Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Disease and immunity

Time allowed: 1 hour 25 minutes

Subject code **0610**

Biology

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 90

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 90 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 **(a)** Complete the description of the immune system, using the words from the list.

Each word may be used once, more than once or not at all.

antibodies **antigens** **biological** **block**

chemical **engulf** **hairs** **mechanical**

nails **vaccines**

The body has defences to protect against infectious diseases.

Skin and ..... in the nose are ..... barriers.

Some types of blood cell are involved in defending the body against infectious diseases.

Some blood cells can produce ..... which can kill the pathogen.

Other cells can ..... the pathogen in a process called phagocytosis. [4]

(b) Describe actions that can be taken by individuals in their homes to reduce the spread of disease.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

Pathogens, body defences and immunity Click for more variations

Reduced to 78% to fit the page (wider than A4).

1(a)	hairs ; mechanical ; antibodies ; engulf ;	4	
1(b)	(named examples of) hygienic food, preparation / storage ;;; (named examples of) good personal hygiene ;;; (named example of) appropriate waste disposal ;	3	e.g., store food at correct temperature / cook food thoroughly / ref. to cleaning utensils or surfaces / avoiding cross contamination / pest-proof food storage e.g., washing hands or body / washing clothes or bedding / not sharing a toothbrush or razor

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2 The body has defences against pathogens.

(a) (i) Define the term *pathogen*.

.....

.....

..... [1]

(ii) State **two** ways a pathogen can be transmitted.

1 .....

.....

2 .....

.....

[2]

(iii) The body can defend itself against pathogens.

Complete Table 4.1 by stating examples of the body's defences.

Table 4.1

defence	example
mechanical barrier	
chemical barrier	

[2]

(b) (i) Blood cells can also defend the body against pathogens.

Outline how they do this.

.....

.....

.....

.....

..... [3]

(ii) State **one** way in which modern medicine can help the body defend itself against pathogens.

.....

..... [1]

[Total: 9]

Blood Click for more variations

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2(a)(i)	disease-causing organism;	**1**	
2(a)(ii)	(direct) contact / through blood / through (named) body fluids; (contaminated) surfaces / AW; (contaminated) food / water / AW; from, animals / (named) vector; through the air / AW;	**2**	
2(a)(iii)	*mechanical* skin / hairs in nose; *chemical* mucus / stomach or hydrochloric acid / gastric juices;	**2**	
2(b)(i)	ref. to white blood cells; phagocytosis / engulfing / description of engulfing; ref. to production of antibodies / causing cells to clump / stick to cell surface AW;	**3**	
2(b)(ii)	vaccination / antibiotics / antifungals / antivirals / antitoxin / antiseptics/AVP;	**1**	
		Total: 9	

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3 Some bacteria are pathogens.

Bacteria were grown in a Petri dish on agar jelly which contained nutrients. The bacteria covered the whole surface of the agar jelly.

Three paper discs were placed on the agar jelly. Each paper disc contained a different antibiotic. The bacteria were left to grow for 24 hours at 35 °C.

Fig. 3.1 shows the growth of the bacteria on the agar jelly at the start and after 24 hours.

