Q1. 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
5   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
10 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)

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(1)

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

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(2)

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

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(2)

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

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(2)

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

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(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.

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(3)
(Total 11 marks)

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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.

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(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.

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(3)

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

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(2)
(Total 8 marks)

Q3. (a) Explain, as fully as you can, how the body's white blood cells respond to infections.

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(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.

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(3)
(Total 7 marks)

Q4.   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.

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(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.

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(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.

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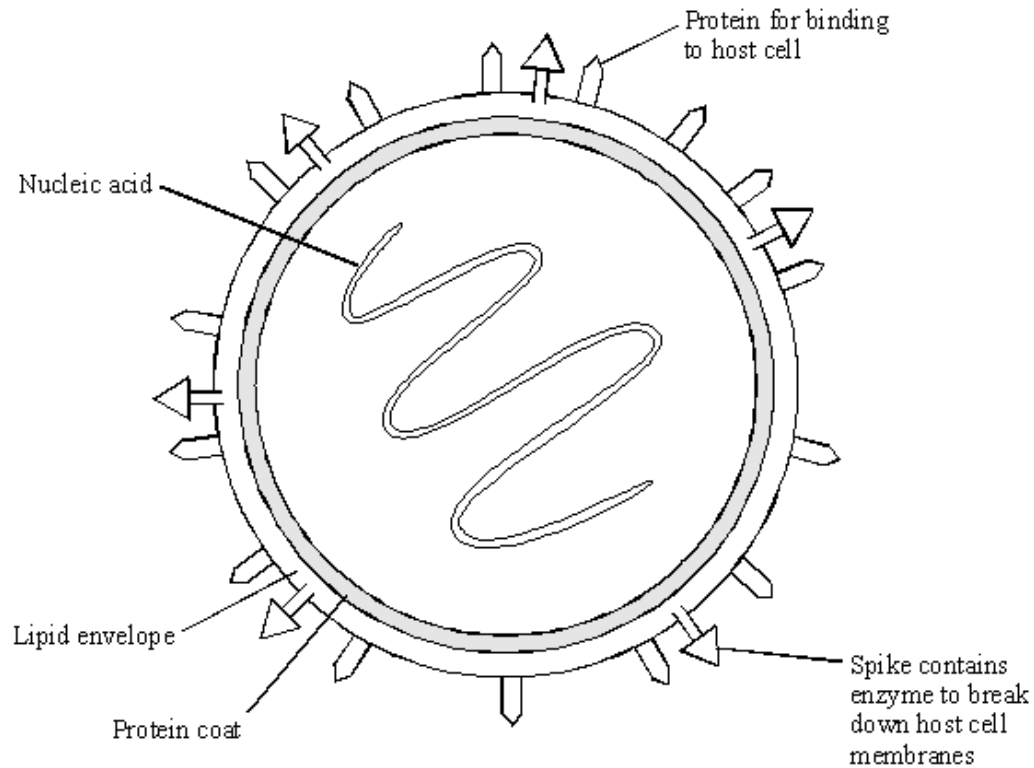
Influenza epidemics can arise because the nucleic acid of the virus frequently changes. This results in changes in the virus structure and so a new strain of the virus is formed. A person who has had influenza or who has been vaccinated may not be immune to the new strain.

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

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(3)
(Total 10 marks)

Q5.   Penicillin is an antibiotic which stops bacteria from reproducing. It was used a lot in the past to treat bacterial infections in humans and other animals. In many hospitals there are now strains of penicillin resistant bacteria.

