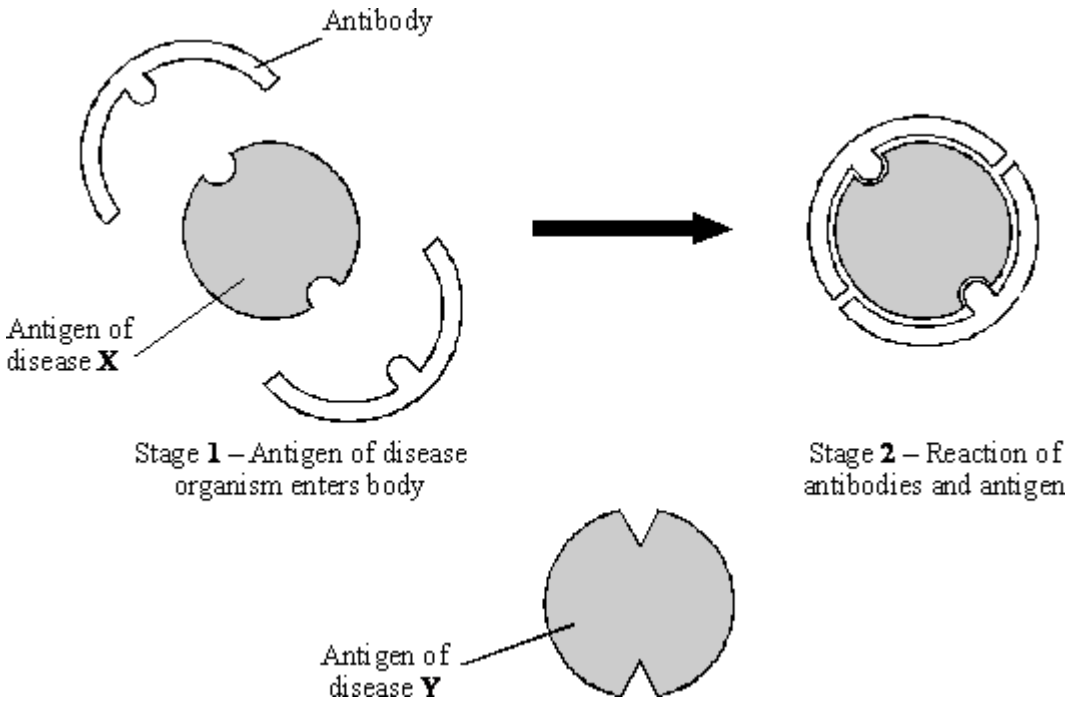
**1** (a) Antibodies help to defend the body against disease. The diagram represents the reaction of antibody and antigen for disease **X.**




Using the diagram to help you, suggest why the body's defence against disease **X** would not be effective against disease **Y**.

