4.3 Infection and Response Higher

Name: _____

Class: _____

Date: _____

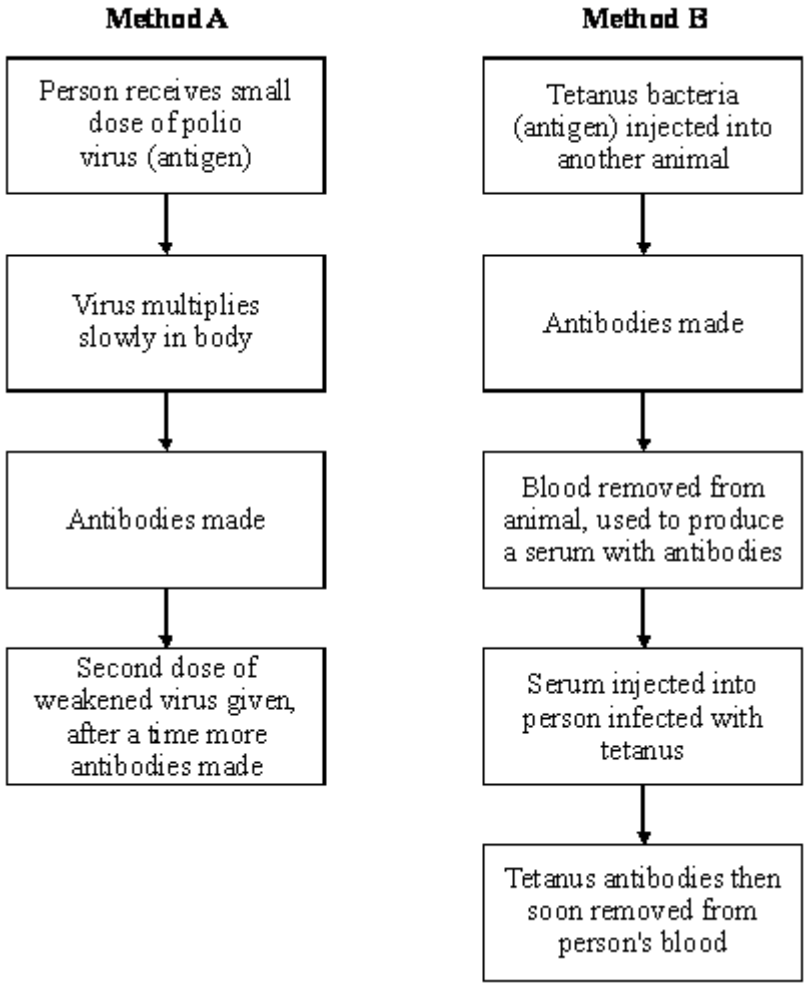
Time: **177 minutes**

Marks: **176 marks**

Comments:

Q1.

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.



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

_____

(1)

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

_____

(1)

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

_____

(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.

_____

(1)

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

_____

_____

(2)

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

_____

(1)

(Total 7 marks)

Q2.

In 2014 there was an outbreak of Ebola virus disease (EVD) in Africa.

At the time of the outbreak there were:

- no drugs to treat the disease
- no vaccines to prevent infection.

(a) By March 2015 there were an estimated 9 850 deaths worldwide from EVD.

The number of deaths is an estimate.

Suggest why it is an estimate rather than an exact number.

_____

_____

(1)

(b) Why were antibiotics **not** used to treat EVD?

_____

_____

_____

(1)

(c) After the outbreak began, drug companies started to develop drugs and vaccines for EVD.

A drug has to be thoroughly tested and trialled before it is licensed for use.

Testing, trialling and licensing new drugs usually takes several years.

Draw **one** line from each word about drug testing to the definition of the word.

Word about drug testing	**Definition**
Dose	Side effects making the person ill

Efficacy	The concentration of the drug to be used and how often the drug should be given
Toxicity	Whether the drug works to treat the illness

(2)

(d) The results of drug testing and drug trials are studied in detail by other scientists.

Only then can the results be published by the drug company.

Suggest **one** reason why the results are studied by other scientists.

_____

_____

(1)

(e) The number of deaths from EVD continued to increase.

The World Health Organization (WHO) decided it was ethical to use unlicensed drugs.

The WHO said unlicensed drugs could only be given to people who gave their permission.

Also, any results had to be shared with other researchers and drug companies.

Some vaccines had shown positive results in animal testing, but the vaccines had not been tested and trialled in humans.

The supplies of the vaccine were low.

At first the vaccines were only used for health workers.

How would the use of a vaccine **reduce the spread** of EVD?

_____

_____

_____

_____

(2)

(f) Evaluate the use of unlicensed drugs and vaccines during the EVD outbreak.

Give a conclusion.

_____

_____

_____

(6)

(Total 13 marks)

Q3.

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)

Q4.

Bacteria and viruses can reproduce quickly inside the body and make us feel ill.
These organisms may cause symptoms such as a high body temperature.

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

_____

_____

(1)

Two common medicines are paracetamol and ibuprofen. These medicines help to reduce high body temperature.

Data was collected to find out whether paracetamol, ibuprofen or a combination of these two medicines was the best to reduce high body temperature in children.

Children who were ill with high body temperatures were identified at doctors' surgeries.

These children were put into three treatment groups:

Group 1: given paracetamol only
Group 2: given ibuprofen only
Group 3: given a combination of paracetamol and ibuprofen

The children in each group were matched for age and gender.

There were 50 children in each group.

The table below shows how often the medicines were given to the children in each group.
The doses were as directed by the manufacturers.

	Time in hours

	0	2	4	6	8	10	12
Group 1: Paracetamol only	P		P		P		P
Group 2: Ibuprofen only	I			I			I
Group 3:Paracetamol andibuprofen	P&I		P	I	P		P&I

Key: P = paracetamol only
I = ibuprofen only
P&I = paracetamol and ibuprofen

(b) This investigation would have been improved if a fourth group of children had been included.

(i) The children in each group were matched for age and gender.

Suggest **one** other factor the children should have been matched for to make this investigation valid.

_____

(1)

(ii) What would the children in the fourth group have been given?

_____

_____

(1)

(iii) Suggest why this would have improved the investigation.