Explain how natural selection could have produced these strains of penicillin resistant bacteria.
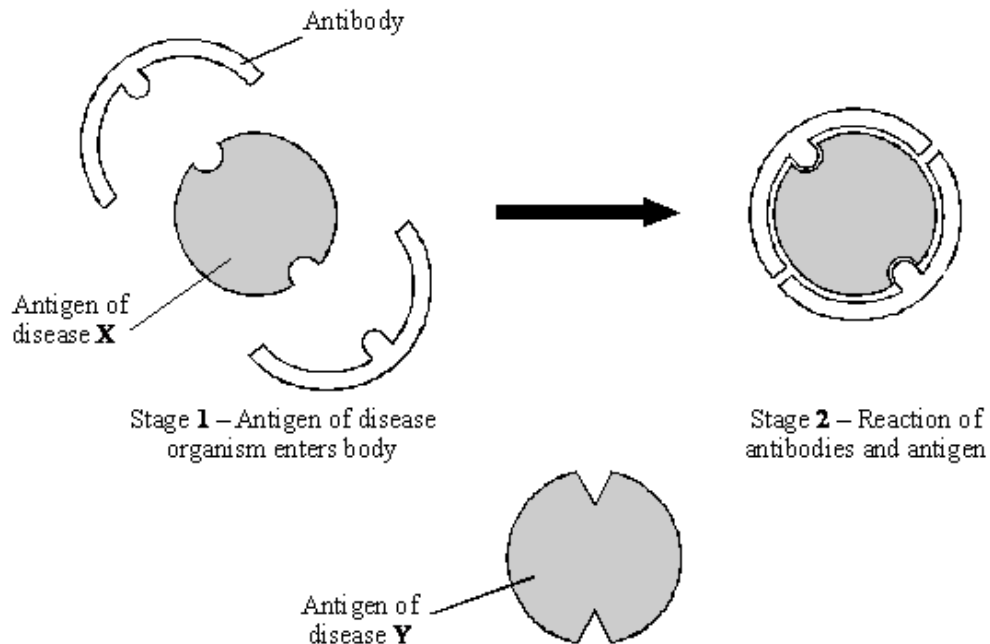
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(Total 5 marks)

Q6.   (a)   Antibodies help to defend the body against disease. The diagram represents the reaction of antibody and antigen for disease **X.**

Stage **1** – Antigen of disease organism enters body

Stage **2** – Reaction of antibodies and antigen

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

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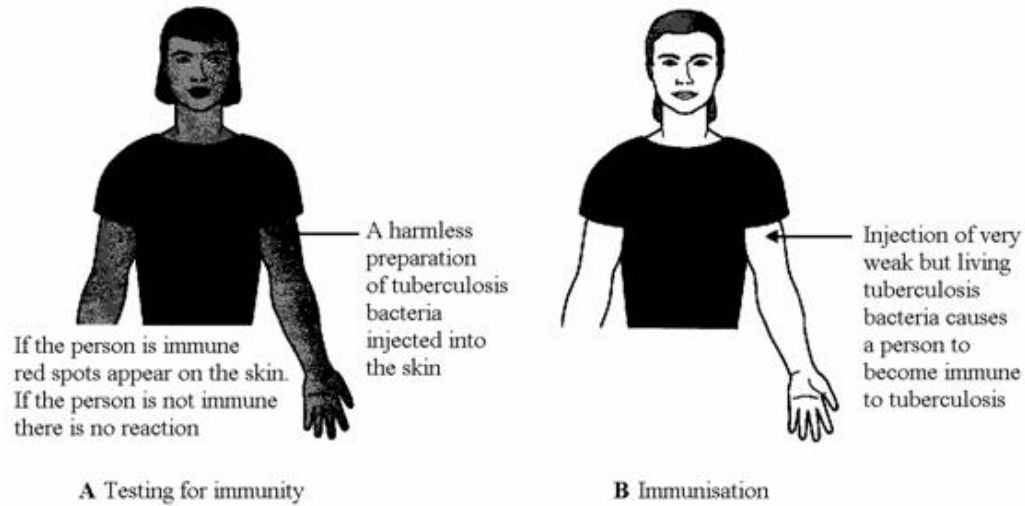
(2)

(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 harmless preparation of tuberculosis bacteria injected into the skin

If the person is immune red spots appear on the skin. If the person is not immune there is no reaction

A Testing for immunity

Injection of very weak but living tuberculosis bacteria causes a person to become immune to tuberculosis

B Immunisation

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

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(2)

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

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(3)
(Total 7 marks)

Q7. The diagram shows two methods which are used to give humans protection against disease. **Method A** shows active immunity and **Method B** shows passive immunity. **Method A** can be used against polio. **Method B** is often used against tetanus.

Method A

Person receives small dose of polio virus (antigen)

↓

Virus multiplies slowly in body

↓

Antibodies made

↓

Second dose of weakened virus given, after a time more antibodies made

Method B

Tetanus bacteria (antigen) injected into another animal

↓

Antibodies made

↓

Blood removed from animal, used to produce a serum with antibodies

↓

Serum injected into person infected with tetanus

↓

Tetanus antibodies then soon removed from person's blood

(a) What is the name of the substances produced by the body which destroy harmful viruses and bacteria?

