10. Diseases and immunity

10.1 Diseases and immunity

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates unless indicated in the question

1 Fig. 4.1 is a photograph of part of a kitchen.

Fig. 4.1

(a) Describe methods of maintaining hygiene in the home that reduce the spread of disease.

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..... [4]

(b) State **two** ways that pathogens can be transmitted indirectly.

1 .....

2 .....

[2]

(c) State **three** body defences against infection.

1 .....

2 .....

3 .....

[3]

[Total: 9]

2 **(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.

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..... [2]

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

1 .....

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2 .....

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[2]

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

1 .....

2 .....

3 .....

[3]

(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]

3 **(b)** Describe why it is important for humans that sewage is treated before entering rivers.

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..... [1]

4 Pathogens in food can cause diarrhoea.

(a) Describe diarrhoea and state how diarrhoea can be treated.

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..... [2]

(b) Describe ways of preventing the spread of diseases that are caused by pathogens in food.

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..... [4]

[Total: 6]

5 Measles is an example of a transmissible disease that is caused by a virus.

(a) Complete the definition of transmissible disease.

A transmissible disease is a disease in which the ..... can be passed from one ..... to another.

[2]

(b) Fig. 7.1 is a pie chart showing the number of people infected with four different transmissible diseases in one country in 2018.

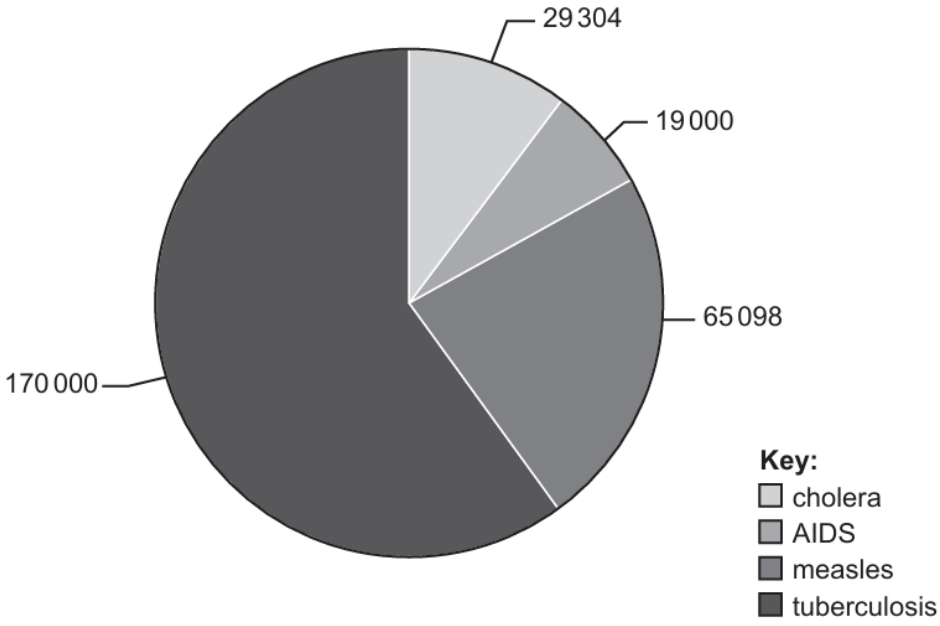

Fig. 7.1

(i) State the name of the disease with the smallest number of infections in Fig. 7.1.

..... [1]

(ii) Use the information in Fig. 7.1 to calculate the total number of people infected with these four diseases.

..... people infected
[1]

(iii) State the type of organism that causes cholera. **(extended only)**

..... [1]

(c) **(i)** The list shows some examples of ways that disease-causing organisms can be transmitted.

air **animals** **blood**

contaminated surfaces **food**

Complete Table 7.1 to show which are examples of direct contact and which are examples of indirect contact.

Each example can be used once, more than once or not at all.

Table 7.1

direct contact	indirect contact

[2]

(ii) Table 7.2 shows **three** ways the body can defend itself and some examples of the three methods.

Place ticks (✓) in the boxes to show the correct type of defence mechanism for each example.

Table 7.2

example of defence mechanism	cells	chemical	mechanical
antibody production			
hairs in the nose			
mucus			
phagocytosis			
skin			
stomach acid			

[3]

[Total: 10]

6 **(b)** The sentences describe how pathogens can be transmitted.

Complete the sentences using words from the list.

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

AIDS	**blood**	**disease**
food	**HIV**	**inherited**

Pathogens for a transmissible ..... may be transmitted through direct contact, for example through ..... or other body fluids. They can also be transmitted indirectly through contaminated surfaces, ..., animals, or from the air.

[3]

(c) The human body has several defences against pathogens.

These can be mechanical barriers, chemical barriers or responses by cells.

The boxes on the left are examples of body defences.

The boxes on the right are the different types of defence.

Draw **one** line to link each example to the correct type of defence.