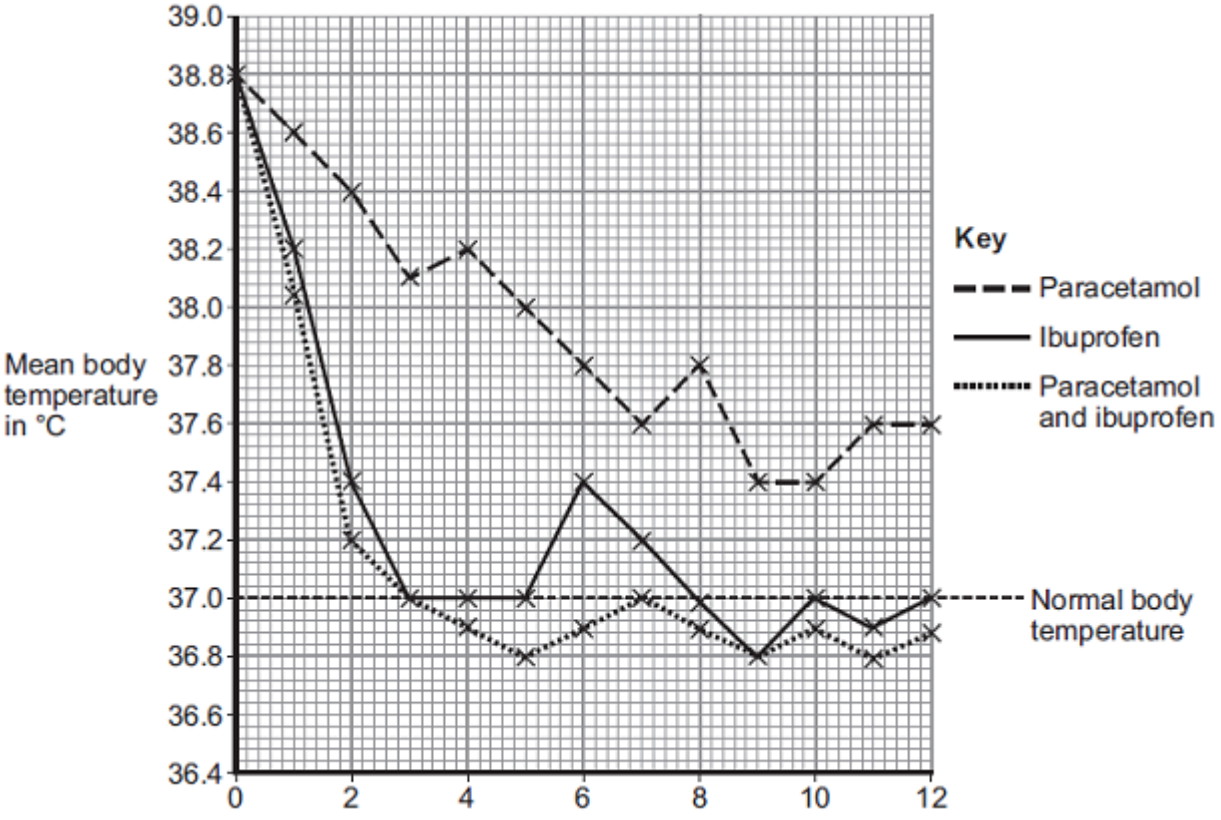
_____

_____

(1)

(c) The children's body temperatures were measured before any medicine was given and every hour after treatment started.

The mean body temperatures for each of the three groups are shown in the figure below.



(i) What was the difference in mean body temperature after 4 hours between the group taking paracetamol only and the group taking ibuprofen only?

_____

_____ °C

(1)

(ii) How many more hours did the mean body temperature stay normal or below normal, when taking both paracetamol and ibuprofen compared to taking ibuprofen only?

_____

_____ hours

(1)

(d) Doctors and nurses usually advise parents to give ibuprofen to children with a high body temperature.

Complete the sentences to suggest reasons why giving only ibuprofen might be better than giving only paracetamol or a combination of paracetamol and ibuprofen. You should use information from the table and the figure.

(i) Giving ibuprofen might be better than giving paracetamol because _____

_____

_____

_____

_____

(2)

(ii) Giving only ibuprofen might be better than giving a combination of paracetamol and ibuprofen because _____

_____

_____

_____

_____

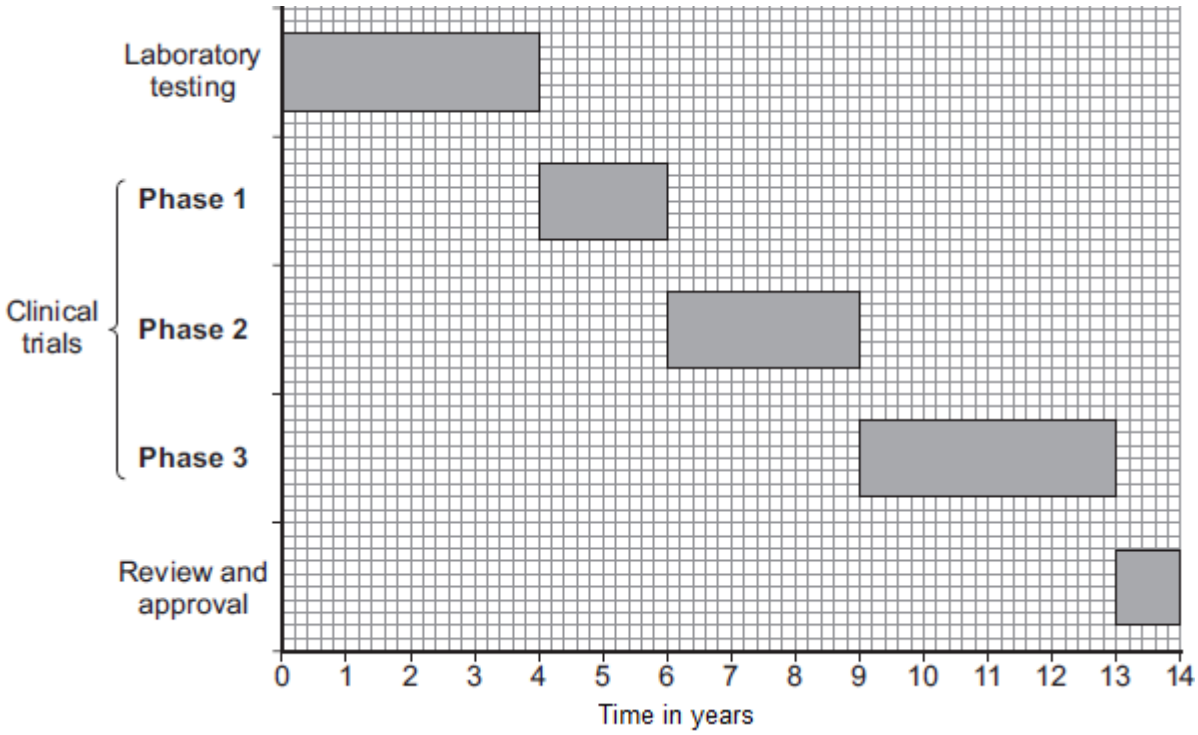
(2)

(Total 10 marks)

Q5.

New drugs have to be tested before they can be sold.

The graph shows how much time the different stages of testing took for a new drug.



