The figure below shows a scale drawing of one type of cell in blood.

(a) Use the scale to determine the width of the cell.

Give your answer to the nearest micrometre.

___________________________________________________________________
___________________________________________________________________

Width of cell = _________________ micrometres

(1)

(b) Complete the table below.

<table>
<thead>
<tr>
<th>Part of the blood</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carries oxygen around the body</td>
</tr>
<tr>
<td></td>
<td>Protects the body against infection</td>
</tr>
<tr>
<td>Plasma</td>
<td></td>
</tr>
</tbody>
</table>

(3)
(c) Platelets are fragments of cells.
Platelets help the blood to clot.

Suggest what might happen if the blood did **not** clot.

___________________________________________________________________

___________________________________________________________________

(1) (Total 5 marks)

Pathogens cause infectious diseases in animals and plants.

(a) Draw **one** line from each disease to the type of pathogen that causes the disease.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonorrhoea</td>
<td>Bacterium</td>
</tr>
<tr>
<td>Malaria</td>
<td>Fungus</td>
</tr>
<tr>
<td>Measles</td>
<td>Protist</td>
</tr>
<tr>
<td></td>
<td>Virus</td>
</tr>
</tbody>
</table>
(b) Some parts of the human body have adaptations to reduce the entry of live pathogens.

Look at Figure 1.

Figure 1

Explain how the trachea is adapted to reduce the entry of live pathogens.

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___________________________________________________________________
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(4)
Malaria is a serious disease that can be fatal. Malaria is spread to humans by infected mosquitoes. Scientists investigated the behaviour of mosquitoes to understand how the spread of malaria could be controlled. Figure 2 shows the equipment the scientists used.

![Figure 2](image)

This is the method used.

1. 30 mosquitoes **infected with malaria** were placed in Container A.
2. 30 **uninfected** mosquitoes were placed in Container B.
3. The total number of times the mosquitoes landed on the socks was recorded.

Name the dependent variable and suggest one control variable in this investigation.

Dependent variable ___________________________________________________
___________________________________________________________________

Control variable _____________________________________________________
___________________________________________________________________

(2)
(d) Infected mosquitoes landed on the socks three times more often than uninfected mosquitoes.

Explain how this information can be used to reduce the spread of malaria.
(e) Tobacco mosaic virus (TMV) affects many species of plant.

**Figure 3** shows a leaf infected with TMV.

**Figure 3**

[Image of leaf with yellow patches where TMV has destroyed chloroplasts]

© Nigel Cattlin/Getty Images

TMV destroys chloroplasts in the leaf.

Explain how this could affect the growth of the plant.

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(3)
(Total 14 marks)
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 9850 deaths worldwide from EVD.

The number of deaths is an estimate.

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

___________________________________________________________________
___________________________________________________________________

(b) Why were no antibiotics used to treat EVD?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(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.

<table>
<thead>
<tr>
<th>Word about drug testing</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>Side effects making the person ill</td>
</tr>
<tr>
<td>Efficacy</td>
<td>The concentration of the drug to be used and how often the drug should be given</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Whether the drug works to treat the illness</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Word about drug testing</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>Side effects making the person ill</td>
</tr>
<tr>
<td>Efficacy</td>
<td>The concentration of the drug to be used and how often the drug should be given</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Whether the drug works to treat the illness</td>
</tr>
</tbody>
</table>

(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?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

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

Give a conclusion.

___________________________________________________________________

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(2)

(6) (Total 13 marks)
Pathogens are microorganisms that cause infectious disease.

(a) Draw one line from each disease to the way the disease is spread.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Way the disease is spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals that draw blood</td>
<td>Cholera</td>
</tr>
<tr>
<td>Drinking contaminated water</td>
<td>Cold</td>
</tr>
<tr>
<td>Droplets in the air when people cough or sneeze</td>
<td>Malaria</td>
</tr>
<tr>
<td>Eating food that is contaminated</td>
<td></td>
</tr>
<tr>
<td>Breathing air polluted with carbon dioxide</td>
<td></td>
</tr>
</tbody>
</table>

(b) One way the human body protects itself against the entry of pathogens is by producing antimicrobial chemicals.

Antimicrobial chemicals kill pathogens.

Give two other ways the human body protects itself against the entry of pathogens.

1. _________________________________________________________________

2. _________________________________________________________________

(c) Measles is a childhood disease caused by a microorganism.

Measles is not treated by antibiotics.

Give the reason why.
(d) Vaccinations help people become immune to infections.

In 2013, 92% of children in the UK had two vaccination injections against measles.

The figure below shows how the concentration of antibodies in the blood changes after each measles vaccination.

![Graph showing antibody concentration](image)

Suggest what day the second vaccination was given.

______________________________________________________________________________

(1)

(e) What is the highest concentration of antibodies produced by the first vaccination?

______________________________________________________________________________

(1)

(f) How will the number of children getting measles change as more children are vaccinated against measles?