Draw **four** lines.

example	**type of defence**
antibody production	chemical
hairs in the nose	mechanical
phagocytosis	response by cells
stomach acid	

[4]

7 **(b)** Cholera is a transmissible disease.

(i) State the type of pathogen that causes cholera. **(extended only)**

..... [1]

(ii) One of the symptoms of cholera is diarrhoea.

Describe what is meant by the term *diarrhoea*. **(extended only)**

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..... [1]

(iii) Outline the treatment for diarrhoea. **(extended only)**

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..... [2]

(c) State **two** ways in which the body can defend itself against pathogens.

1 .....

2 .....

[2]

8 **(a)** Cholera is an example of a transmissible disease.

Define the term *transmissible disease*.

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..... [2]

(b) Cholera is transmitted in contaminated water.

State **two** ways water can be treated to prevent the spread of cholera. **(extended only)**

1 .....

2 .....

[2]

(c) Table 2.1 shows the number of reported cases of cholera in the world during 2014 and 2015.

Table 2.1

year	2014	2015
number of cases	191 000	172 000

(i) Calculate the percentage decrease in the number of cases of cholera between 2014 and 2015.

Show your working and give your answer to the nearest whole number. **(extended only)**

.....%

[2]

(ii) State the name of the type of organism that causes cholera. **(extended only)**

..... [1]

(d) Cholera causes diarrhoea.

(i) Describe what is meant by the term *diarrhoea*. **(extended only)**

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..... [1]

(ii) Outline the treatment for the symptoms of cholera. **(extended only)**

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..... [2]

9 **(a)** Eating food contaminated by bacteria can cause illness.

This type of illness is called food poisoning.

Fig. 3.1 shows the number of cases of food poisoning per 100 000 people in the population in one country.

(i) State the year with the highest number of cases of food poisoning in Fig. 3.1.

.....[1]

(ii) State the number of cases of food poisoning per 100 000 people in the population in the year 1996 in Fig. 3.1.

..... cases per 100 000 people [1]

(iii) Describe the trend in the number of cases of food poisoning between 2003 and 2011 in Fig. 3.1.

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.....[3]

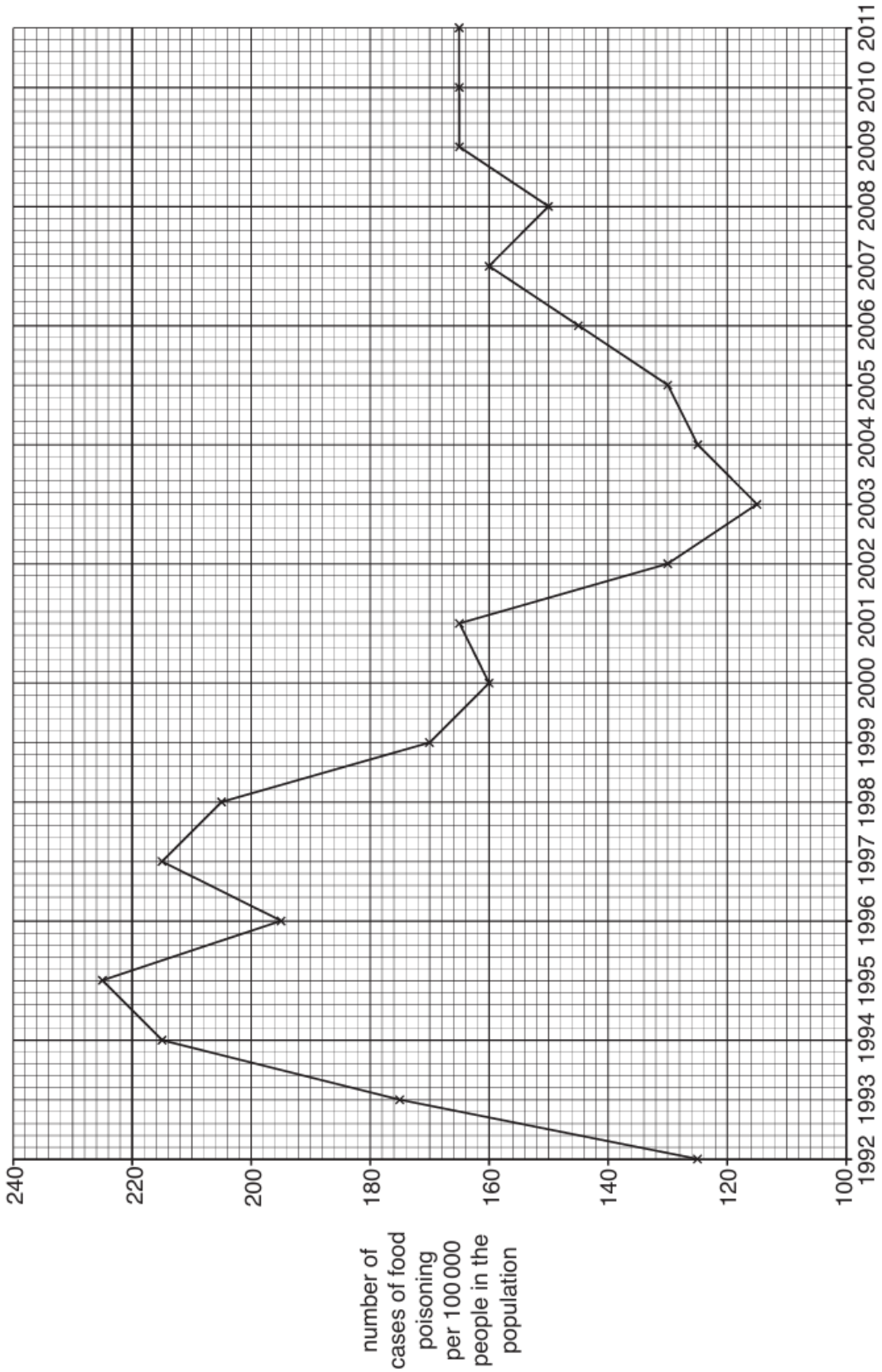
number of cases of food poisoning per 100 000 people in the population
240
220
200
180
160
140
120
100
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
year