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(1)

(b) Why does **Method A** give long lasting protection against polio?

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(1)

(c) Why does **Method B** not give long lasting protection against tetanus?

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(1)

(d) In immunisation against polio a second dose of the weakened virus is given (this is known as a booster). Suggest why this booster is necessary.

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(1)

(e)   **Method A** would **not** be helpful for a person who had just been infected with tetanus bacteria. Explain the reason for this.

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(2)

(f)   Why is **Method B** very good for dealing quickly with an infection of tetanus?

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(1)
(Total 7 marks)

Q8.   Pathogenic bacteria and viruses may make us feel ill if they enter our bodies.

(a)   Why do bacteria and viruses make us feel ill?

Bacteria ....

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Viruses ....

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(2)

(b)   Most drugs that kill bacteria cannot be used to treat viral infections.

Explain why.

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(2)

(c)   Antibiotic-resistant strains of bacteria are causing problems in most hospitals.

Explain, as fully as you can, why there has been a large increase in the number of antibiotic-resistant strains of bacteria.

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(4)
(Total 8 marks)

Q9.   The MMR vaccine is used to protect children against measles, mumps and rubella.

(a)   Explain, as fully as you can, how the MMR vaccine protects children from these diseases.

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(3)

(b) Read the passage.

> Autism is a brain disorder that can result in behavioural problems. In 1998, Dr Andrew Wakefield published a report in a medical journal. Dr Wakefield and his colleagues had carried out tests on 12 autistic children.
>
> Dr Wakefield and his colleagues claimed to have found a possible link between the MMR vaccine and autism.
>
> Dr Wakefield wrote that the parents of eight of the twelve children blamed the MMR vaccine for autism. He said that symptoms of autism had started within days of vaccination.
>
> Some newspapers used parts of the report in scare stories about the MMR vaccine. As a result, many parents refused to have their children vaccinated.
>
> Dr Wakefield's research was being funded through solicitors for the twelve children. The lawyers wanted evidence to use against vaccine manufacturers.

Use information from the passage above to answer these questions.

(i) Was Dr Wakefield's report based on reliable scientific evidence?

Explain the reasons for your answer.

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(2)

(ii) Might Dr Wakefield's report have been biased?

Give the reason for your answer.

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(1)
(Total 6 marks)

Q10.   Influenza is a disease caused by a virus.

(a)   Explain why it is difficult to treat diseases caused by viruses.

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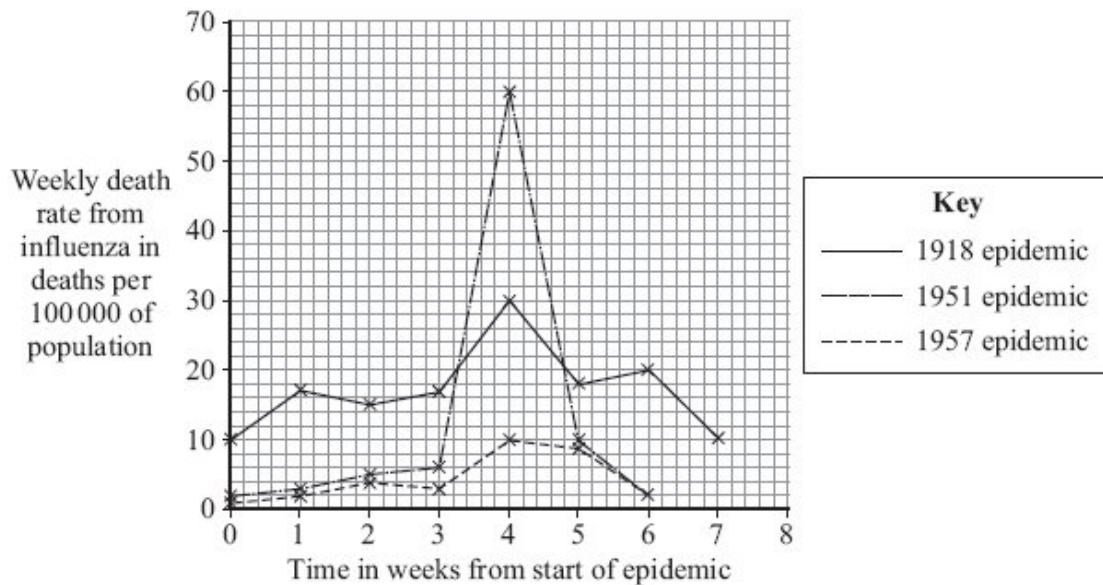
(2)

(b)   In some years there are influenza epidemics.