Give a reason for your answer.

Change _____________________________________________________________

Reason _____________________________________________________________

______________________________________________________________________________

(2)

(Total 10 marks)
The parts of the blood can be separated from each other by spinning the blood in a centrifuge. The image below shows the separated parts of a 10 cm³ blood sample.

(a) Calculate the percentage of the blood that is made up of plasma.

___________________________________________________________________
___________________________________________________________________

Answer = _______________ %

(2)

(b) Name three chemical substances transported by the plasma.

1. _________________________________________________________________

2. _________________________________________________________________

3. _________________________________________________________________

(3)
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

White blood cells are part of the immune system. White blood cells help the body to defend itself against pathogens.

Describe how pathogens cause infections and describe how the immune system defends the body against these pathogens.

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(6)
(Total 11 marks)
Scientists investigated the effect of different factors on health.

(a) People who are not active may have health problems.

The graph shows the percentage of 16-year-olds in some countries who are not active.

(i) What percentage of 16-year-olds in the UK are not active?

_____________ % 

(1)

(ii) What percentage of 16-year-olds in the UK are active?

_____________ % 

(1)

(iii) A newspaper headline states:

![People in the UK are the laziest in the world.]

Information in Figure 1 does not support the newspaper headline.

Suggest one reason why the newspaper headline may be wrong.

____________________________________________________________________________________

____________________________________________________________________________________

(1)
Doctors gave a percentage rating to the health of 16-year-olds. 100% is perfect health.

The table shows the amount of exercise 16-year-olds do and their health rating.

<table>
<thead>
<tr>
<th>Amount of exercise done in minutes every week</th>
<th>Health rating as %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>72</td>
</tr>
<tr>
<td>90</td>
<td>76</td>
</tr>
<tr>
<td>180</td>
<td>82</td>
</tr>
<tr>
<td>300</td>
<td>92</td>
</tr>
</tbody>
</table>

What conclusion can be made about the effect of exercise on health?

Use information from the table.

___________________________________________________________________
___________________________________________________________________

(1)

Inherited factors can also affect health.

Give one health problem that may be affected by the genes someone inherits.

Draw a ring around the correct answer.

being malnourished having a high cholesterol level having a deficiency disease

(1)

White blood cells are part of the immune system.

Use the correct answer from the box to complete each sentence.

<table>
<thead>
<tr>
<th>antibiotics</th>
<th>antibodies</th>
<th>pathogens</th>
<th>vaccines</th>
</tr>
</thead>
</table>

(i) When we are ill, white blood cells produce ___________________ to kill microorganisms.

(1)

(ii) Many strains of bacteria, including MRSA, have developed resistance to drugs called

___________________________________________________________________

(1)

(Total 7 marks)
Some infections are caused by bacteria.

(a) The genetic material is arranged differently in the cells of bacteria compared with animal and plant cells.

Describe two differences.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(b) Tuberculosis (TB) is an infection caused by bacteria.

The table below shows the number of cases of TB in different regions of southern England from 2000–2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>London</th>
<th>South East</th>
<th>South West</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>37</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>2001</td>
<td>36</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>2002</td>
<td>42</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2003</td>
<td>42</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>2005</td>
<td>49</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2006</td>
<td>44</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>43</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2008</td>
<td>44</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>44</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>2010</td>
<td>42</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>45</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
(i) How does the number of cases of TB for London compare with the rest of southern England?

______________________________________________________________

______________________________________________________________

______________________________________________________________

(1)

(ii) Describe the pattern in the data for cases of TB in the South East.

______________________________________________________________

______________________________________________________________

______________________________________________________________

(1)

(iii) Describe the pattern in the data for cases of TB in the South West.

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

(2)

(c) (i) On the graph paper below:

• plot the number of cases of TB in **London**

• label both the axes on the graph

• draw a line of best fit.
(ii) Suggest why a student thought the value for 2005 in London was anomalous.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(1)

(d) People can be vaccinated against TB.

Suggest how a vaccination programme would reduce the number of people with TB.

Details of how a vaccine works are not required.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2) (Total 13 marks)

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

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

Give one reason why.

___________________________________________________________________
___________________________________________________________________
(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.

![Graph showing number of measles antibodies over time]

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

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

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

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

Why?

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

___________________________________________________________________

(Total 10 marks)

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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(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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(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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(Total 7 marks)
The mould *Penicillium* can be grown in a fermenter. *Penicillium* produces the antibiotic penicillin.

The graph shows changes that occurred in a fermenter during the production of penicillin.

(a) During which time period was penicillin produced most quickly?

Draw a ring around one answer.

0 – 20 hours  
40 – 60 hours  
80 – 100 hours

(1)

(b) (i) Describe how the concentration of glucose in the fermenter changes between 0 and 30 hours.