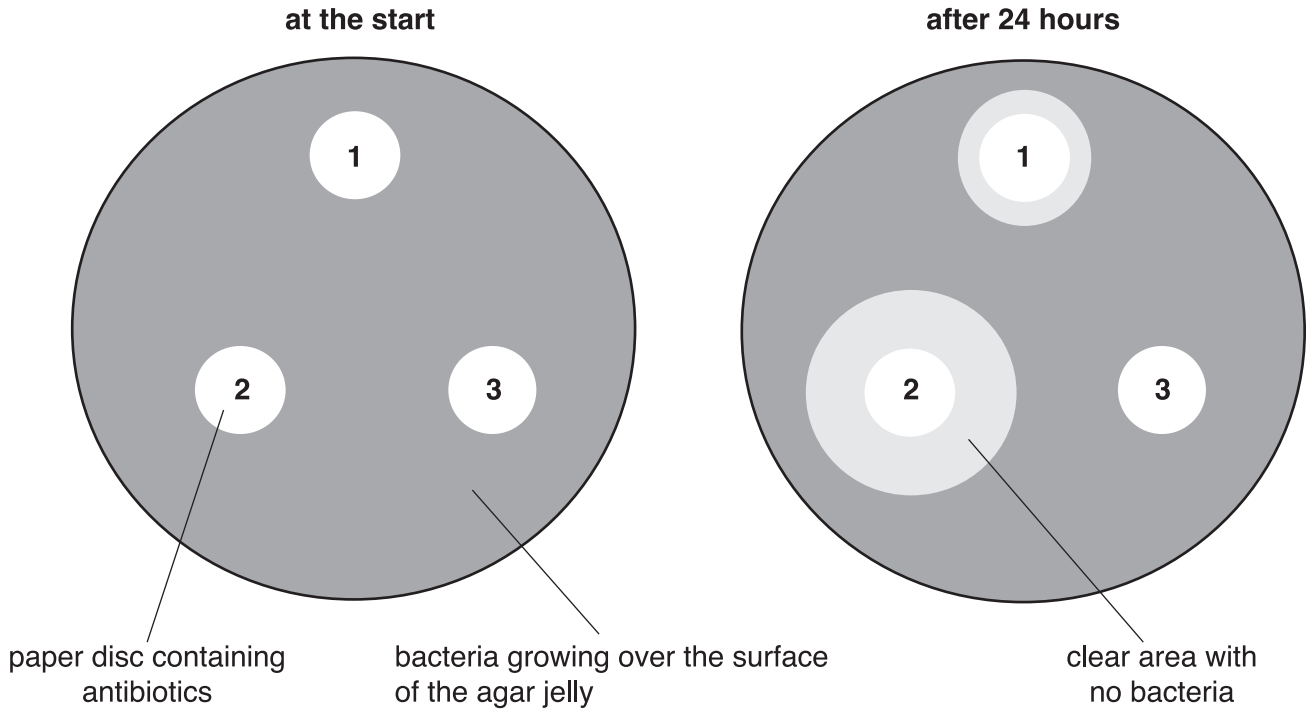


Fig. 3.1

(a) (i) Suggest why there are clear areas around some of the paper discs after 24 hours.

.....

.....

..... [1]

(ii) List the numbers of the antibiotics in order from most effective to least effective.

Give a reason for your choice.

most effective .... least effective

reason .....

.....

.....

[2]

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(b) Fig. 3.2 is a drawing of a bacterial cell.

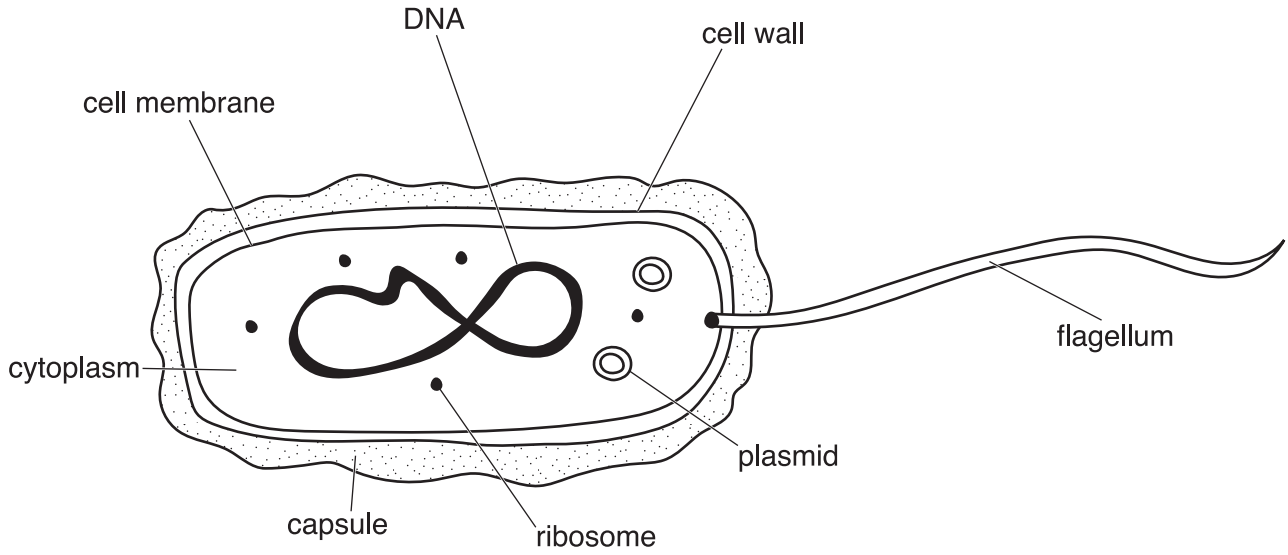


Fig. 3.2

State **three** ways in which a plant cell is similar to the bacterial cell shown in Fig. 3.2.