_____

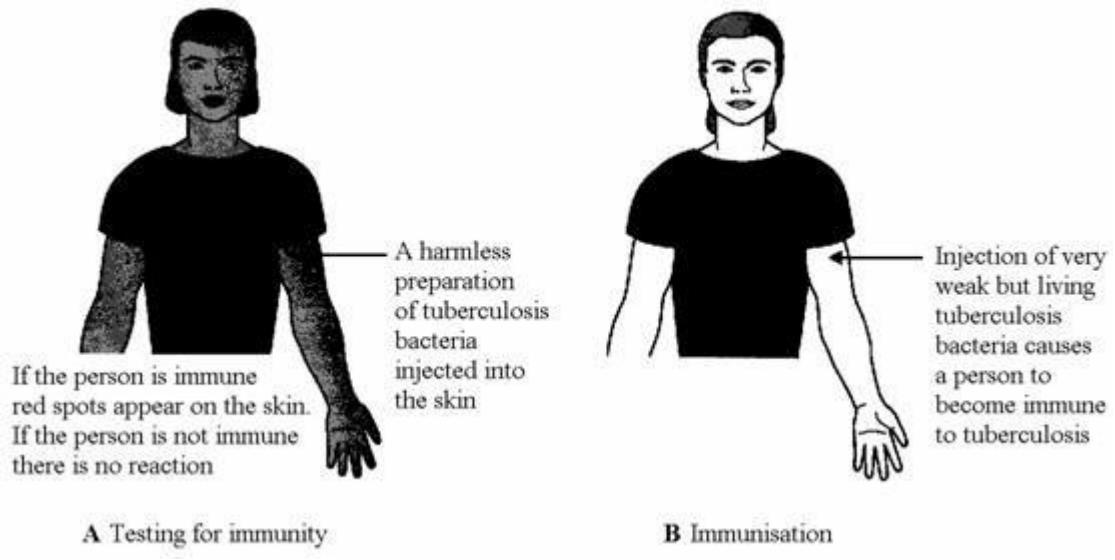
_____

_____

**(2)**

(b) Tuberculosis is a disease which is caused by a bacterium. The body is able to produce antibodies to destroy the bacteria which cause the disease. Some people are naturally immune. A person can be tested to find if they are immune.

Use information in the diagrams to help you answer the questions.




**A** Testing for immunity **B** Immunisation

(i) Suggest the possible cause of the reaction when a person who is already immune is tested, as shown in diagram **A**.

_____

_____

_____

**(2)**

(ii) Explain why the injection of tuberculosis bacteria (diagram **B**) causes immunity but does not cause the disease.

_____

_____

_____

_____

_____

**(3)**

**(Total 7 marks)**

**2** (a) Explain, as fully as you can, how the body's white blood cells respond to infections.

_____

_____

_____

_____

_____

**(4)**

(b) Describe, in as much detail you can, how **one** method of immunisation protects us from a named disease.

Name of disease _____

How immunisation protects us from this disease.

_____

_____

_____

_____

_____

_____

**(3)**

**(Total 7 marks)**

**3** The influenza virus damages the cells lining the respiratory tract causing sore throats.

Coughing and sneezing spread the virus.

(a) Give the correct term for this method of spreading an infection.

_____

**(1)**

(b) In an immunisation programme such as that for MMR (Measles, Mumps and Rubella), suggest why it is essential for a large proportion of the child population to be vaccinated in order to protect the few individuals who are unable to be vaccinated.

_____

_____

**(1)**

(c) In some modern influenza vaccines the protein surface sub-units are separated from the virus coat and used for the vaccine. This stimulates an effective immune response in the same way as inactive pathogens.

(i) Explain how this immunity is produced in the body following vaccination, and how further illness from the same virus is prevented.