Fig. 3.1

(b) Food poisoning is caused by different types of bacteria.

A common type of bacterium that causes food poisoning is *Campylobacter jejuni*.

State the genus of this species. **(extended only)**

.....[1]

(c) Food poisoning can result in vomiting and diarrhoea.

Outline the treatment of diarrhoea. **(extended only)**

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.....[1]

(d) The body has several defence mechanisms against bacteria.

Table 3.1 shows three types of defence mechanism.

The word list gives examples of these defence mechanisms.

In Table 3.1 write the examples under the correct type of defence.

Use each word once only.

antibodies **mucus** **nasal hairs**

phagocytosis **skin** **stomach acid**

Table 3.1

cellular	chemical	mechanical

[3]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

10 **(a)** Polio is a viral disease that can cause nerve damage in humans.

In one area, polio vaccination began in 1957.

Fig. 6.1 shows the number of cases of polio in this area between 1950 and 1970.

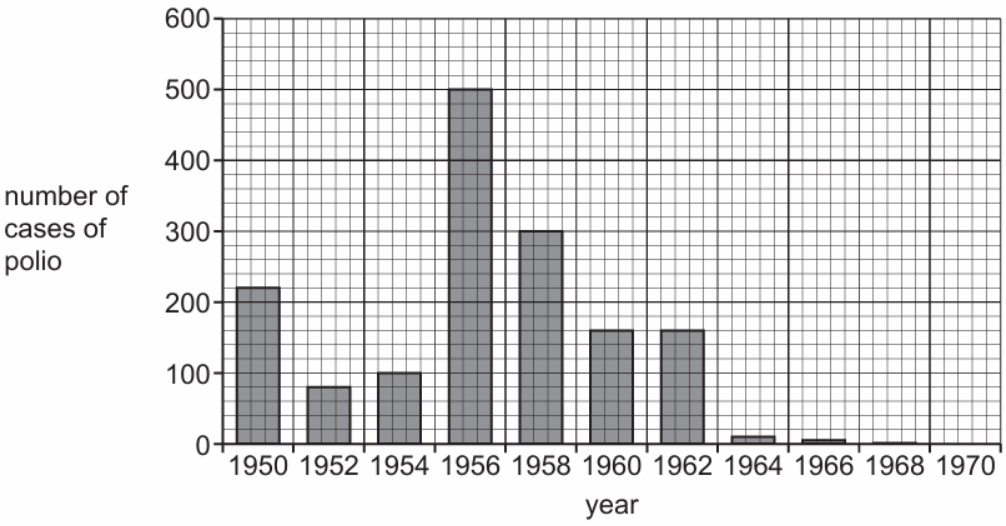

Fig. 6.1

(i) Calculate the percentage change in the number of cases of polio between 1950 and 1952 in Fig. 6.1.

Give your answer to **two** significant figures.

Space for working.

(ii) Explain how vaccination causes the results shown between 1958 and 1970 in Fig. 6.1. **(extended only)**

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..... [5]

(iii) Explain why the polio vaccine does **not** protect you from other diseases. **(extended only)**

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..... [2]

(b) Blood clotting helps to prevent some infections.

Outline how a blood clot is formed **and** how it can prevent infections. **(extended only)**

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..... [3]

(c) State the name of the component of blood responsible for transporting blood cells.

..... [1]

11 **(b)** Describe how a person becomes infected with cholera. **(extended only)**

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..... [1]

(c) People with cholera can become very dehydrated.

Explain how cholera causes dehydration. **(extended only)**

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..... [4]

(d) Vaccination can help to prevent the spread of diseases such as cholera.