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

(2)
(ii) How does the change in the concentration of oxygen in the fermenter compare with the change in concentration of glucose between 0 and 30 hours?

Tick (✓) two boxes.

- The oxygen concentration changes after the glucose concentration.
- The oxygen concentration changes before the glucose concentration.
- The oxygen concentration changes less than the glucose concentration.
- The oxygen concentration changes more than the glucose concentration.

(2)

(iii) What is the name of the process that uses glucose?

Draw a ring around one answer.

- distillation
- filtration
- respiration

(1)

(Total 6 marks)
Infections by antibiotic resistant bacteria cause many deaths.

The bar chart below shows information about the number of deaths per year in England from *Methicillin-resistant Staphylococcus aureus* (MRSA) and from *Clostridium difficile* (*C. difficile*) over 4 years.

(a) (i) Describe the trend for deaths caused by *C. difficile*.

________________________________________________________________________

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________________________________________________________________________

(2)

(ii) Suggest a reason for the trend you have described in part (a)(i).

Explain your answer.

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________

(2)
(iii) Calculate the percentage change in deaths caused by MRSA from 2009 to 2010.

Percentage change in deaths caused by MRSA = ________________ %

(iv) Numbers have not yet been published for 2011.

When the numbers are published, scientists do not expect to see such a large percentage change from 2010 to 2011 as the one you have calculated for 2009 to 2010.

Suggest one reason why.

(b) Before 2007 there was a rapid increase in the number of deaths caused by MRSA.

Describe how the overuse of the antibiotic methicillin led to this increase.

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.

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____________________________________________________________________________

(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.

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(6)
(Total 10 marks)
Parents all over the world advise children to ‘wrap up warm or you’ll catch a cold’. Scientists at Cardiff University recruited 180 volunteers to take part in an investigation to find out if the advice was true. The investigation took place during the city’s common cold season.

Half of the volunteers put their feet in bowls of ice cold water for 20 minutes. The other volunteers sat with their feet in empty bowls.

Over the next few days, almost a third of the volunteers who put their feet into cold water developed colds. Fewer than one in ten of the other volunteers developed colds.

(a) Draw a ring around the correct answer to complete the sentence.

The advice ‘wrap up warm or you’ll catch a cold’ is an example of

- hearsay.
- a hypothesis.
- a prediction.

(b) What was the experimental control in the investigation?

___________________________________________________________________

(1)

(c) The scientists did not prove that the advice ‘wrap up warm or you’ll catch a cold’ is true. Explain why.

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(3)
(Total 5 marks)
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.

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______________________________________________________________________________

(3) (Total 6 marks)
(a) Explain how vaccination makes a person immune to a disease.

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(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?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(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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___________________________________________________________________
___________________________________________________________________

(4) (Total 7 marks)
Scientists at a drug company developed a new pain-killing drug, drug X.

(a) Painkillers do not cure infectious diseases.

Why?

(b) The scientists compared drug X with two other pain-killing drugs, drug A and drug B. In their investigation the scientists:
   • chose 600 volunteers. The volunteers were all in pain
   • gave 200 of the volunteers a standard dose of drug A
   • gave 200 of the volunteers a standard dose of drug B
   • gave 200 of the volunteers a standard dose of drug X.

Over the next seven hours the volunteers recorded how much pain they felt.

To get valid results the three groups of volunteers should be matched for as many factors as possible.

Suggest two of the factors that should be matched.

(c) The graph shows the results of the investigation.

(i) How much pain did the volunteers still feel, four hours after taking drug A?

______________________________ percent

17
(ii) Give one advantage of taking drug A and not drug B.

______________________________________________________________

______________________________________________________________

(1)

(iii) Give two advantages of taking drug B and not drug A.

______________________________________________________________

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______________________________________________________________

______________________________________________________________

(2)

(d) Drug X is much more expensive than both drug A and drug B.

A pharmacist advised a customer that it would be just as good to take drug A and drug B together instead of drug X.

Do you agree with the pharmacist’s advice?

Give reasons for your answer.

___________________________________________________________________

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___________________________________________________________________

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___________________________________________________________________

(3) (Total 10 marks)

People may be immunised against diseases using vaccines.

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

______________________________________________________________

______________________________________________________________

______________________________________________________________

(2)

Brookvale Groby Learning Trust
(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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________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(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)

Obesity is linked to several diseases.

(a) Name **two** diseases linked to obesity.

1. _________________________________________________________________

2. _________________________________________________________________

(2)
(b) Scientists trialled a new slimming drug. The table shows their results after one year.

<table>
<thead>
<tr>
<th>Percentage change in mass of each volunteer</th>
<th>Number of volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td>gained mass or lost 0 to 3.9 %</td>
<td>1900</td>
</tr>
<tr>
<td>lost 4.0 to 4.9 %</td>
<td>1100</td>
</tr>
<tr>
<td>lost 5.0 to 9.9 %</td>
<td>1500</td>
</tr>
<tr>
<td>lost 10 % or more</td>
<td>1500</td>
</tr>
</tbody>
</table>

(i) Calculate the proportion of the volunteers who lost 10 % or more of their mass.
You should first calculate the total number of volunteers, then work out the proportion.