(a) (i) How much more time did the clinical trials take than the laboratory testing?

_____

_____ years

(1)

(ii) Apart from the time taken, what other difference is there between laboratory testing and clinical trials?

_____

_____

(1)

(b) (i) During **Phase 1** clinical trials, the drug is tested on healthy volunteers using low doses.

Suggest why **only** healthy volunteers and **only** low doses are used at this stage of drug testing.

_____

_____

_____

_____

_____

(2)

(ii) In **Phase 2** and **Phase 3** clinical trials, a double blind trial is usually done.

Explain what a double blind trial is and why a double blind trial is good practice.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q6.

People can be immunised against a pathogen by injecting them with a vaccine.

(a) What does a vaccine contain?

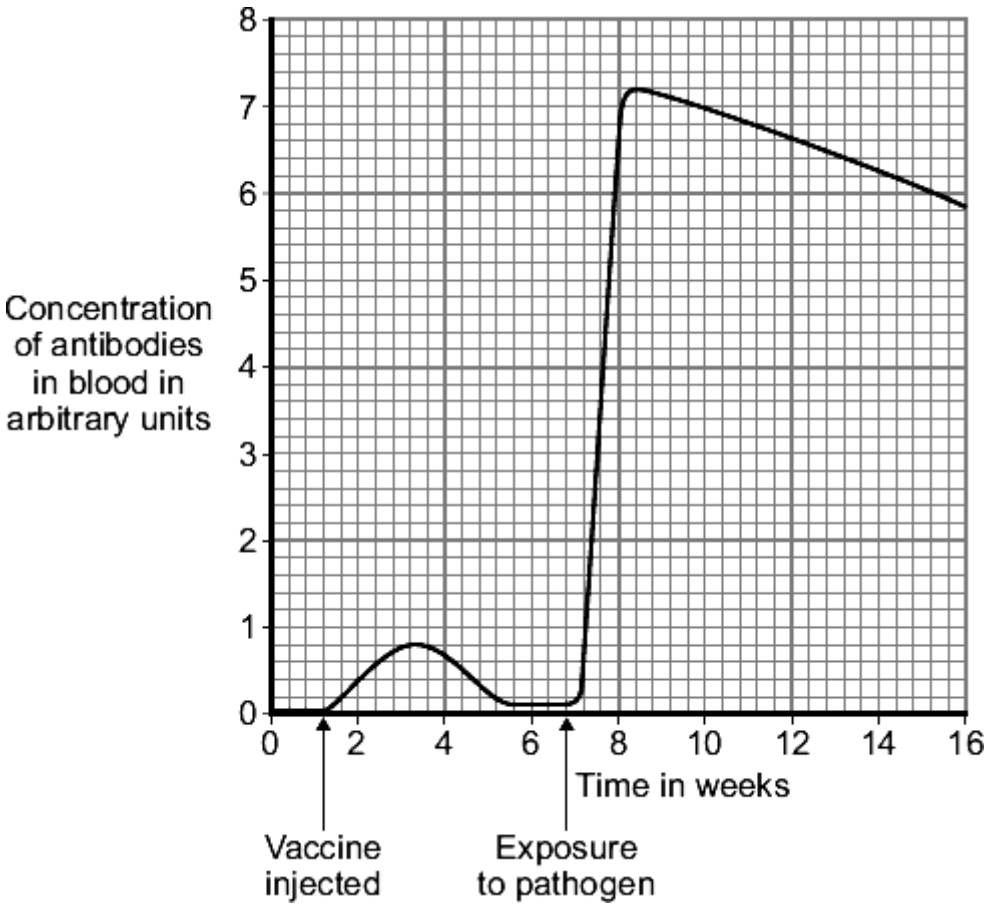
_____

_____

(1)

(b) A person was injected with a vaccine. A few weeks later the person was exposed to the pathogen they had been immunised against.

The graph shows how the concentration of antibodies in the blood changed after injection of the vaccine and after exposure to the pathogen.



(i) Describe in detail the differences between antibody production after the injection of the vaccine **and** after the person was exposed to the pathogen.

(3)

(ii) Suggest an explanation for the differences you have described in part (b)(i).

_____

_____

_____

(3)

(Total 7 marks)

Q7.

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)

Q8.

MRSA is a strain of bacterium that developed due to a mutation.

MRSA is difficult to treat so has led to high numbers of infections in hospital patients.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q9.

(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)

Q10.

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

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

Give **one** reason why.

_____

_____

(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. _____

_____

2. _____

_____

(2)

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

(i) One type of virus causes measles.

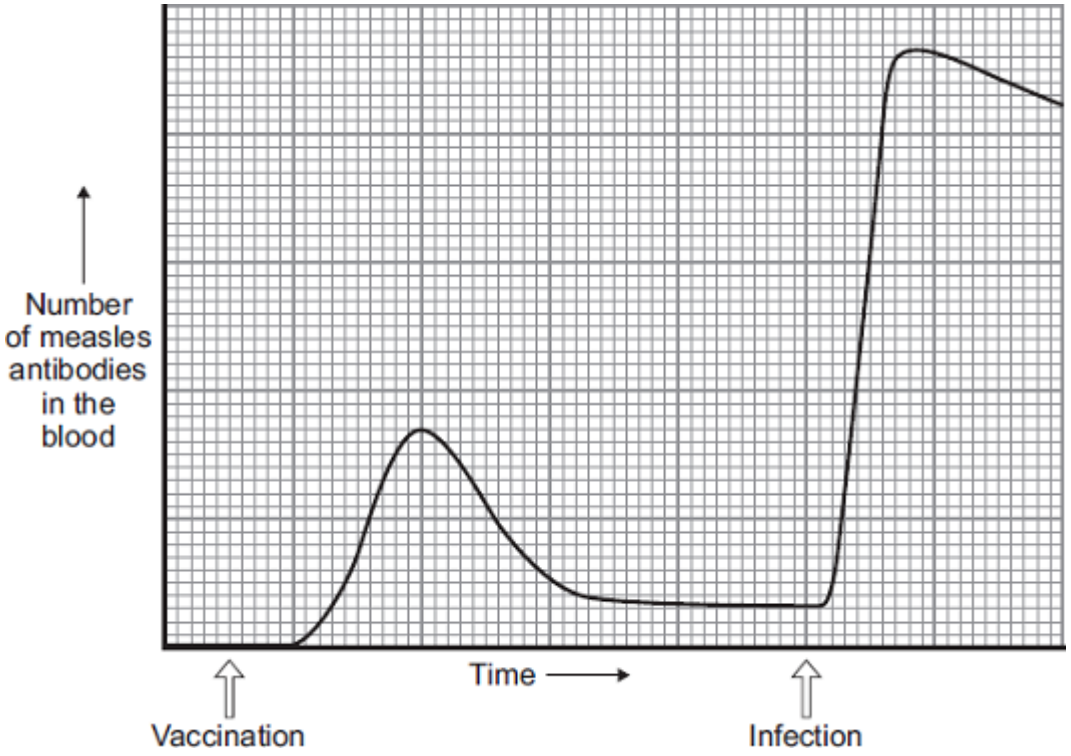
A doctor vaccinates a child against measles.