Outline the process of vaccination and explain how it can prevent the spread of diseases. **(extended only)**

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..... [6]

12 **(b)** During pregnancy, antibodies are acquired by the fetus from the mother.

State the organ the antibodies cross to reach the fetus. **(extended only)**

..... [1]

(c) A baby was breastfed for six months. The concentration of antibodies in the baby's blood obtained from breast milk and the concentration of antibodies made by the baby itself were measured. **(extended only)**

Fig. 6.1 shows the results.

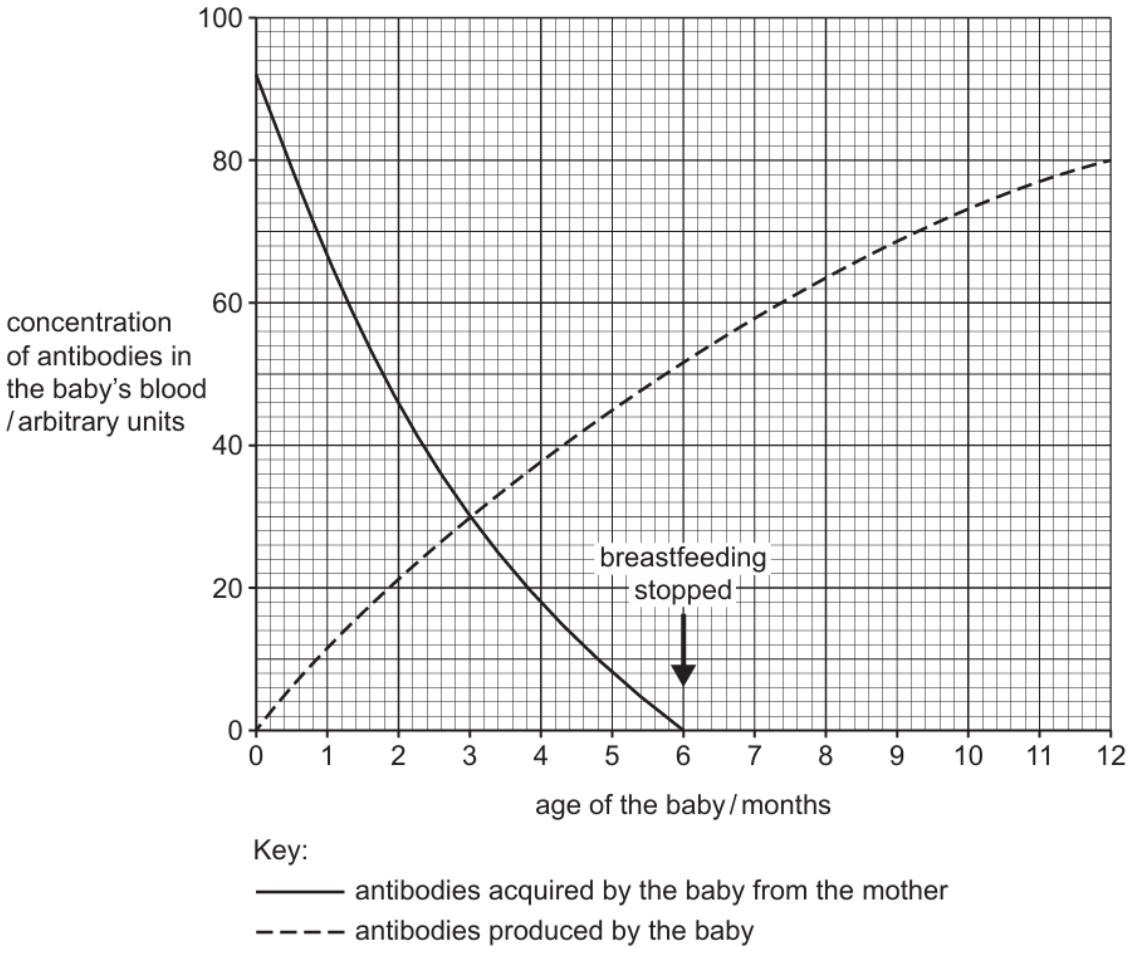

Fig. 6.1

(i) Complete the sentences to describe the changes in antibody concentration in the baby. **(extended only)**

After birth the concentration of antibodies acquired from the mother decreases rapidly to 0 arbitrary units at ..... months.

Antibodies start being produced by cells called ..... in the baby immediately after birth.

The total concentration of antibodies in the baby from both sources is ..... arbitrary units at 4 months.

The concentration of antibodies acquired from the mother and the concentration of antibodies produced by the baby are the same at ..... months.

[4]

(ii) Describe the benefits of breastfeeding a baby for the first six months of life. **(extended only)**

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..... [2]

(iii) State **two** ways, other than breastfeeding, that a baby can acquire immunity. **(extended only)**

1 .....