1 .....

2 .....

3 .....

[3]

(c) Pathogens for transmissible diseases can be transmitted either through direct contact or indirect contact.

Table 3.1 gives examples of ways in which pathogens can be transmitted.

Identify the examples of **direct** contact by placing a tick (✓) in the correct boxes in Table 3.1.

Table 3.1

example	direct contact
air	
blood	
body fluids	
contaminated food	
contaminated surfaces	

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[2]

[Total: 8]

Drugs and antibiotics Click for more variations

3(a)(i)	(antibiotic), killed the bacteria / stopped the growth of bacteria ;	1	
3(a)(ii)	(most effective) **2** **1** **3** (least effective) ; *reason:* more bacteria killed / more clear area / AW ;	2	
3(b)	cytoplasm ; DNA ; cell wall ; cell membrane ;	3	**A** ribosome ;
3(c)	<table><tr><th>example</th><th>direct contact</th></tr><tr><td>air</td><td></td></tr><tr><td>blood</td><td>✓ ;</td></tr><tr><td>body fluids</td><td>✓ ;</td></tr><tr><td>contaminated food</td><td></td></tr><tr><td>contaminated surfaces</td><td></td></tr></table>	2	

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4 **(a)** Symptoms of the disease influenza may include sneezing.

Fig. 4.1 shows a sign at a hospital.



Fig. 4.1

Explain why washing your hands after sneezing can help to prevent the spread of disease.

.....

.....

.....

.....

..... [2]

(b) State **two** ways of preventing the spread of disease through water.

1 .....

.....

2 .....

.....

[2]

(c) State **three** ways the body defends itself against disease.

1 .....

2 .....

3 .....

[3]

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(d) Identify each disease or virus as transmissible or non-transmissible by drawing a circle around the correct word.

Human immunodeficiency virus (HIV)	**transmissible / non-transmissible**
coronary heart disease (CHD)	**transmissible / non-transmissible**
scurvy	**transmissible / non-transmissible**

[2]

[Total: 9]

Pathogens, body defences and immunity Click for more variations

Reduced to 77% to fit the page (wider than A4).

4(a)	sneeze (may) contain (named) pathogens ; *idea of* pathogens being removed by washing hands ;	**2**	
4(b)	*any two from:* boiling water / bottled water ; chlorinated water / UV steriliser / purification or sterilising tablets ; waste disposal / sewage treatment / separate drinking and toilet systems ; AVP;	**2**	**A** do not drink contaminated water e.g. microfiltration / remove water to stop mosquitoes breeding / AW
4(c)	*any three from:* skin ; hairs in the nose ; mucus / ciliated cells ; stomach acid ; white blood cells / antibodies / phagocytosis ; tears ; AVP ;	**3**	**A** immune system e.g. platelets / blood clotting / increased body temperature / fever / ear wax
4(d)	transmissible non–transmissible non–transmissible ;;	**2**	all three correct = two marks two or one correct = one mark

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5 **(a)** Define the term drug.

.....

.....

..... [2]

(b) Antibiotics are a type of drug.

State the type of infection antibiotics are used to treat.

..... [1]

(c) Table 6.1 shows the year in which three different types of antibiotics were first used and the year that antibiotic resistance was first detected.

Table 6.1

antibiotic	year of first use	year resistance first detected
A	1952	1988
B	1962	1973
C	2000	2003

Compare the data for the three antibiotics in Table 6.1.

.....

.....

.....

.....

.....

.....

..... [3]

(d) The body has defences against infections caused by pathogens.

State **three** body defences that prevent pathogens from entering the body.

1 .....

2 .....

3 .....

