>from day 1 to day 6 there is no change in number of white blood cells ✓</p> <p>number of white blood cells starts to fall on day 6 (after treatment) ✓</p> <p>number of white blood cells falls (rapidly) on day 7 (after treatment) ✓</p> <p>the number of white blood cells falls 7-14 days (after treatment) ✓</p> <p>AND</p> <p>Any one from:</p> <p>the number of white blood cells is at its lowest 14 days (after treatment) ✓</p> <p>the number of white blood cells (starts to) rise on or from 14 days (after treatment) ✓</p> <p>the number of white blood cells increases rapidly on or from day 15 (after treatment) ✓</p>	2 (AO 3.2b × 2)	<p>ALLOW lowest between days 13-14 (after treatment)</p> <p>IGNORE number of white blood cells starts to rise on day 15</p>

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
	<p>the number of white blood cells has returned to normal 21 days (after treatment) ✓</p>		<p>IGNORE answers that refer to weeks</p> <p><u>Examiner's Comments</u></p> <p>Candidates found this AO3 question challenging because they mis-read what they were asked to do. Half of candidates were able to score one or both marks by using information from the graph to describe what happened to the number of white blood cells after chemotherapy. Marks were lost for a number of reasons, namely</p> <ul style="list-style-type: none"> – not using information from the graph to describe the trend – attempting to identify key days on the graph but drawing slanting or inaccurate lines from the line to the x axis – attempting to explain why the number of white blood cells changed – using vague descriptions such as “after a couple of weeks the white blood cells slowly start to increase to a suitable amount”

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	ii	<p>Any two from:</p> <p>white blood cells engulf or ingest and digest pathogens ✓</p> <p>white blood cells produce antibodies ✓</p> <p>white blood cells become memory cells in case of re-infection ✓</p> <p>AND</p> <p>Any one from:</p> <p>white blood cells contain enzymes to digest pathogens ✓</p> <p>white blood cells have receptors that recognise antigens on pathogens ✓</p> <p>the antibodies produced by white blood cells are specific to pathogens ✓</p>	2 (AO 1.1 × 2)	<p>ALLOW carry out phagocytosis</p> <p>NOT white blood cells produce antigens</p> <p><u>Examiner's Comments</u></p> <p>This is an AO1 question. It was clear that candidates had been taught about white blood cells but because they did not use scientific language they lost marks. There were many references to "fighting" and "attacking" pathogens and some candidates were confused between the terms antigen and antibody and on occasion between antibody and pathogen. Very few candidates knew how white blood cells are adapted to their function and were therefore limited to two marks.</p>
	iii		2 (AO 1.1 × 2)	<p>two or three correct lines = 2 marks</p> <p>one correct line = 1 mark</p> <p><u>Examiner's Comments</u></p> <p>This is an AO1 questions. Candidates scored well on this question with most scoring full marks.</p>
	iv	<p>Eve ✓</p> <p>Mia ✓</p>	2 (AO 2.1 × 2)	<p><u>Examiner's Comments</u></p> <p>Almost all candidates were able to score at least one mark here (most often for identifying Eve), with many correctly identifying both candidates. This question assessed objective AO2.</p>
		Total	10	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
9		<p>antimicrobial substances kill / protect plants from (death/damage caused by) pathogens/disease(s) ✓</p> <p>Plus any two from: we depend on plants for food ✓</p> <p>(photosynthesising) plants add oxygen to the air / remove carbon dioxide from the air / provide breathable air ✓</p> <p>plants are an essential part of the carbon cycle ✓</p> <p>all organisms (in an ecosystem) are <u>interdependent</u> ✓</p>	3 (AO 1.1 × 3)	<p>DO NOT ALLOW idea of plants being “immune” to diseases/pathogens</p> <p>Examiner’s Comments</p> <p>Higher ability candidates were able to answer this synoptic question well, by linking understanding of plant defences against disease (B2.2.6) to ideas about the interdependence of organisms (B3.3.5) and why humans depend on plants (B3.1.1, B3.3.2 and B3.3.9).</p>
		Total	3	