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2 .....

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[2]

(d) Explain the importance of the shape of an antibody. **(extended only)**

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..... [3]

13 **(b)** The human immunodeficiency virus (HIV) infects and destroys lymphocytes.

The number of lymphocytes in the blood of a person infected with HIV was measured over a period of 84 months.

The results are shown in Fig. 4.2.

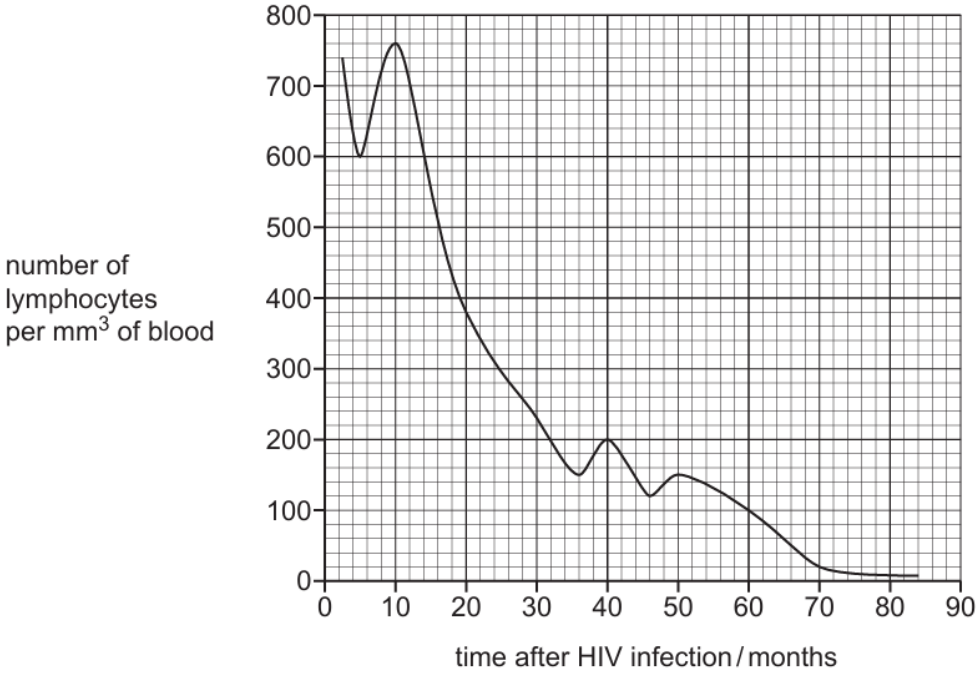

Fig. 4.2

(i) Use the information shown in Fig. 4.2 to calculate the percentage change in the number of lymphocytes from month 10 to month 60.

Give your answer to **two** significant figures.

Space for working.

.....%
[3]

(ii) Describe the changes in the number of lymphocytes, over the 84 months following infection with HIV, shown in Fig. 4.2. **(extended only)**

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..... [2]

(iii) Outline the consequences of the changes in the number of lymphocytes for the health of the person infected with HIV. **(extended only)**

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..... [4]

14 **(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. **(extended only)**

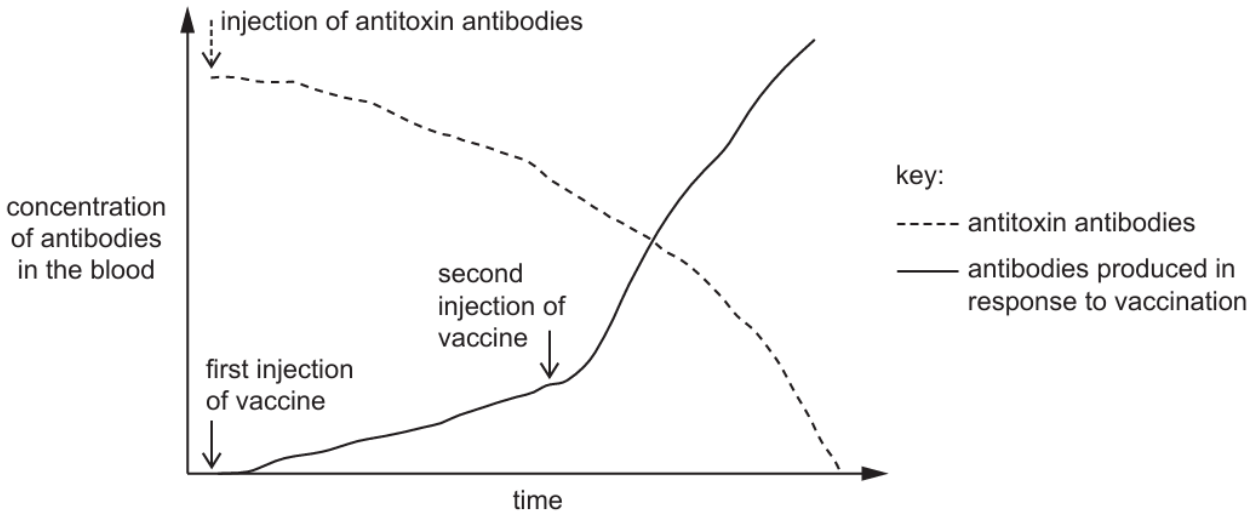

Fig. 6.1

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

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..... [2]

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

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..... [3]

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

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..... [4]

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

State **two** functions of the lymphatic system **other than** defence against disease. **(extended only)**

1 .....