[3]

[Total: 9]

Measurements, tables, graphs and conclusions Click for more variations

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5(a)	any substance (taken into the body), that modifies / affects ; chemical reactions (in the body) ;	2	
5(b)	bacterial ;	1	
5(c)	1 resistance to antibiotic **A** took the longest time (to be detected) / AW; 2 resistance to antibiotic **C** took the least time (to be detected) / AW ; 3 resistance to antibiotic **B** was the first (to be detected) ; 4 *idea of* the newer the antibiotic the quicker resistance developed ; 5 data manipulation ;	3	e.g. idea of years taken to develop resistance in **one** of the antibiotics **A** took 36 years, **B** took 11 years, **C** took 3 years
5(d)	mucus ; stomach / hydrochloric, acid ; hairs in the nose ; skin ; blood clot / scabs ; AVP ;; e.g. tears, vaginal secretions, ear wax, saliva, cilia	3	

6 **(a)** The body has defence mechanisms to protect it from infection.

Outline the body's defence mechanisms.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(b) State the name of a type of drug that can be used to treat bacterial infections.

..... [1]

[Total: 6]

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Pathogens, body defences and immunity Click for more variations

6(a)	(named) mechanical (barriers) ; (named) chemical barriers ; ref. to active immunity ; white blood cells / lymphocytes / phagocytes ; (phagocytes) engulf (named) microorganisms / phagocytosis ; lymphocytes produce antibodies ; ref. to specific, antigens / pathogens ; ref. to long term immunity / memory cells ; AVP ;	**5**	
6(b)	antibiotics ;	**1**	

7 Viruses can cause diseases.

(a) **(i)** State **two** other features of all viruses.

1 .....

2 .....

[2]

(ii) Describe how vaccination can prevent the spread of disease.

.....

.....

.....

.....

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.....

.....[5]

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(b) Fig. 6.1 shows four different viruses.

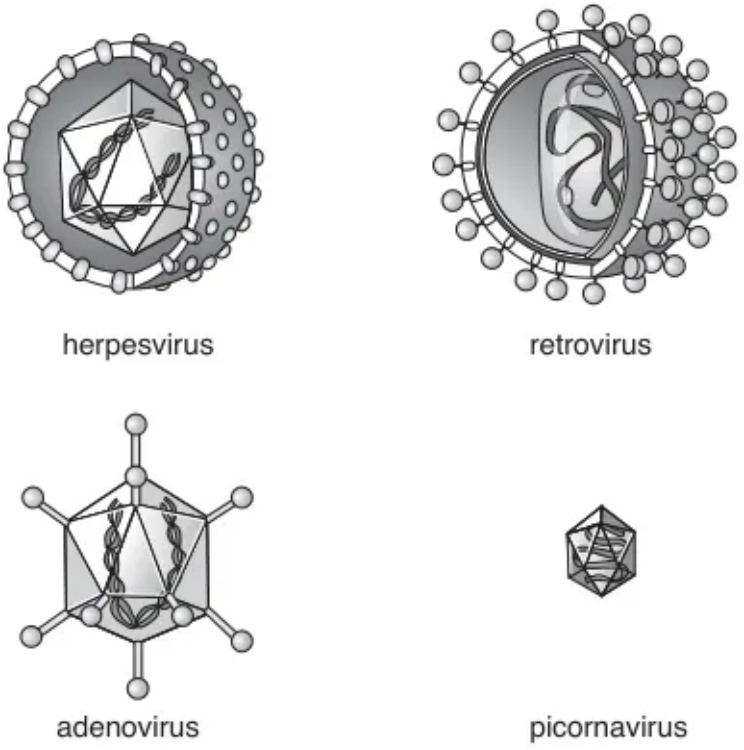


Fig. 6.1

Suggest **one** feature that could be used to classify viruses into groups.

.....

.....[1]

[Total: 8]

Pathogens, body defences and immunity Click for more variations

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7(a)(i)	genetic material ; protein coat ; parasitic / pathogenic ; only reproduce in a host / do not show (other) features of living organisms / AW ; very small ; they are not cellular / absence of named organelle; AVP ; cannot be killed / cannot be treated, with antibiotics.	**2**	**A** DNA / RNA **A** virus are non-living.
7(a)(ii)	active immunity ; harmless / dead / weakened / attenuated pathogen / microorganisms ; injected / ingested ; ref. to antigens ; (antigen) triggers antibody production ; by lymphocytes ; memory cells (are produced) ; rapid response to reinfection ; long-term immunity ; prevention of spread person to person e.g. no host for pathogen / herd ref to programmes of mass vaccination ; AVP ;	**5**	.
7(b)	shape / size / AW ; genetic material (sequence / type) ; host species / type of disease it causes ; AVP ;	**1**	

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8 Fig. 5.1 shows the bacterium *Helicobacter pylori*, which is a human pathogen.