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

(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.

(3)

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

Why?

_____

(1)

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

_____

(1)

(Total 10 marks)

Q11.

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.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 5 marks)

Q12.

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.

_____

_____

_____

_____

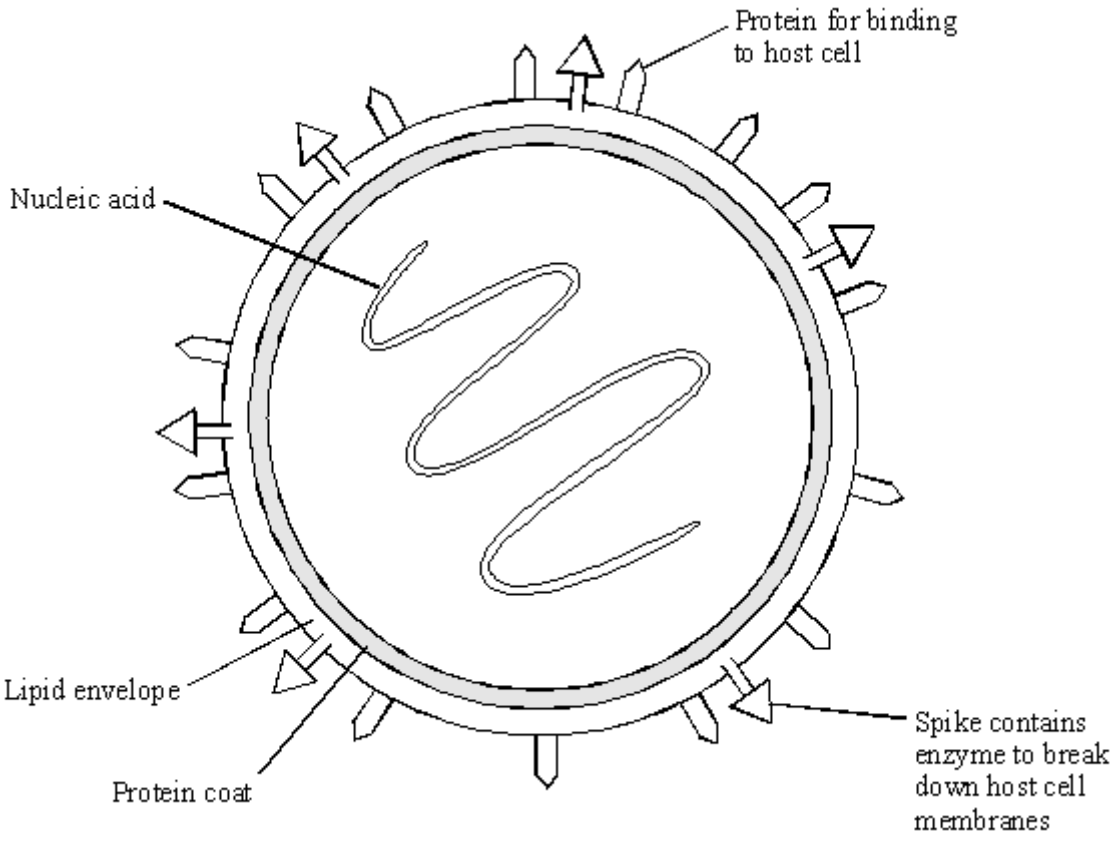
_____

(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)

Q13.

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.

(2)

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

Explain why.

(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.

_____

_____

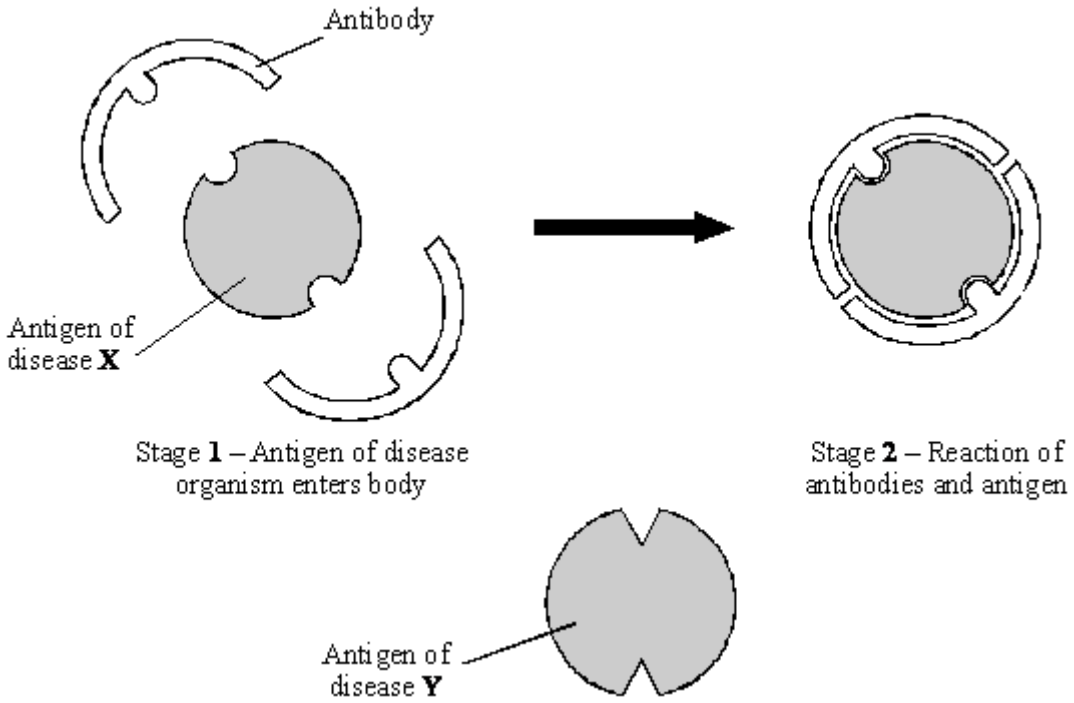
_____

(3)

(Total 7 marks)

Q14.

(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**.