2 .....

[2]

15 **(d)** Eyelashes and eyelids are mechanical barriers that help to prevent particles and pathogens entering the eye.

(i) Give **two** other mechanical barriers that defend the body against pathogens.

1 .....

2 .....

[2]

(ii) State the name of the white blood cells that digest pathogens. **(extended only)**

..... [1]

(iii) Conjunctivitis can be caused by pathogens and affects the tissues lining the eyelids and covering the sclera. People with conjunctivitis that is caused by a pathogen can develop active immunity.

Explain why the shape of specific parts of a pathogen is important in the development of active immunity. **(extended only)**

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..... [3]

16 Cholera is a transmissible disease.

(a) State the name of the type of pathogen that causes cholera. **(extended only)**

..... [1]

(b) A study was designed to test the effectiveness of a cholera vaccine in an area where outbreaks of cholera occur frequently.

The doctors gave some people in this area the new vaccine. **(extended only)**

(i) Suggest what the cholera vaccine must contain to be effective.

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..... [1]

(ii) Explain why the people were not protected from cholera immediately after receiving the vaccine.

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..... [3]

(iii) The doctors ensured that the people who received the new vaccine had **not** had cholera before.

Suggest why.

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..... [1]

(iv) There was an outbreak of cholera in the area two months after the new vaccine was given.

The people who had symptoms of cholera were monitored in hospital for two days.

Some of the infected people had received the new vaccine and others had **not** received the vaccine.

The results are shown in Fig. 4.1.