Proportion of volunteers = ________________

(2)

(ii) The National Health Service (NHS) gave permission for the drug to be used.
Use information from the table to suggest a reason why the NHS gave permission for the drug to be used.

______________________________________________________________________

______________________________________________________________________

(1)
(Total 5 marks)
List A gives the names of three stages in trialling a new drug.

List B gives information about the three stages.

Draw a line from each stage in List A to the correct information in List B.

<table>
<thead>
<tr>
<th>List A Stage</th>
<th>List B Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests on humans including a placebo</td>
<td>Used to find if the drug is toxic</td>
</tr>
<tr>
<td>Tests on humans using very small quantities of the drug</td>
<td>The first stage in the clinical trials of the drug</td>
</tr>
<tr>
<td>Tests on animals</td>
<td>Used to find the optimum dose of the drug</td>
</tr>
<tr>
<td></td>
<td>Used to prove that the drug is effective on humans</td>
</tr>
</tbody>
</table>
Daily coffee dose delays development of Alzheimer’s in humans.

Alzheimer’s is a brain disease that causes memory loss in elderly people. Scientists studied 56 mice that had been genetically engineered to develop Alzheimer’s.

Before treatment all the mice did badly in memory tests.

Half the mice were given a daily dose of caffeine in their drinking water. The dose was equivalent to the amount of caffeine in six cups of coffee for a human.

The other mice were given ordinary water.

After two months, the caffeine-drinking mice did better in memory tests than the mice drinking ordinary water.

The headline for the passage is not justified.

Explain why as fully as possible.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(Total 6 marks)
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.

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people infected with the resistant strain</td>
<td>3499</td>
<td>3553</td>
<td>3767</td>
<td>3809</td>
<td>4131</td>
</tr>
</tbody>
</table>

(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)
MRSA strains of bacteria are causing problems in many hospitals.

(a) The diagram shows a hand-gel dispenser.

Hand-gel dispensers are now placed at the entrance of most hospital wards. Explain why.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(b) Explain, as fully as you can, how MRSA strains of bacteria became difficult to treat.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

___________________________________________________________________

(3) (Total 5 marks)
The body’s immune system protects us from diseases.

Describe the different ways in which white blood cells protect us from infectious diseases.

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
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_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
(Total 4 marks)

New drugs have to be thoroughly tested before they are sold.

The diagram shows a time line for the testing of a new drug.

\[
\begin{array}{cccccccccc}
\text{Time in years} & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \\
\end{array}
\]

\begin{tabular}{|c|c|c|}
\hline
Pre-clinical testing & Clinical testing & Drug on sale \\
\hline
Laboratory tests including tests on animals & Phase 1 & Phase 2 & Phase 3 \\
\hline
10–100 volunteers & 200–400 patients & 3000+ new patients \\
\hline
\end{tabular}

(a) What is the main purpose of pre-clinical testing?

_______________________________________________________________________
_______________________________________________________________________

(1)

(b) In Phase 1 of the clinical testing, very low doses of the new drug are used on a small number of volunteers.

(i) What is the main purpose of Phase 1 testing?

_______________________________________________________________________

(1)
(ii) In Phase 1 testing, healthy volunteers are used rather than patients. Suggest one reason for this.

___________________________________________________________________
___________________________________________________________________
(1)

(c) What is the main purpose of the Phase 2 and Phase 3 testing?

___________________________________________________________________
___________________________________________________________________
(1)

(d) During Phase 3 testing, many of the patients are given a placebo.

(i) What is meant by a placebo?

___________________________________________________________________
___________________________________________________________________
(1)

(ii) During the testing, who knows which patients are receiving the placebo?

Tick (✔) one box.

- Only the patients
- Only the doctors
- Both patients and doctors
- Neither patients nor doctors

(1)

(Total 6 marks)

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.

___________________________________________________________________
___________________________________________________________________
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___________________________________________________________________

(Total 4 marks)

Diet and exercise affect health.

(a) Many people are obese (very overweight).

Obesity can lead to heart disease.

Other than heart disease, name **two** conditions which are linked to obesity.

1. _________________________________________________________________

2. _________________________________________________________________

(2)
(b) The graph shows the number of deaths from heart disease each year in the UK.

![Graph showing number of deaths from heart disease]

The pattern for deaths from heart disease in men is different from the pattern in women.

(i) Give two differences between the patterns for men and women.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

(2)

(ii) Suggest two reasons for the difference in the number of deaths from heart disease in men and women between the ages of 40 and 60.

1. ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________

(2)
(c) Scientists have developed drugs to reduce the concentration of cholesterol in the blood.