The graph shows the death rate in Liverpool during three influenza epidemics.

(i)   The population of Liverpool in 1951 was approximately 700 000.

Calculate the approximate number of deaths from influenza in week 4 of the 1951 epidemic.

Show clearly how you work out your answer.

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Number of deaths ....

(2)

(ii)   In most years, the number of deaths from influenza in Liverpool is very low.

Explain, in terms of the influenza virus and the body's immune system, why there were large numbers of deaths in years such as 1918 and 1951.

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(3)
(Total 7 marks)

Q11.   Some students investigated the effect of pH on the growth of one species of bacterium.

They transferred samples of bacteria from a culture of this species to each of eight flasks. Each flask contained a solution of nutrients but at a different pH.

After 24 hours, the students measured the amount of bacterial growth.

(a)   It was important that the flasks in which the bacteria grew were not contaminated with other microorganisms.

Describe **two** precautions the students should have taken to prevent this contamination.

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2 ....

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(2)

(b)   To see the effect of pH on the growth of the bacteria, other conditions should be kept constant.

Suggest **two** conditions which should have been kept constant for all eight flasks.

1 ....

2 ....

(2)

(c) The graph shows the results of the investigation.
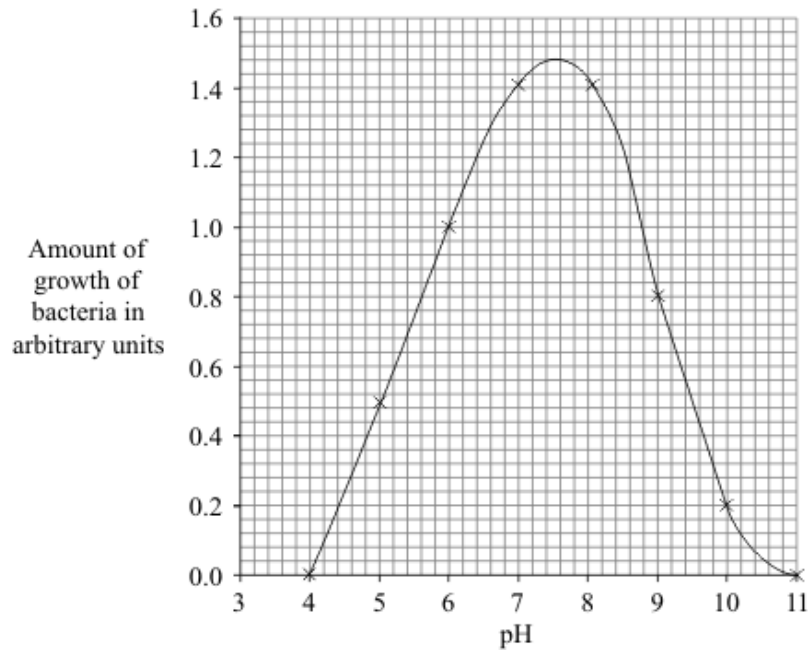
The students wanted to find the best pH for the growth of this species of bacterium.

(i) Use the graph to estimate the pH at which the bacteria would grow best.

pH ....

(1)

(ii) What could the students do to find a more accurate value for the best pH for growth of the bacteria?

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(1)

(Total 6 marks)

Q12. Influenza is caused by a virus.

(a) How do viruses cause illness?

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(1)

(b)   A British company making a reality television show in the Peruvian Amazon has been accused of starting an influenza epidemic. This epidemic allegedly killed four members of a remote Indian tribe and left others seriously ill.

The members of the television crew did not show symptoms of influenza, but members of the Indian tribe died from the disease.

Suggest an explanation for this.

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(3)
(Total 4 marks)

Q13.   Many strains of bacteria have developed resistance to antibiotics.