Fig. 5.1

(a) State the genus of *Helicobacter pylori*.

.....[1]

(b) *H. pylori* is placed in the prokaryote kingdom.

State **two** structural features that *H. pylori* shares with other prokaryotes.

1 .....

2 .....

[2]

(c) **(i)** *H. pylori* can cause infections in the stomach.

Suggest how this infection could be treated.

.....[1]

(ii) State **one** natural body defence that is found in the stomach.

.....[1]

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(d) The immune system is not very effective against pathogens, such as *H. pylori*, that live inside the alimentary canal. This means that active immunity and passive immunity do not provide complete protection against *H. pylori* infections.

Explain how active immunity differs from passive immunity.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 9]

Pathogens, body defences and immunity Click for more variations

Reduced to 74% to fit the page (wider than A4).

8(a)	*Helicobacter* ;	**1**	
8(b)	circular DNA / chromosome ; plasmid(s) ; cell membrane ; cell wall (not made of cellulose) ; cytoplasm ; capsule ; (small) ribosomes ; flagella ; AVP ;	**2**	**A** naked, DNA / chromosome **I** cilia e.g. pili
8(c)(i)	antibiotic(s) ;	**1**	
8(c)(ii)	(stomach / hydrochloric / gastric) acid / HCl / mucus ;	**1**	
8(d)	*active immunity* 1 exposure to antigen ; **ora** 2 after, infection by pathogen / vaccination ; 3 immune response occurs / antibodies produced ; *passive immunity* 4 antibodies acquired from another individual ; 5 e.g. by breast milk / injection of antibodies ; 6 active is, permanent / long-term (immunity) ; **ora** 7 ref to memory cells, in active / not in passive ; 8 response is slow on first exposure in active ; **ora**	**4**	

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9 **(a)** Antibodies are proteins that are produced by lymphocytes. Antitoxins are antibodies which neutralise the toxins released by some bacteria.

The transmissible disease diphtheria is caused by a bacterium that releases a toxin that can cause serious damage to the body.

A person is suspected of having caught diphtheria.

At a clinic, the person is given an injection of antitoxin antibodies that provide protection against the diphtheria toxin. She is also given an injection of the vaccine for diphtheria.

A few weeks later she is given a second injection of the diphtheria vaccine.

Fig. 6.1 shows the changes in concentration of the antitoxin antibodies and the antibodies produced in response to the vaccine.