_____

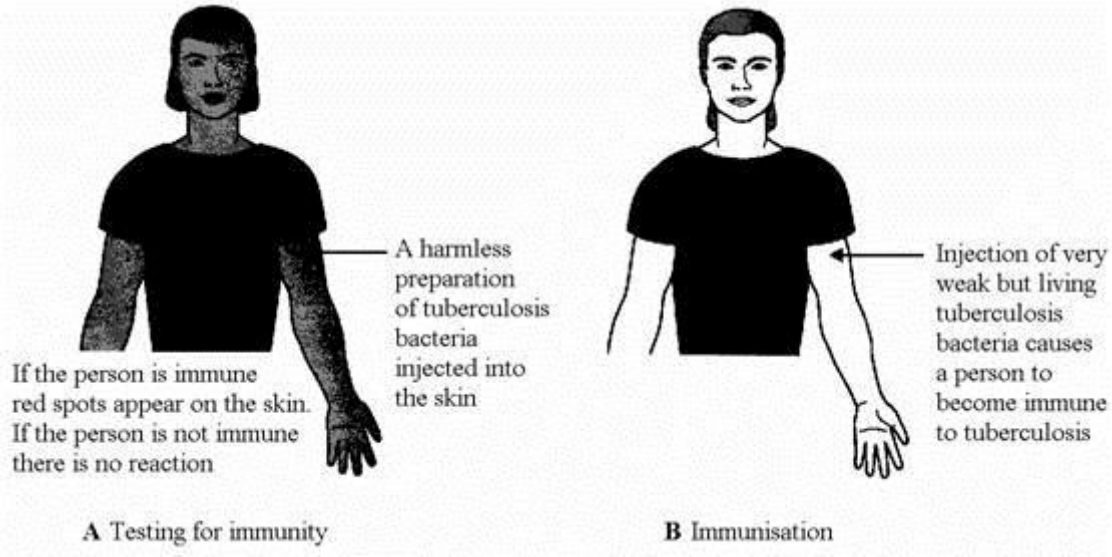
_____

_____

(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.



(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)

Q15.

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.

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.

(3)

(Total 5 marks)

Q16.

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 _____

Viruses _____

(2)

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

Explain why.

(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.

(4)

(Total 8 marks)

Q17.

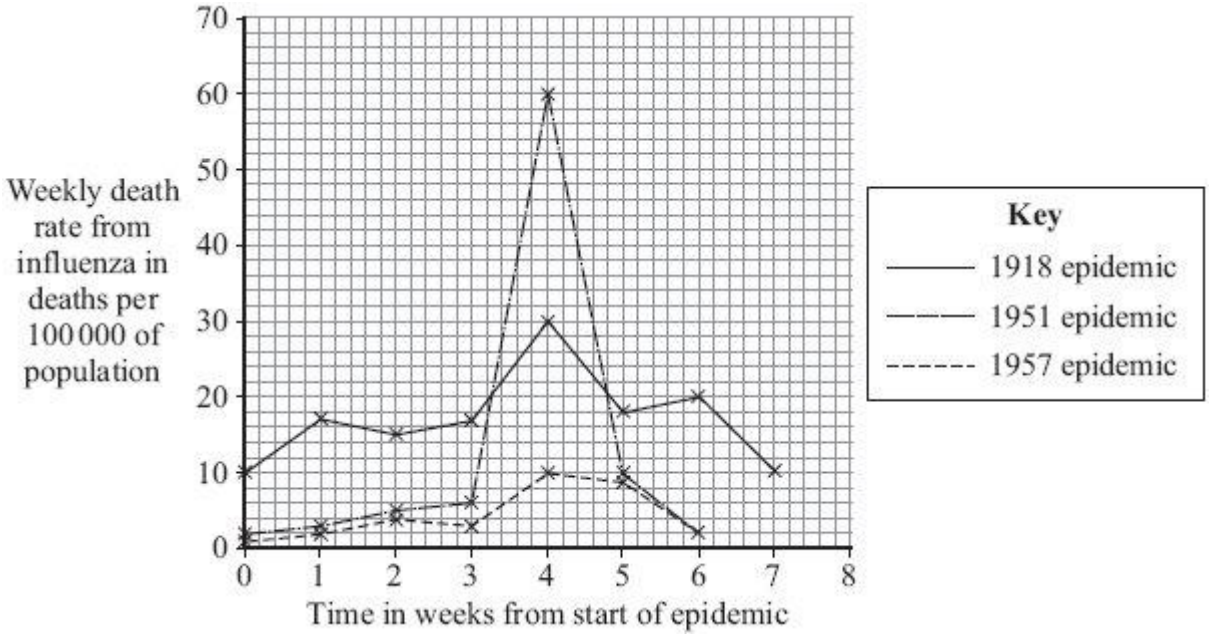
Influenza is a disease caused by a virus.

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

(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.

_____

_____

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.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q18.

Drugs must be trialled before the drugs can be used on patients.

(a) (i) Before the clinical trials, drugs are tested in the laboratory.
The laboratory trials are **not** trials on people.

What is the drug tested on in these laboratory trials?

_____

(1)

(ii) Drugs must be trialled before the drugs can be used on patients.

Give **three** reasons why.

_____

_____

_____

_____

_____

_____

(3)

(b) Read the information about cholesterol and ways of treating high cholesterol levels.

Diet and inherited factors affect the level of cholesterol in a person's blood.
Too much cholesterol may cause deposits of fat to build up in blood vessels and reduce the flow of blood. This may cause the person to have a heart attack.
Some drugs can lower the amount of cholesterol in the blood.

The body needs cholesterol. Cells use cholesterol to make new cell membranes and some hormones. The liver makes cholesterol for the body.

Some drugs can help people with high cholesterol levels.

Statins block the enzyme in the liver that is used to produce cholesterol.
People will normally have to take statins for the rest of their lives. Statins can lead to muscle damage and kidney problems. Using some statins for a long time has caused high numbers of deaths.

Cholesterol blockers reduce the absorption of cholesterol from the intestine into the blood.
Cholesterol blockers can sometimes cause problems if the person is using other drugs.

Evaluate the use of the two types of drug for a person with high cholesterol levels.

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 10 marks)

Q19.

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.

(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.

_____

_____

_____

_____

(2)

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

Give the reason for your answer.

_____

_____

_____

(1)

(Total 6 marks)

Q20.

Influenza is caused by a virus.

(a) How do viruses cause illness?

_____

_____

(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.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 4 marks)

Q21.

Scientists have discovered that curry spices affect sheep and cattle. Curry spices can reduce the amount of methane that grazing animals give off.

'Bad' bacteria in the animal's stomach produce methane. About 12% of the animal's food is changed into methane.

The curry spice coriander works like an antibiotic. Adding coriander to animal food reduces methane production by about 40%.

(a) (i) Why does adding coriander to an animal's food reduce methane production?

_____

_____

(1)

(ii) Explain **one** advantage to a farmer of adding coriander to the animal's food.

_____

_____

_____

_____

(2)

(b) Farm animals give off large amounts of methane.

Explain the effects of adding large amounts of methane to the atmosphere.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q22.