The table shows the number of people infected with a resistant strain of one species of bacterium in the UK.

Year	2004	2005	2006	2007	2008
Number of people infected with the resistant strain	3499	3553	3767	3809	4131

(a)   Calculate the percentage increase in the number of people infected with the resistant strain between 2004 and 2008.

Show clearly how you work out your answer.

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Percentage increase = ...

(2)

(b) Explain, in terms of natural selection, why the number of people infected with the resistant strain of the bacterium is increasing.

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(3)
(Total 5 marks)

Q14. People may be immunised against diseases using vaccines.

(a) (i) Which part of the vaccine stimulates the body's defence system?

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(2)

(ii) A person has been vaccinated against measles. The person comes in contact with the measles pathogen. The person does **not** catch measles.

Explain why.

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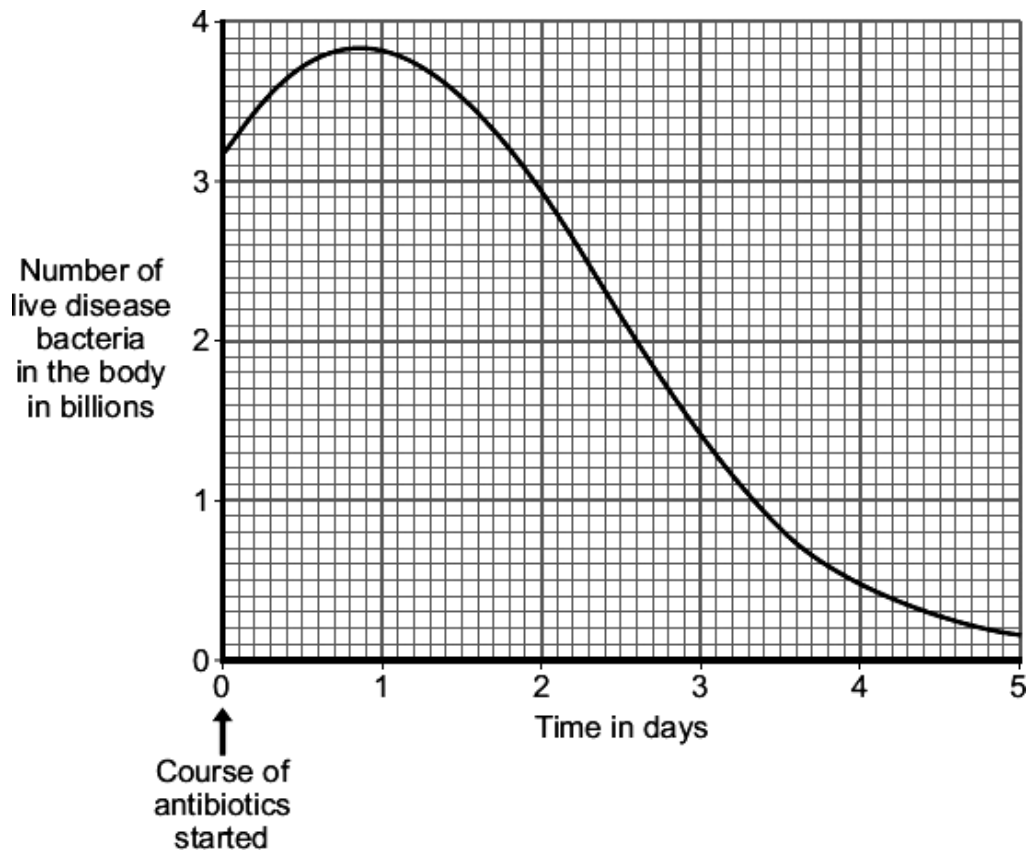..

(3)

(b)   A man catches a disease. The man has **not** been immunised against this disease. A doctor gives the man a course of antibiotics.

The graph shows how the number of live disease bacteria in the body changes when the man is taking the antibiotics.

(i)   Four days after starting the course of antibiotics the man feels well again.
It is important that the man does **not** stop taking the antibiotics.

Explain why.

Use information from the graph.

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(2)

(ii)   Occasionally a new, resistant strain of a pathogen appears.

The new strain may spread rapidly.

Explain why.