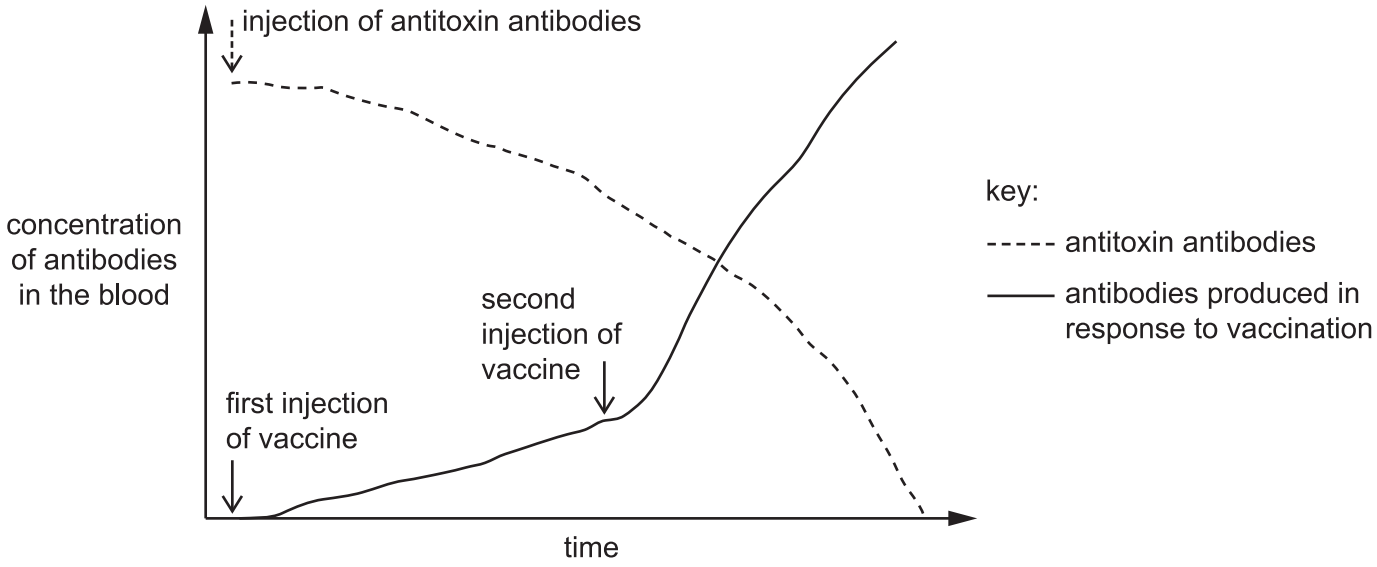


Fig. 6.1

(i) Explain the advantage of giving the person an injection of antitoxin antibodies.

.....

.....

.....

.....

..... [2]

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(ii) Explain how the two injections of the vaccine result in better protection against diphtheria than the injection of antitoxin antibodies.

.....

.....

.....

.....

.....

.....

..... [3]

(b) Explain how antibodies protect the body against pathogens.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Antibodies can travel through the body in the lymphatic system.

State **two** functions of the lymphatic system **other than** defence against disease.

1 .....

2 .....

[2]

[Total: 11]

Pathogens, body defences and immunity Click for more variations

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9(a)(i)	*any two from:* ref. to passive immunity ; *idea of* immediate / fast, protection / response / AW ; AVP ; e.g. idea that gives time for immune system to produce own, antibodies / antitoxins	**2**	
9(a)(ii)	*any three from:* ref. to active immunity ; (more) memory cells are produced ; long-term, immunity / protection ; after second injection higher concentration of antibodies than passive immunity ; reduces the chance of catching the disease (again) / AW ; response to second injection is, faster / greater, than first ; AVP ;	**3**	

9(b)	*any four from:* pathogens have antigens ; antibodies, lock on to, antigens / pathogens ; antibody is specific (to antigen / pathogen) ; antibody has a complementary (shape) to antigen / AW ; antibody marks pathogen for, destruction by phagocytes / phagocytosis ; antibodies destroy pathogens / described ; AVP ;	**4**	
9(c)	*any two from:* absorbs / transports, fat / fatty acids (and glycerol from lacteals) ; drains / AW, tissue fluid ; returns, fluid / lymph, to, blood / plasma ; AVP ;	**2**	

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10 Antibiotics are used to treat human diseases.

Many bacteria have become resistant to antibiotics. Some antibiotics can no longer be used to treat certain diseases.

Samples of bacteria were taken from a person who had an infectious disease. They were spread onto four Petri dishes of agar (agar plates). Three of these agar plates contained the antibiotics **1**, **2** or **3**.

The results are shown in Fig. 2.1.