Give the three main stages in testing a new drug before it is sold to the public.

1. _________________________________________________________________
   ___________________________________________________________________

2. _________________________________________________________________
   ___________________________________________________________________

3. _________________________________________________________________
   ___________________________________________________________________

(Total 9 marks)

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

(a) Complete the sentences about vaccination.

   Vaccines stimulate white blood cells to produce ___________________________.

   This makes children ________________________________________ to the pathogen.

(2)
In the 1990s, many people thought that the MMR vaccine caused autism in some children. As a result, the Japanese government stopped using the MMR vaccine.

The graph gives information about the percentage of children in Japan vaccinated with the MMR vaccine and the number of children who developed autism during the 1990s.

(i) Describe how the percentage of children vaccinated with the MMR vaccine changed between 1990 and 1995.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(2)
(ii) Does the data in the graph support a link between MMR vaccination and autism?

Draw a ring around your answer. Yes / No

Explain the reason for your answer.

________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

(2) (Total 6 marks)

In the 19th century, Dr Semmelweiss investigated infection in a hospital.

He compared the number of deaths of mothers on two maternity wards.

- On Ward 1, babies were delivered mainly by doctors. These doctors worked on many different wards in the hospital.

- On Ward 2, babies were delivered by midwives. The midwives did not work on other wards.

The bar chart shows the results of his investigations.
(a)  (i)  600 mothers gave birth on **Ward 2** in 1845.

How many mothers died from infections on **Ward 2** in 1845?

Show clearly how you work out your answer.

______________________________________________________________________________

______________________________________________________________________________

Number of mothers who died _______________

(2)

(ii)  Which was the safer ward on which to have a baby?

Draw a ring around your answer. **Ward 1 / Ward 2**.

Using data from the bar chart, give a reason for your answer.

______________________________________________________________________________

______________________________________________________________________________

(1)

(b)  In January 1848, Dr Semmelweis asked all doctors to wash their hands before delivering babies.

The table shows the number of deaths on the two wards in 1848.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Number of deaths from infections per 100 births</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ward 1</td>
<td>3</td>
</tr>
<tr>
<td>Ward 2</td>
<td>1</td>
</tr>
</tbody>
</table>

(i)  Plot this data on the bar chart above.

(1)

(ii)  What was the effect on the death rate on **Ward 1** of doctors washing their hands before delivering babies?

______________________________________________________________________________

______________________________________________________________________________

(1)
Influenza is a disease caused by a virus.

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

(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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________

(3)

(Total 7 marks)

Polio is a disease caused by a virus. In the UK, children are given polio vaccine to protect them against the disease.

(a) In the sentences below, draw a ring around the correct words in each box.

(i) It is difficult to kill the polio virus inside the body

because the virus is not affected by drugs

lives inside cells

produces antitoxins

(1)
(ii) The vaccine contains an active infective inactive form of the polio virus. (1)

(iii) The vaccine stimulates the white blood cells to produce antibiotics antibodies drugs which destroy the virus. (1)

(b) The graph shows the number of cases of polio in the UK between 1948 and 1968.

(i) In which year was the number of cases of polio highest?

__________________________________________________________________________ (1)

(ii) Polio vaccination was first used in the UK in 1955. How many years did it take for the number of cases of polio to fall to zero?

__________________________________________________________________________ (1)
There have been no cases of polio in the UK for many years. But children are still vaccinated against the disease.

Suggest one reason for this.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(1)
(Total 6 marks)

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.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

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

Give the reason for your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2) (Total 6 marks)

Pathogens can enter the body and cause disease.

(a) (i) Name **one** type of medicine which kills bacteria in the body.

________________________________________________________________________

(ii) Name **one** type of medicine which helps to relieve the symptoms of infectious disease.

________________________________________________________________________

(1)
(b) Vaccination protects us from pathogens.

The graph shows the concentration of antibodies in the blood of a person after two injections of vaccine given four weeks apart.

(i) How long after the first injection did it take for the concentration of antibodies to reach the minimum level for protection against the pathogen?

__________________ weeks

(ii) Describe what happened to the concentration of antibodies in the blood from week 0 to week 7.

______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________

(3)
(iii) Would you expect the concentration of antibodies to stay above the level needed for protection against the pathogen over the next ten years?

Draw a ring around your answer. Yes / No

Give a reason for your answer.

____________________________________________________________________

____________________________________________________________________

(Total 7 marks)

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 ________________________________________________________________

____________________________________________________________________

(Total 2 marks)

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

Explain why.

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

(Total 2 marks)
(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)

Controlling infections in hospitals has become much more difficult in recent years.

(a) Explain why MRSA is causing problems in many hospitals.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(b) The pioneer in methods of treating infections in hospitals was Ignaz Semmelweiss. He observed that women whose babies were delivered by doctors in hospital had a death rate of 18% from infections caught in the hospital. Women whose babies were delivered by midwives in the hospital had a death rate of 2%. He observed that doctors often came straight from examining dead bodies to the delivery ward.
(i) In a controlled experiment, Semmelweiss made doctors wash their hands in chloride of lime solution before delivering the babies. The death rate fell to about 2% – down to the same level as the death rate in mothers whose babies were delivered by midwives.