_____

_____

_____

_____

_____

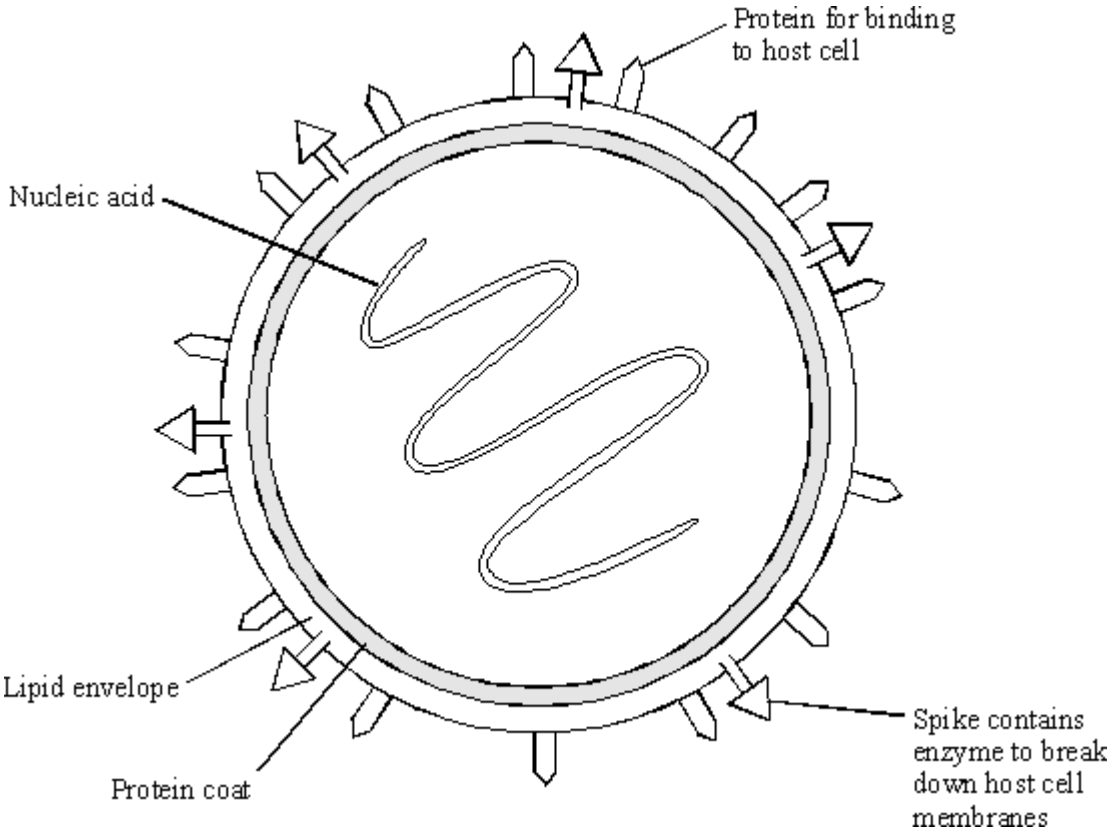
**(4)**

(ii) This type of immunity resulting from an influenza injection is described

as_____immunity.

**(1)**

(d) The diagram shows the structure of an influenza virus.



Influenza epidemics can arise because the nucleic acid of the virus frequently changes. This results in changes in the virus structure and so a new strain of the virus is formed. A person who has had influenza or who has been vaccinated may not be immune to the new strain.

Explain why this is so, using the diagram of the influenza virus structure and your knowledge of immunity.

_____

_____

_____

_____

_____

_____

**(3)**

**(Total 10 marks)**

**4** Read the following passage.

'The immune system is the body's defence force. It protects against infections which might enter the body. The potential invaders include bacteria and viruses. The two basic defences are cells and chemicals. The best known action of defence cells is the ingesting and killing of microbes. The best known chemical defence is the antibody - a protein specially made to match with the surface of an invading microbe. Once covered with antibody, the microbe becomes easier to destroy.

So how do the invaders ever win? Part of the answer is that the chemical defenders take some time to become effective. When the body is infected for the first time by a particular microbe, there is a race between the multiplying microbes and the multiplying cells producing the antibody. Given time, the body usually wins; eventually enough antibodies are formed to overcome the invaders. But if the initial invasion force is large, or the immune system is weak, the battle may be lost.'

(a) (i) Which type of cells ingest and kill invading microbes? (lines 3 - 4)

_____

**(1)**

(ii) Give **two** circumstances in which the initial invasion force might be very large (lines 11 - 12).

1. _____

_____

2. _____

_____

**(2)**

(iii) After being ingested, the microbes are digested in the cells. Briefly explain what happens to the proteins that the microbes contain.

_____

_____

_____

_____

**(2)**

(b) Explain how bacteria cause disease once they get into the body.

_____

_____

_____

_____

**(2)**

(c) Name a type of medicine that kills bacteria inside the body.

_____

**(1)**

(d) People often risk first-time infection by a particular microbe while visiting other countries. People can be immunised against the disease that the microbe causes.

Explain, as fully as you can, how immunisation works.

_____

_____

_____

_____

_____

_____

**(3)**

**(Total 11 marks)**

**5** Read the following passage.

> One of the deadliest diseases in history to be making a comeback in Britain. Doctors are alarmed at the rising number of cases of tuberculosis (TB) over the past three years, after decades in which it had declined.
> In the middle of the last century TB accounted for 16% of all deaths in Britain. The turning point in the fight against TB came in 1882 when Robert Koch identified the bacterium that causes the disease. In 1906 two French scientists began developing the vaccine to provide immunity against TB. The vaccine, BCG, (so-called from the initials of the two scientists) has routinely been injected into children aged 12 or 13 who are not already infected with the TB bacterium. BCG does not protect people who are already infected with TB. Recently, however, some Health Authorities have dropped their school vaccination programme.