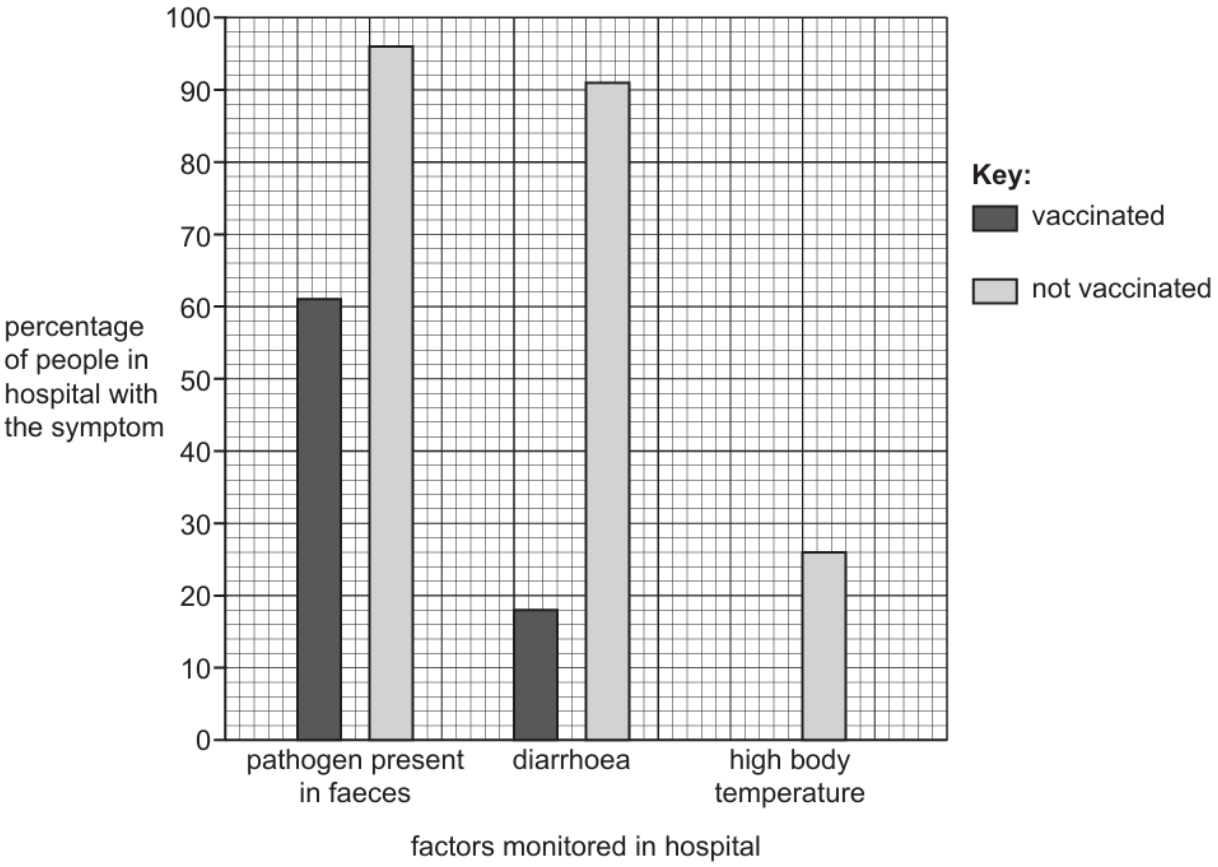

Fig. 4.1

Using the information in Fig. 4.1, discuss how effective the vaccine was at preventing the symptoms of cholera.

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..... [2]

(c) (i) Explain how cholera causes diarrhoea. **(extended only)**

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..... [4]

(ii) Describe how diarrhoea is treated. **(extended only)**

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..... [2]

17 **(c)** The cholera bacterium can survive in the small intestine and the large intestine. The bacterium releases a toxin that interacts with receptors on the surface of cells. **(extended only)**

Fig. 3.3 shows the effect of the toxin. The arrows indicate the direction of movement.

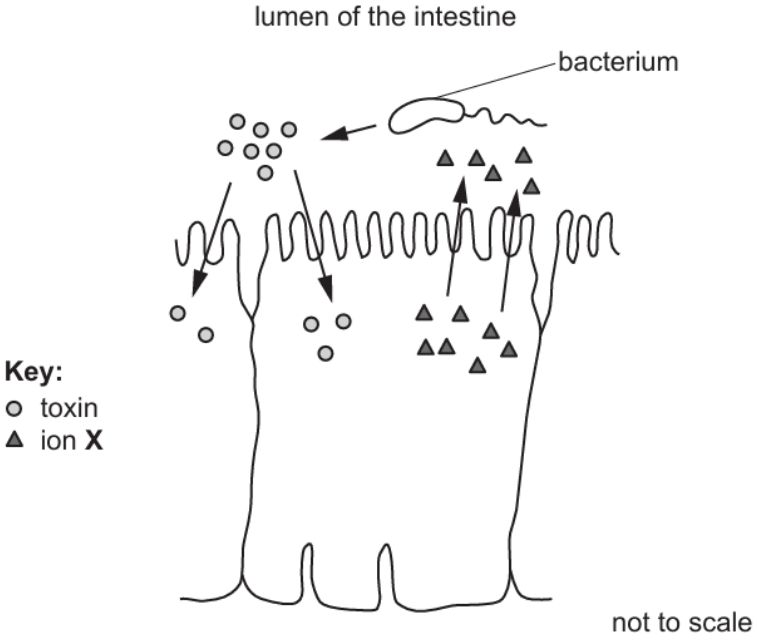

Fig. 3.3

(i) State the name of ion **X**.

..... [1]

(ii) Describe the effects on the body of the secretion of ion **X** into the lumen of the intestine.

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..... [4]

18 **(g)** Drug **X** can be injected into the body. This is one way that HIV can be transmitted.

Describe **two** other ways that HIV can be transmitted.

1 .....

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2 .....

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[2]

19 Pathogens cause disease.

(a) Fig. 2.1 shows some cells that are part of the human immune system. These cells are responding to one type of pathogen.

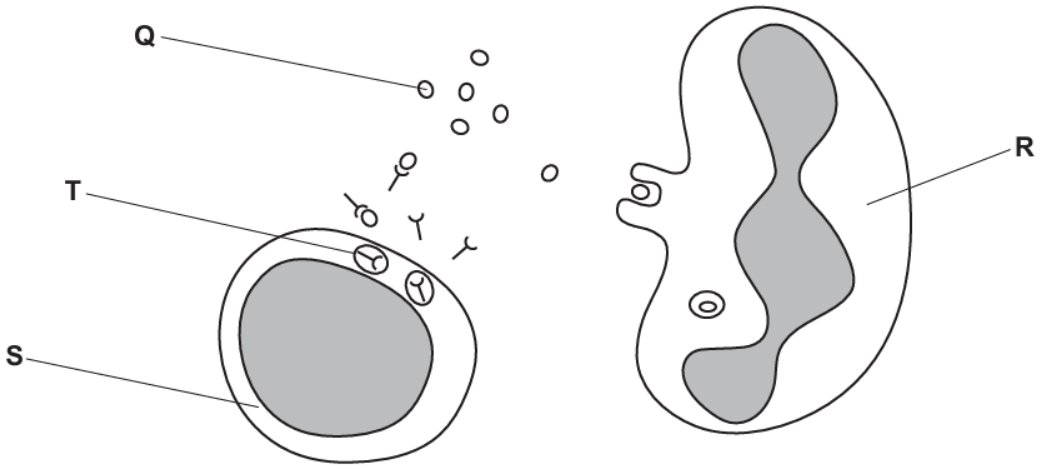

Fig. 2.1

Explain how the immune system responds to an invasion of pathogens.