Explain why the death rate fell.

________________________________________________________________________

________________________________________________________________________

(1)

(ii) Explain how Semmelweiss's results could be used to reduce the spread of MRSA in a modern hospital.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2)

(Total 5 marks)
Scientists began to keep records of cases of H5N1 bird flu in humans in January 2004. The graph shows the total number of cases of bird flu in humans and the total number of deaths up to January 2006.

(a)  
(i) How many people had died from bird flu up to 01/07/05?

____________________________________________________________________________________

(1)

(ii) Describe, as fully as you can, how the number of cases of bird flu in humans changed between 01/07/04 and 01/01/06.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

(2)
At present, humans can only catch bird flu from contact with infected birds. The bird flu virus may mutate into a form that can be passed from one human to another.

Explain why millions of people may die if the bird flu virus mutates in this way.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)
(Total 5 marks)
Mark schemes

(a) 8 (micrometres)

(b) red blood cell(s)

white blood cell(s)

accept named cell

eg phagocyte / lymphocyte

(plasma)

transports proteins / dissolved substances / food (molecules) / urea / hormones / blood cells

(c) any one from:

• you could lose a lot of blood
• bleed internally

allow bleeding would not stop

allow could bleed to death

(a) (b) (trachea) has mucus

(b) (trachea) has mucus

(b) (trachea) has mucus

(b) (trachea) has cilia
to move mucus out of trachea

(c) \textbf{dependent variable:}
number of times mosquitoes landed on socks

\textbf{control variable:}
any one from:
- number of mosquitoes in each container
- length of time socks worn
- dampness of socks
- same type of socks
- size of container
- time
- temperature
- species of mosquito
- age of mosquito

(d) use worn socks
\textbf{or}
use chemical from worn socks
to attract / trap infected mosquitoes

\textbf{or accept:}
wear clean socks / change socks regularly (1)
to reduce the chance of attracting mosquitoes (1)

(e) less chlorophyll present

\hspace{1cm}(so) less light absorbed

\hspace{1cm}(so) reduced photosynthesis
\textbf{or}
\hspace{1cm}(so) less sugar / food made

\begin{itemize}
  \item \textbf{any one} from:
  \begin{itemize}
    \item not all deaths recorded
    \item not all causes of deaths recorded
      \textit{allow cause may not be known}
  \end{itemize}
\end{itemize}

(b) antibiotics do not kill viruses
\textit{allow antibiotics only kill bacteria}
(c) any one from:
• not all deaths recorded
• not all causes of deaths recorded
  allow cause may not be known
(b) antibiotics do not kill viruses
  allow antibiotics only kill bacteria

c) any one from:
• 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

all correct for 2 marks
1 or 2 correct for 1 mark
(d) any one from:

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

(e) some people would be immune to EVD

allow those vaccinated would not contract the disease

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

(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
(a) **Disease**  **Way the disease is spread**

- Animal that draw blood
- Drinking contaminated water
- Droplets in the air when people cough or sneeze
- Eating food that is contaminated
- Breathing air polluted with carbon dioxide

*extra lines from left cancel the mark*

(b) any two from:

- skin acts as a barrier
- blood clots (over cuts)
- nose (hairs) catch particles (breathed in)
- mucus (in trachea / bronchi) traps microorganisms
- acid in stomach kills microorganisms

(c) because measles is a virus

(d) 28 / twenty eight

\[\pm 0.5 \text{ small square tolerance}\]

(e) 2.5

(f) number will decrease

less likely to come into contact with someone with measles / the disease

(a) 55%

*2 marks for correct answer alone*

accept 54 – 56

5.5 / 10 × 100 alone gains 1 mark
(b) any three from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

- ignore blood cells and platelets
- ignore oxygen
- max 1 named example of each for ions and hormones
- allow minerals

(c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a ‘best-fit’ approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
There is a description of pathogens with errors or roles confused.

or
the immune response with errors or roles confused.

Level 2 (3 – 4 marks)
There is a description of pathogens and the immune response with some errors or confusion

or
a clear description of either pathogens or the immune response with few errors or little confusion.

Level 3 (5 – 6 marks)
There is a good description of pathogens and the immune response with very few errors or omissions.
Examples of biology points made in the response:

- bacteria and viruses are pathogens  
  *credit any ref to bacteria and viruses*
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

White blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses  
  *credit engulf / digest / phagocytosis*
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)  
  *credit memory cells / correct description*
- this leads to immunity from that pathogen.