(a) People infected with a small number of TB bacteria often do **not** develop the disease.

Explain, as fully as you can, how the body defends itself against the TB bacteria.

_____

_____

_____

_____

_____

**(3)**

(b) The BCG vaccine contains a mild form of the TB bacterium. A person injected with it does **not** develop the disease.

Explain, as fully as you can, how the vaccine makes the person immune to tuberculosis.

_____

_____

_____

_____

_____

**(3)**

(c) Explain why the BCG vaccine is **not** effective as a cure for people who already have tuberculosis.

_____

_____

_____

_____

_____

**(2)**

**(Total 8 marks)**

**1** (a) shape of antibody is not complementary;

*accept shapes of antibody and antigen do not match or antibody does not correspond to antigen **Y or** is not the same shape as antigen **Y or** antibody different shape*

**1**

so unable to attach or join to antigen **Y**

*accept they do not fit*

**1**

(b) (i) <u>antibodies</u> in blood or in skin or in body;

*accept already have the antibodies*

**1**

<u>react</u> with (injected) antigens or bacteria;

*accept skin affected by antigen-antibody complex **or** blood vessels <u>in skin</u> enlarge **or** dilate*

*do **not** accept attack instead of react*

**1**

(ii) any **three** from

bacteria weak so do not cause disease

*accept not harmful*

*do **not** accept bacteria are dead*

cause antibody production;

memory cells remain;

*accept a suitable description*

so body can quickly produce more antibodies in a real infection;

*accept antibodies remain in blood **or** in body*

**3**

**[7]**

**2** (a) engulf bacteria
produce antibodies
produce antitoxins
effect of antibodies/antitoxins

*for 1 mark each*

**4**

(b) method must be related to disease
dead/weakened microbes (as appropriate)
stimulate antibody production
antibody production rapid if microbe enters again

*for 1 mark each*

**3**

**[7]**

**3** (a) droplet infection **or** aerosol infection

*do **not** accept airborne*
*accept airborne droplets*

**1**

(b) so there is no large group which could catch the infection/pass on the infection

*converse – if large numbers can't pass it on the virus is less likely to reach those few who are susceptible*

**1**

(c) (i) any **four** of the following points:-

*example of a 3 mark answer: Lymphocytes produce specific antibodies……*

comment on specificity applied to antibodies or lymphocytes

(recognition by) lymphocytes;

(white cells) make antibodies;

antibodies destroy/neutralise the virus/antigen/protein subunit;

*do **not** accept antibodies KILL viruses*

*accept white blood cells replicate*

*accept some white cells form memory cells/live a long time;*

*accept subsequent infection results in very rapid antibody production;*

**max 4**

(ii) active;

**1**

(d) any **three** of the following points

*Structure change in:*
protein for binding to host cell;

*accept changes in surface proteins (of protein coat)*

spike containing enzyme;

*changes in antigen*

*Fit:* existing/circulating/old antibodies don't match new virus strain shape/new antigen/new binding protein;

*Wrong antibodies:* injection does not stimulate antibodies against all strains/different antigens;

*accept wrong antibodies for 1 mark*

**max 3**

**[10]**

**4** (a) (i) white blood cells

*for 1 mark*

**1**

(ii) e.g. contact with infected person unhygienic conditions

*for 1 mark each*

**2**

(iii) broken down, by enzymes into amino acids

*any 2 for 1 mark each*

**2**

(b) reproduce rapidly produce toxins

*for 1 mark each*

**2**

(c) antibiotic or named

*for 1 mark*

**1**

(d) mild or deal microbes introduced white cells produce antibodies which can destroy disease microbes
idea of memory cells
idea that injecting antibodies give immediate production

*any 3 for 1 mark each*

**3**

**[11]**

**5** (a) white cells ingest bacteria
produce antibodies which destroy bacteria
produce antitoxins which counteract poisons produced by bacteria

*for 1 mark each*

**3**

(b) dead/mild microbes
stimulate antibody production
white cells can quickly produce these again

*for 1 mark each*

**3**

(c) adds more bacteria (mild)
does not affect TB bacteria

*for 1 mark each*

**2**

**[8]**