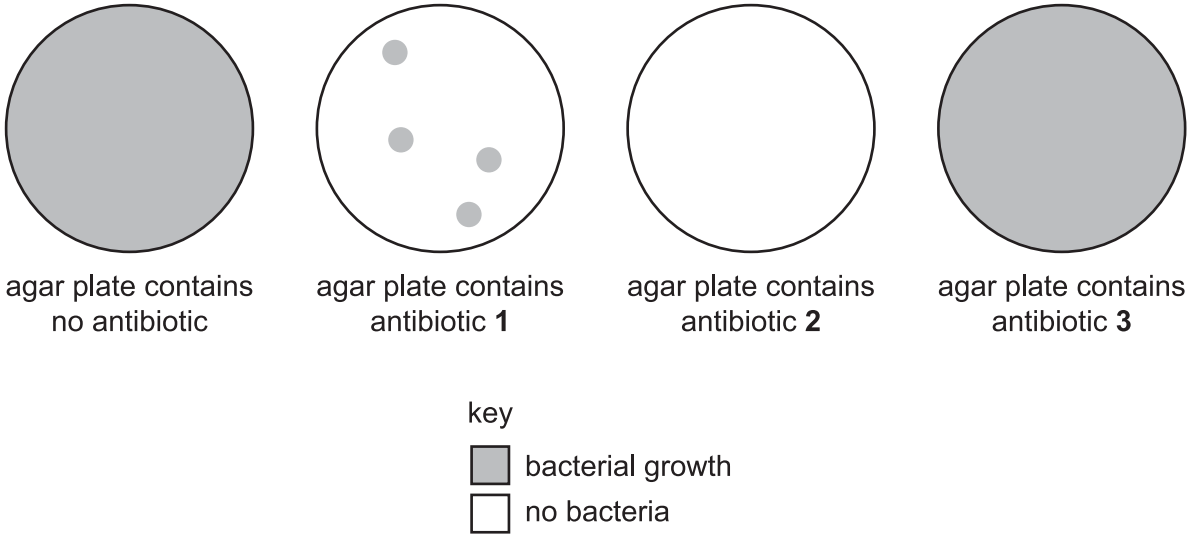


Fig. 2.1

(a) Explain why:

(i) no bacteria grew in the agar plate with antibiotic **2**;

.....

.....

..... [1]

(ii) bacteria grew in the agar plate with antibiotic **3**;

.....

.....

..... [1]

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(iii) only a small number of bacteria grew with antibiotic **1**.

.....

.....

.....

.....

..... [2]

(b) Explain why it is important to carry out a test similar to that shown in Fig. 2.1 before giving an antibiotic to a person infected with a bacterial disease.

.....

.....

.....

.....

..... [2]

(c) Antibiotic resistance has become a major problem worldwide.

Suggest how the problem of antibiotic resistance can be limited.

.....

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.....

.....

.....

.....

.....

.....

..... [4]

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(d) Hormones are used to treat a variety of conditions.

The most common hormonal treatment is the use of insulin to treat diabetes. Most of the insulin is produced using cells that are grown in large fermenters. These cells have been genetically engineered to produce human insulin.

Fig. 2.2 shows the stages involved in transferring the gene for insulin from human cells to bacterial cells.

P	gene from human cell removed from chromosome 11
Q	bacterium produces human insulin
R	plasmid vector enters bacterium
S	gene for human insulin found to be on chromosome 11
T	bacterium divides by binary fission
V	gene for human insulin inserted into a plasmid vector

Fig. 2.2

(i) Put the stages into the correct sequence. Two have been done for you.

S					**Q**

[1]

(ii) Diabetes is often treated with human insulin that has been produced by genetically modified cells. In most countries this type of insulin has replaced the insulin that was prepared from animals.

Suggest the advantages of providing human insulin to people with diabetes rather than insulin obtained from animals.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 14]

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Drugs and antibiotics Click for more variations

10 Reduced to 73% to fit the page (wider than A4).			
(a) (i)	all bacteria are, susceptible / sensitive to this antibiotic / not resistant ; (antibiotics) killed the bacteria / stopped bacteria growing / AW ;	[max 1]	**R** immune (as equivalent to resistance)
(ii)	(all) bacteria are, resistant / not affected (by the antibiotic) / ORA ;	[1]	**R** immune (as equivalent to resistance) **ecf** from 2(a)(i)
(iii) **1** **2** **3**	only a few bacteria from the sample are resistant / ORA ; caused, by mutations / genes ; resistant bacteria, grew / reproduced ;	[max 2]	**R** immune (as equivalent to resistance) **ecf** from 2 (a)(i) and 2 (a)(ii) **A** susceptible bacteria did not grow
(b) **1** **2** **3** **4**	person may be infected with bacteria, that are resistant to, some / an, antibiotic(s) ; (test) to find the most effective antibiotic ; that kills all bacteria (in the person) ; prevents antibiotic resistance ;	[max 2]	**R** immune (as equivalent to resistance) No **ecf** from 2 (a)
(c) **1** **2** **3** **4** **5** **6** **7**	prescribe / use, antibiotics less often ; not for, viral / fungal, infections ; make sure people complete the course of antibiotics / AW ; develop new antibiotics ; do not use the same antibiotics for too long / rotate antibiotics / AW ; use combinations of antibiotics ; AVP ; e.g. isolation of patients with antibiotic-resistant infections / good hygiene to prevent spread of infection	[max 4]	

(d) (i)	**S** | **P** | **V** | **R** | **T** | **Q**	[1]	
(ii) **1** **2** **3** **4** **5** **6** **7**	easier / quicker, to supply the demand ; more cost effective ; no / less, rejection / allergies / side effects ; human insulin more effective (than animal insulin) ; because can be individually modified ; no risk of transmission of disease from animals ; ethical / religious / animal welfare consideration ;	[max 3]	
		[Total:14]	

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