Use the letters in Fig. 2.1 in your answer. **(extended only)**

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(b) A vaccine was introduced in 1942 for a particular disease.

Fig. 2.2 shows the effect of introducing the vaccine on the number of cases of the disease in one country.

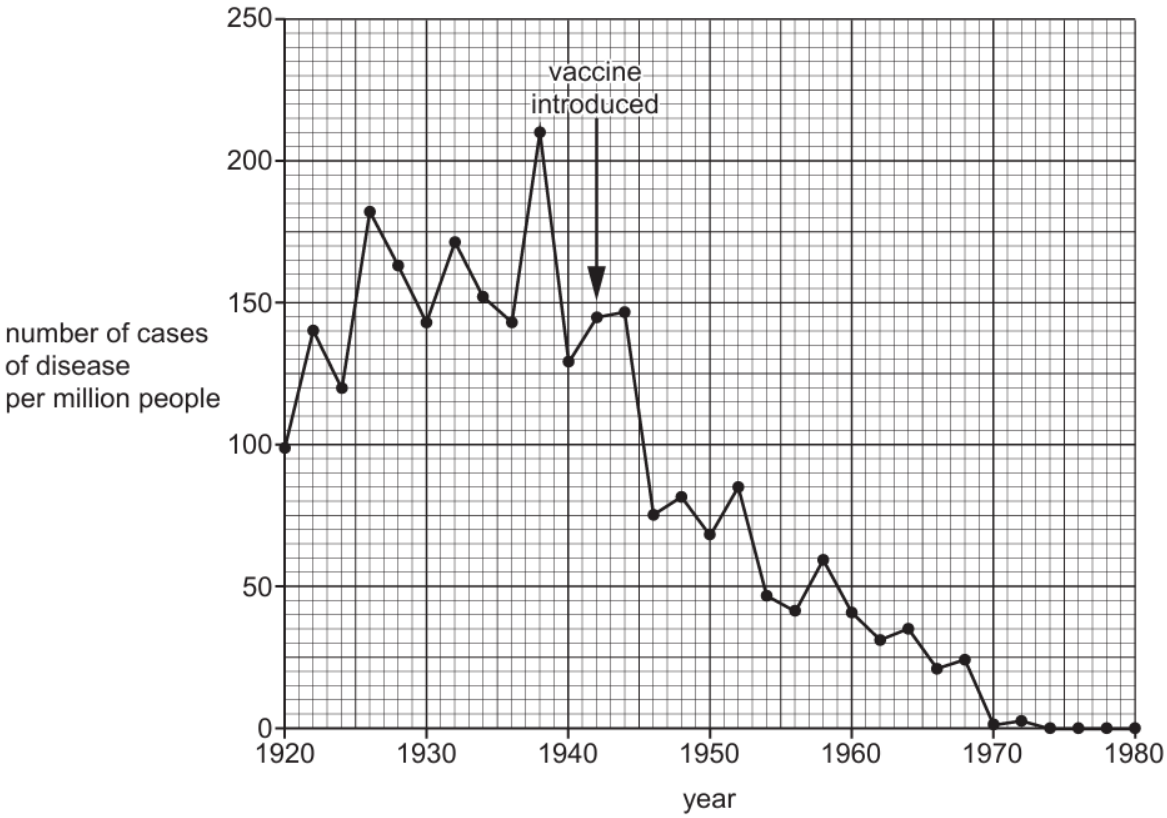

Fig. 2.2

In 1946 the government of the country concluded that the vaccine was successful.

Discuss the evidence, shown in Fig. 2.2, for **and** against this conclusion. **(extended only)**

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..... [4]

20 **(d)** Milk is produced by mammals.

(i) Explain the advantages to newborn mammals of breast milk. **(extended only)**

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..... [4]

(ii) Explain why breast-feeding mothers are advised to drink plenty of water and avoid excessive alcohol consumption. **(extended only)**

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..... [2]

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

Outline the body's defence mechanisms. **(extended only)**

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..... [5]

22 **(b)** Tuberculosis (TB) is a transmissible disease caused by a bacterial pathogen. The spread of this disease can be controlled by vaccination.

Explain how vaccination provides a defence against transmissible diseases. **(extended only)**

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..... [4]

23 Young mammals that are orphaned can be bottle-fed.

Fig. 6.1 shows a newborn tiger cub sucking on a bottle. **(extended only)**

Fig. 6.1

(a) (i) Sucking is an example of an involuntary action observed in newborn mammals.

State the name given to involuntary actions. **(extended only)**

.....[1]

(ii) Describe the advantages of breast-feeding compared with bottle-feeding. **(extended only)**

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.....[4]