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(3)
(Total 10 marks)

Q15.   (a)   Explain how vaccination makes a person immune to a disease.

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(4)

(b)   Scientists are trialling a 'nicotine vaccine' that might help **wean smokers off** the drug nicotine.
The trials so far have produced very mixed results.
Nicotine molecules are very small and can get through the protective layers around the brain.

(i)   How does nicotine cause a person to become addicted?

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(1)

(ii) The 'nicotine vaccine' is made by attaching proteins to nicotine molecules. After 'vaccination' the body reacts to the nicotine in the same way as it reacts to pathogens.

Suggest how the 'nicotine vaccine' might help wean a smoker off nicotine.

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(2)
(Total 7 marks)

Q16. Some diseases can be cured by using antibiotics or prevented by vaccination.

(a) (i) Explain fully why antibiotics cannot be used to cure viral diseases.

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(2)

(ii) There has been a large increase in the populations of many antibiotic-resistant strains of bacteria in recent years.

Explain why.

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(2)

(b)   A person can be immunised against a disease by injecting them with an inactive form of a pathogen.

Explain how this makes the person immune to the disease.

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(3)
(Total 7 marks)

Q17.   White blood cells protect the body against pathogens such as bacteria and viruses.

(a)   (i)   Pathogens make us feel ill.

Give **one** reason why.

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(1)

(ii)   White blood cells produce antibodies. This is one way white blood cells protect us against pathogens.

Give **two** other ways that white blood cells protect us against pathogens.

1...

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2...

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(2)

(b)   Vaccination can protect us from the diseases pathogens cause.

(i)   One type of virus causes measles.

A doctor vaccinates a child against measles.

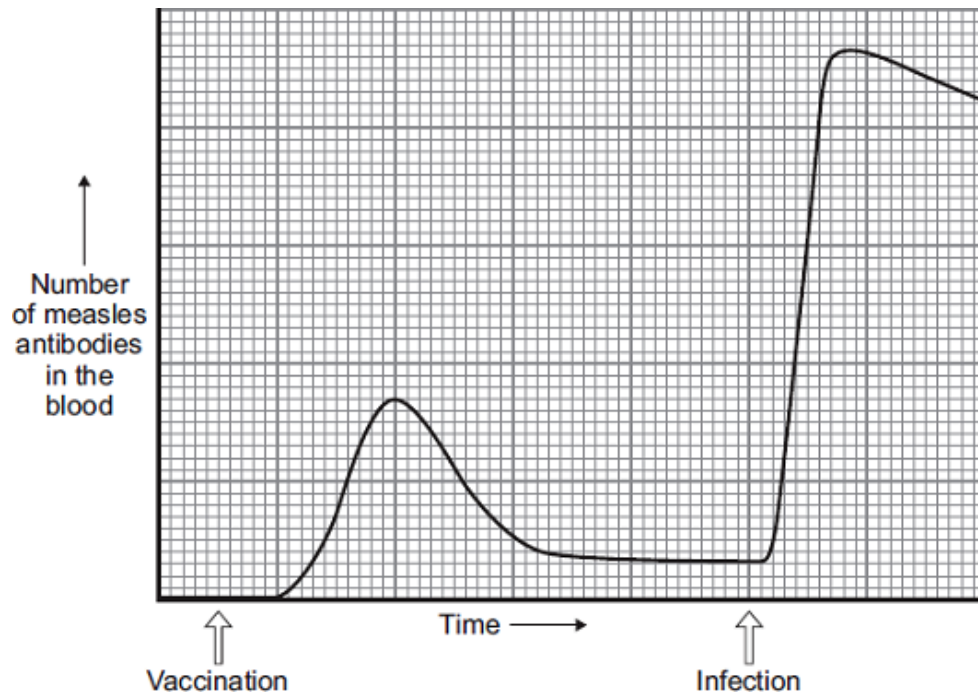What does the doctor inject into the child to make the child immune to measles?

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(2)

(ii) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection.

More measles antibodies are produced after the infection than after the vaccination.

Describe other differences in antibody production after infection compared with after vaccination.

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(3)

(iii) Vaccination against the measles virus will **not** protect the child against the rubella virus.

Why?

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(1)

(c) What is the advantage of vaccinating a large proportion of the population against measles?

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(1)
(Total 10 marks)