People may be immunised against diseases using vaccines.

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

_____

_____

_____

_____

(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.

_____

_____

_____

_____

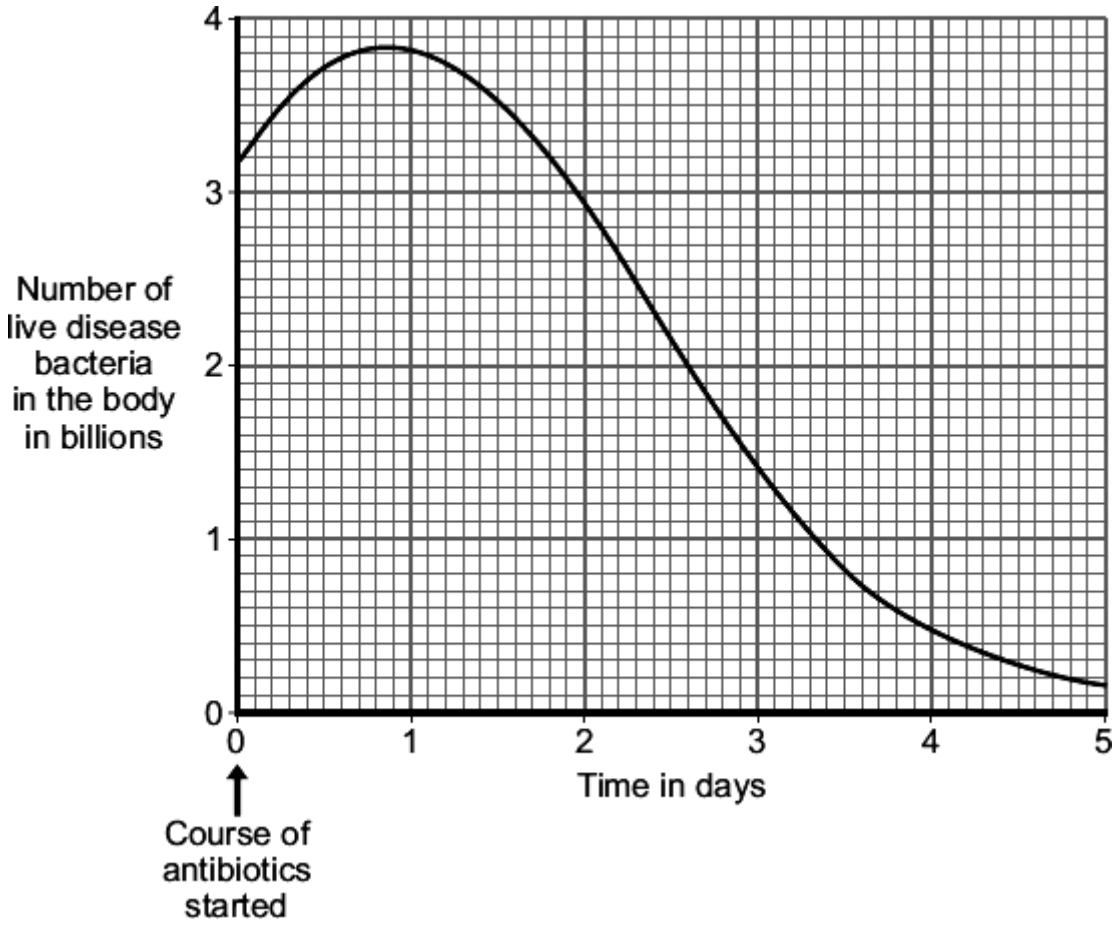
_____

_____

(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.

_____

_____

_____

_____

(2)

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

The new strain may spread rapidly.

Explain why.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q23.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(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?

_____

_____

(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.

_____

_____

_____

_____

(2)

(Total 7 marks)

Mark schemes

Q1.

(a) antibodies;

if incorrect term used then penalise in (a) then regard as continuous error for rest of question

1

(b) antibodies remain (for several years)
or are not removed

*accept last a long time **or** not destroyed*
***or** continues to make antibodies*
***or** causes increased number of antibodies **or** more antibodies*
***or** stays in body **or** person has made own antibodies*
***o**r if memory cells named must link to antibody production*

1

(c) antibodies removed (from blood);

*accept destroyed **or** unable to make **or** replace antibodies **or** they are not human antibodies **or** person has not made own antibodies*

1

(d) so more antibodies made;

*accept so enough antibodies made **or** so correct amount of antibodies present **or** to keep antibodies high **or** so body keeps making antibodies*

1

(e) any **two** from

already has tetanus bacteria in body;

*accept could boost infection **or** make it worse*

would take too long **or**
a long time for antibodies to be made;

*accept too slow forming antibodies **or** cannot form correct amount of antibodies*

disease would have effect before
antibodies made;

*accept antibodies are specific **or** will work for one disease but not another*

2 max

(f) injection of ready made antibodies;

*accept does not have to wait for antibody formation **or** has large amount of antibodies quickly **or** has enough antibodies quickly*

or *antibodies start working straight away*

1

[7]

Q2.

(a) any **one** from:

- not all deaths recorded
- not all causes of deaths recorded

allow cause may not be known

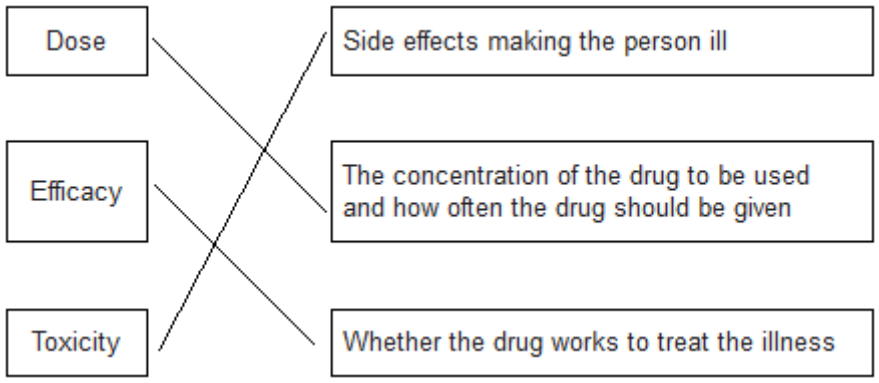
1

(b) antibiotics do not kill viruses

allow antibiotics <u>only</u> kill bacteria

1

(c)



*all correct for **2** marks*

*1 or 2 correct for **1** mark*

2

(d) any **one** from:

- to prevent false claims
- to make sure the conclusions are correct / valid
- to avoid bias

1

(e) some people would be immune to EVD

allow those vaccinated would not contract the disease

1

if less people (in a population) have EVD less chance of it being passed on

1

(f) **Level 3 (5–6 marks):**
A detailed and coherent evaluation is provided which considers a range of arguments for and against the use of unlicensed drugs and comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):
An attempt to give arguments for and against the use of unlicensed drugs is made. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):
Discrete relevant points made. The logic may be unclear and the conclusion, if present,

may not be consistent with the reasoning.