(a)  
(i) 64

(ii) 36  
*allow e.c.f from (i) i.e. 100 – answer given in (a)(i)*

(iii) any one from:
- only considers 16-year-olds  
  *ignore lack of evidence*
  *allow does not refer to all ages*
- only about some / 5 countries  
  *allow does not refer to all countries.*

(b) the more exercise done the healthier a person is  
*allow the more exercise done the higher the health rating*
*allow the less exercise done the lower the health rating*

(c) having a high cholesterol level

(d) (i) antibodies

(ii) antibiotics
(a) any two from:

- only one ‘chromosome’
  
  allow one strand of DNA
- circular
  
  allow loop
- may have plasmids
- not in a nucleus / no nucleus

(b) (i) any one from:

- London is much higher
  
  or converse
- more variable / wider range
  
  allow ‘on average it is 5 / 6 times greater’

(ii) increases

Included figures must be correct

(iii) overall slight increase

accept ‘doesn’t change much’

variable / goes up and down

(c) (i) both axes correctly labelled

x = Year

y = Number of cases

correct points

all correct = 2 marks

1-2 errors = 1 mark

> 2 errors = 0 marks

suitable line of best fit

accept straight line or smooth curve

(ii) doesn’t fit the pattern / line of best fit

(d) provides immunity / protection (to TB)

ignore ‘stops people catching it’

ignore ‘resistance’
prevents TB spreading
   accept ref to herd immunity

(a) (i) any one from:
   • (produce) toxins / poisons
   • (cause) damage to cells
     kill / destroy cells
     allow kills white blood cells

(ii) produce antitoxins

   engulf / ingest / digest pathogens / viruses / bacteria / microorganisms
   accept phagocytosis or description
   ignore eat / consume / absorb for engulf
   ignore references to memory cells

(b) (i) dead / inactive / weakened
        accept idea of antigen / protein

   (measles) pathogen / virus
   ignore bacteria

(ii) (after infection)
        accept converse if clearly referring to before vaccination

   rise begins sooner / less lag time
   steeper / faster rise (in number)
   longer lasting or doesn’t drop so quickly
       idea of staying high for longer
       ignore reference to higher starting point

(iii) antibodies are specific or needs different antibodies
        accept antigens are different or white blood cells do not recognise virus
(c) reduces spread of infection / less likely to get an epidemic

accept idea of eradicating measles

(a) (i) viruses live inside cells

viruses inaccessible to antibiotic

allow drug / antibiotic (if used)

would (have to) kill cell

(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’

(b) (stimulate) antibody production

ignore antitoxin

(by) white cells

rapidly produce antibody on re-infection

ignore antibodies remain in blood

(a) 40 – 60 hours

(b) (i) decrease

1st slowly then faster / appropriate detail from the graph – e.g. from 7.8 to 0 / faster after 4 – 10h

(ii) oxygen after glucose

extra box ticked cancels 1 mark

oxygen less than glucose
(iii) respiration

(a) (i) decrease

rate of decrease slows

(ii) any one from:
- more use of disinfectant
  *allow any reasonable increase in hygiene or sterilisation precautions*
- more use of hand washing
- more careful / more often cleaning of patient facilities
- raised awareness / education about hygiene

Explanation:
stops / reduces the bacteria being transferred / spreading

(iii) $800 - 500 \times 100 = $

37.5 (%)  
correct answer with or without working gains 2 marks

(iv) any one from:
- numbers quite low now so hard to reduce further
- was a big campaign / much publicity (in 2009) so more people already doing it
- hygiene / cleaning now good so hard to improve
- hospitals short of money so less staff to clean

(b) mutation occurred giving resistance (to methicillin)
*do not accept overuse caused mutation*

resistant bacteria not able to be treated / not killed

these bacteria multiplied / reproduced / spread quickly
(a)  (i) any one from:

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

(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

(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

(a) hearsay

(b) (volunteers with feet in) empty bowls
accept bowl with no (iced) water
do not accept mention of bowl with iced water

c) any three from:
ignore control variables, eg age, gender
• only some of those whose feet were in cold water caught colds
• some controls caught colds
• only feet were cold in experimental group
allow (control) not wrapped up warm
• only kept feet in cold water for 20 minutes
• insufficient evidence for ‘proof’ / only showed increased risk
allow small sample size
• don’t know activities of individuals before / after the investigation (eg exposure to cold virus) / reference to immune system
allow investigation done in ‘cold season’

(a) (i) kills / gets rid of / reduces methane bacteria
allow kills / gets rid of / reduces bad bacteria
ignore acts like antibiotic

(ii) less food converted to methane
allow can keep more cattle without further environmental damage
ignore energy
more growth / meat / muscle / milk produced / more profit / fatter animals
ignore references to bacteria and disease
(b) absorbs energy / heat radiated by Earth
   allow absorbs / traps energy / heat / from Earth
   **do not** allow absorbs energy / heat from Sun