0 marks:
No relevant content

Indicative content

pros
- might save some lives
- vaccine could reduce chance of future outbreaks
- patient made aware of risk and agreed to use of drug
- sharing of results could speed up development of effective vaccines / drugs
- used mainly for health workers who were risking their lives to help

cons
- could be dangerous
  or
  vaccine could harm a healthy person
- goes against legislation / laws governing drug development
- might set a precedent for other drugs not to be fully tested
- unfair as not available to the African people

a justified conclusion

6

[13]

Q3.

(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]

Q4.

(a) (bacteria and viruses produce) toxins

allow poisons
allow damage body cells

1

(b) (i) body mass

allow weight
allow ethnicity
ignore height / size

1

(ii) placebo / fake drug

allow sugar pill

allow no treatment

1

(iii) any **one** from:

- as a control group
- for comparison
- to see if the drugs worked
- to take account of psychological effect

accept placebo effect

allow to avoid bias

1

(c) (i) 1.2 (°C)

1

(ii) 3 (hours)

1

(d) (i) (Paracetamol)

any **two** from:

- ibuprofen reduces body temperature faster
- ibuprofen reduces temperature more
- ibuprofen doesn't need to be taken as often
- ibuprofen keeps body temperature lower / normal / 37 °C for longer

allow works faster

2

(ii) (Paracetamol + ibuprofen)

any **two** from:

- body temperature decreases at a similar rate

  allow ibuprofen works (almost) as fast
- ibuprofen maintained body temperature close to normal / 37 °C

  allow ibuprofen maintained normal body temperature almost as long

  allow doesn't make temperature drop below normal as long
- (better to) take fewer drugs

  allow less chance of overdose / giving too much

  allow (better to) take drugs less frequently
- easier to administer

  allow less chance of missing doses / taking at the wrong time

2

[10]

Q5.

(a) (i) 5 (years)

1

(ii) lab tests on cells / tissues / animals **and** clinical trials in humans

*allow 1 block of lab tests **and** 3 blocks of clinical trials*

or

number of phases

1

(b) (i) (healthy volunteers)

any **one** from:

- too great a risk for ill person / patient
- patient might be taking another drug
- side effects <u>easier to see</u>
  ignore references to the immune system

1

(low dose)

any **one** from:

- to reduce any risk
- to look for side effects
  allow to avoid harm

1

(ii) placebo and drug tested
allow fake drugs / sugar pills

1

neither patients nor doctors know (who has taken placebo or drug)
*this full statement would gain **2** marks*

1

(so) avoids bias

or

(therefore) controls for psychological effects

or

(so) can tell if drug works rather than placebo effect

1

[7]

Q6.

(a) dead / inactive form of pathogen / microorganism / bacterium / virus
ignore disease (for organism)
ignore toxins / antibodies

1

(b) (i) any **three** from:

(after exposure):

- greater number of antibodies produced / higher concentration
- antibodies stay (in higher concentration) for longer

- antibodies produced quicker
- quantitative, eg 9 times higher / 0.8 to 7.2

*scores **2** marks for increased to 9 times higher / from 0.8 to 7.2*

3

(ii) white cells

allow lymphocytes / leucocytes

*do **not** accept phagocytes / macrophage*

1

have had previous exposure to pathogen / recognise pathogen on re-entry / familiar with pathogen / reference to memory cells

ignore knows how to kill pathogen
ignore live pathogen introduced on exposure

1

<u>therefore</u> antibodies produced (more) rapidly

this marking point dependent on previous marking point

1

[7]

Q7.

(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]

Q8.

(MRSA is) resistant to / not killed by <u>antibiotics</u>

ignore references to viruses

ignore immune

ignore not treated by antibiotics

1

(as is a) new / different strain / type of bacterium

ignore has mutated

ignore new species

1

(therefore) people are not immune to it

accept can't produce the correct antibodies

ignore resistant

1

(many) patients more susceptible to infection / weaker immune system

ignore references to hygiene

1

[4]

Q9.

(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]

Q10.

(a) (i) any **one** from:

- (produce) toxins / poisons
- (cause) damage to cells

kill / destroy cells

allow kills white blood cells

1

(ii) produce antitoxins

1

engulf / ingest / digest pathogens / viruses / bacteria / microorganisms

accept phagocytosis or description

ignore eat / consume / absorb for engulf

ignore references to memory cells

1

(b) (i) dead / inactive / weakened

accept idea of antigen / protein

1

(measles) pathogen / virus

ignore bacteria

1

(ii) (after infection)

accept converse if clearly referring to before vaccination

1

rise begins sooner / less lag time

steeper / faster rise (in number)

1

longer lasting **or** doesn't drop so quickly

idea of staying high for longer

ignore reference to higher starting point

1

(iii) antibodies are specific or needs different antibodies

*accept antigens are different **or** white blood cells do not recognise virus*

1

(c) reduces spread of infection / less likely to get an epidemic

accept idea of eradicating measles

1

[10]

Q11.

mutation or description of mutation (gives resistance to penicillin)

1

some survive (penicillin)

1

(survivors) reproduce **or** multiply

1

asexual reproduction **or** binary fission **or** cloning

accept mitosis

1

gene for resistance **or** the mutation is passed on (to offspring)

allow reference to bacteria being immune

ignore reference to survival of fittest

1

[5]

Q12.

(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]

Q13.

(a) (i) viruses live inside cells

1

viruses inaccessible to antibiotic

allow drug / antibiotic (if used)

would (have to) kill cell

1

(ii) any **two** from eg

- non-resistant strains killed (by antibiotics)
- so less competition
- overuse of antibiotics / antibiotics prescribed for mild infections

if no marks gained allow one mark for 'people do not finish course of antibiotics'

2

(b) (stimulate) antibody production

ignore antitoxin

1

(by) white cells

1

rapidly produce antibody on re-infection

ignore antibodies remain in blood

1

[7]

Q14.

(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) antibodies in blood or in skin or in body;

accept already have the antibodies

1

react with (injected) antigens or bacteria;

*accept skin affected by antigen-antibody complex **or** blood vessels in skin 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]

Q15.

(a) 18.06 / 18 / 18.1

*correct answer gains **2** marks*

if answer incorrect evidence of
(4131 - 3499) ÷ 3499 × 100
or *632 ÷ 3499 × 100*
or *((4131 ÷ 3499) × 100) - 100*
or *0.18*
*gains **1** mark*

2

(b) antibiotics kill non-resistant strain
or resistant strain bacteria survive

accept resistant strain the successful competitor
*do **not** accept intentional adaptation*
ignore strongest / fittest survive
ignore mutation
ignore people do not finish antibiotic course

1

resistant strain bacteria reproduce
or resistant strain bacteria pass on genes

1

population of resistant strain increases **or** proportion of resistant bacteria increases

allow high numbers of resistant bacteria

or
people more <u>likely</u> to be infected by resistant strain (than non-resistant strain)

1

[5]

Q16.

(a) (bacteria) produce toxins / poisons

1

(viruses) damage / kills cells **or** toxins released from cell

1

(b) any **two** from:

- viruses live inside cells
- viruses inaccessible to drug
- drug would damage body cells / tissue

2

(c) any **four** from:

- overuse of antibiotics
- bacteria mutate

*do **not** allow antibiotic causes mutation*

- antibiotics kill non-resistant strains **or** idea of selection
- reduced competition
- resistant bacteria reproduce

4

[8]

Q17.

(a) any **two** from

- live inside / infect body cells
- difficult for drugs to enter (body) cells / drug would kill (body) cell
- antibiotics ineffective against viruses
- viruses mutate **frequently**

2

(b) (i) 420

*correct answer with **or** without working*
*if answer incorrect evidence of 'number of deaths' × 7 **or** 60 seen gains **1** mark*
ignore 6 000 000

2

(ii) any **three** from:

- virus / flu mutates
- people no longer / not immune
  ignore resistance
- white blood cells / memory cells / immune system do not recognise virus
- relevant reference to antibodies / antigens
- current vaccine ineffective **or** no vaccine available then **or** takes time to develop new vaccine
  allow no tamiflu / anti-viral drugs
- conditions less hygienic / lack of hygiene
- people in poor health (following world wars)
  allow people had 'weak' immune system

3

[7]

Q18.

(a) (i) any **one** from:

- cells
- tissues
- (live) animals / named
  allow mammals

1

(ii) any **three** from:

(to test for)

- toxicity / check not poisonous / not harmful
  allow side-effect
  allow converse
- interaction with other drugs
- efficacy **or** to see if they work **or** check if they treat the disease
  allow converse
- dosage **or** how much is needed

3

(b) **argued evaluation**

*comparison can be written anywhere in evaluation allow use of 'only' for implied comparison for each point eg **only** statins damage muscles / kidneys / organs*

any **six** from:

- statin can damage / muscles / kidneys / organs but cholesterol blockers don't
  ignore liver
  *if neither of the first 2 points are given accept for **1** mark*
- statins can cause death but cholesterol blockers don't
  *statins are more dangerous than cholesterol blockers **or** statins have more side effects*
- cholesterol blockers can interfere with action of other drugs but statins don't
- statins are for a life time but cholesterol blockers are not
- statins (might) reduce cholesterol to zero but cholesterol blockers only reduce it **or** statins reduce cholesterol more
  allow statins (might) stop membrane / hormone production but cholesterol blockers don't
- statins better for people with inherited high cholesterol
- cholesterol blockers better for people with dietary cholesterol problems
- taking/using statins/cholesterol blockers is better than dying from heart attack or build up of fat in blood vessels or reduced blood flow

6

[10]

Q19.

(a) any **three** from:

- vaccine is inactive / dead form of (pathogen)
  allow antigens
- stimulates antibody production
- stimulates antitoxin production

- by white cells
- antibodies kill (pathogen)
- antitoxins neutralise poisons
- antibodies quickly produced on reinfection
  ignore antibodies remain in blood
- reference to ingestion by white cells

3

(b) (i) (no)

any **two** from

- sample size small / only 12
- conclusion based on hearsay from parents
- only 8 parents linked autism to MMR
- no control used

2

(ii) (yes)
being paid by parents / lawyers

1

[6]

Q20.

(a) produces toxins / damage cells / reproduce rapidly **or** reproduce in cells
ignore invade cells

1

(b) any **three** from:

- TV crew immune / Indians not immune / Indians have weak(er) immune system
  ignore resistant
- TV crew had / produced antibodies / Indians had no antibodies **or** antibody production faster in TV crew
- TV crew had previous exposure to flu / had been vaccinated
  or
  Indian tribe had no previous exposure to flu / had not been vaccinated
  allow immunised
- Indians caught disease from TV crew
  or
  TV crew were carriers (of the virus)

3

[4]

Q21.

(a) (i) kills / gets rid of / reduces <u>methane</u> bacteria

allow kills / gets rid of / reduces <u>bad</u> bacteria
ignore acts like antibiotic

1

(ii) less food converted to methane
allow can keep more cattle without further environmental damage
ignore energy

1

more growth / meat / muscle / milk produced / more profit / fatter animals
ignore references to bacteria and disease

1

(b) absorbs energy / heat radiated by Earth
allow absorbs / traps energy / heat / from Earth
*do **not** allow absorbs energy / heat from Sun*

1

some energy / heat reradiated
ignore reflected
*do **not** allow reradiates energy / heat from Sun*

1

leading to global warming / enhanced greenhouse effect
accept effects of global warming eg melting ice caps
accept methane is a greenhouse gas
ignore references to ozone

1

[6]

Q22.

(a) (i) dead / inactive / weakened
allow antigen / protein
ignore ref to other components
ignore small amount

1

pathogen / bacterium / virus / microorganism
ignore germs / disease

1

(ii) *antigen / antibiotic instead of antibody = max 2*

white blood cells produce / release antibodies
accept lymphocytes / leucocytes / memory cells produce antibodies
*do **not** accept phagocytes*

1

antibodies produced quickly

1

(these) antibodies destroy the pathogen
allow kill
*do **not** accept antibodies engulf pathogens*

1

(b) (i) (live) bacteria still in body
ignore numbers

1

would reproduce
ignore mutation / growth

1

(ii) antibiotics / treatment ineffective **or** resistant pathogens survive
accept resistant out compete non-resistant

1

these reproduce

1

population of resistant pathogens increases
allow (resistant pathogens reproduce) rapidly

1

[10]

Q23.

(a) dead or inactive or weak form of pathogen / bacterium / virus / microorganism introduced
ignore disease / germ

1

(stimulates) white cells / lymphocytes / leucocytes
accept B and T cells
ignore phagocytes

1

to produce antibodies
ignore antitoxins / antigens

1

antibodies made quickly on re-infection / idea of memory cells
ignore already has antibodies
ignore 'body remembers'

1

(b) (i) alters / causes chemical processes / body chemistry
ignore craving / withdrawal symptoms

1

(ii) any **two** from:

- combined molecule / vaccine stimulates antibody production
- if nicotine taken, antibodies bind to nicotine molecules
ignore destroys nicotine
- making them too large to get to brain / making them ineffective
allow prevents nicotine entering brain

2

[7]