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

   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

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

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

   to produce antibodies
   ignore antitoxins / antigens

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

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

   (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**
(a) don’t kill pathogens / bacteria / viruses / microbes / microorganisms
   allow don’t contain antibiotics
   ignore antibodies / attack / fight
   allow only treat symptoms / pain
   ignore kill disease / germs

(b) any two from:
   • age
   • gender
   • extent / severity of pain
     or how long had pain before trial
   • type of pain / illness / site of pain
     accept ‘the pain’ for 1 mark, if neither extent or type given
     ignore pain threshold
   • (body) mass / weight / height
     allow body size / physique
   • other medical issues / drugs taken / health / fitness
   • ethnicity

(c) (i) 75
   ignore calculations / %

(ii) faster pain relief / decrease
   allow pain relief sooner
   or it works quicker
   or more pain relief at start / in first 1 $\frac{3}{4}$ hours

(iii) decrease of pain higher / more
   ignore more effective unless qualified by time $> 1 \frac{3}{4}$ hours
   allow effect lasts longer

   decrease of pain is longer lasting
(d) any three from:

_**ignore yes or no**_

(Yes because)

- rapid pain relief (from A)
- long lasting pain relief (from B)
- and it costs less
- the sum of the pain relief (from A + B) is greater (than X)

(No because)

- drug X gives more pain relief
- (A + B / they ) might interact with each other
- could result in overdose
- could be more / new side effects
  
  _if neither points gained_
  
  _allow (more) dangerous_

(a) (i) dead / inactive / weakened

_allow antigen / protein_

_ignore ref to other components_

_ignore small amount_

pathogen / bacterium / virus / microorganism

_ignore germs / disease_

(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_

antibodies produced quickly

(these) antibodies destroy the pathogen

_allow kill_

_do not accept antibodies engulf pathogens_
(b) (i) (live) bacteria still in body

ignore numbers

would reproduce

ignore mutation / growth

(ii) antibiotics / treatment ineffective or resistant pathogens survive

accept resistant out compete non-resistant

these reproduce

population of resistant pathogens increases

allow (resistant pathogens reproduce) rapidly

(a) any two from:

ignore eating disorder

ignore cancer

- arthritis

accept worn joints

- diabetes

accept high blood sugar

- high blood pressure

ignore cholesterol

- heart disease / heart condition / heart attack / blood vessel disease

allow blood clots / strokes

(b) (i) \[ \frac{1}{4} \text{ or } 0.25 \text{ or } 25\% \]

correct answer gains 2 marks

if answer incorrect, evidence of \[ \frac{1500}{6000} \] gains 1 mark

25 without % gains 1 mark

(ii) majority / most / high proportion of people in trial lost mass / weight

ignore good results / it worked

1 [5]
(a)

A

Tests including a placebo

Tests using very small ...

Tests on animals

B

Used to find whether the drug is toxic

The first stage in the clinical trials of the drug

Used to find the optimum dose of the drug

Used to prove that the drug is effective on humans

1 mark for each correct line
mark each line from left hand box
two lines from left hand box cancels mark for that box
(b) any three from:

Students have been informed that the headline is not justified

- reference to reliability, eg only a small number of mice tested 
or trial too short 
or investigation not repeated

- reference to control, eg mice given caffeine not coffee 
or 6 cups (equivalence) is more than 1 dose

- (and) the effect on mice might not be same as on humans 
  allow only tested on mice

- (also) text suggests that the treatment improves memory loss (rather than delays it) 
  accept text suggests disease cured

  or mice already have memory loss or experiment only showed improvement in memory
  or does not show delays Alzheimer’s
  or experiment not done on old mice

  allow reference to the fact that mice engineered to have it

(a) 18.06 / 18 / 18.1

correct answer gains 2 marks
if answer incorrect evidence of

\[(4131 - 3499) \div 3499 \times 100\]
or 
\[632 \div 3499 \times 100\]
or 
\[((4131 \div 3499) \times 100) - 100\]
or  0.18

gains 1 mark

(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

resistant strain bacteria reproduce
or resistant strain bacteria pass on genes
population of resistant strain increases or proportion of resistant bacteria increases
allow high numbers of resistant bacteria

or
people more likely to be infected by resistant strain (than non-resistant strain)

(a) kills / destroys bacteria / MRSA
do not allow germs

prevents / reduces transfer
allow stops MRSA entering ward

(b) mutation
do not accept antibiotics causes mutation

(cause) resistance
allow not effective
ignore immunity

to antibiotics

(wbc) ingest / digest pathogens / bacteria / viruses
allow eat germs
ignore swallow germs
ignore ingest the disease
ignore attack / kill the disease

(wbc) produce antibodies

(wbc) produce antitoxins
any one from:

- (antibodies) destroy or kill pathogens / bacteria / viruses / germs
  
  ignore destroy / kill disease
  ignore attack / fight pathogens

- (antitoxins) counteract / destroy / neutralise toxins / poisons
  
  ignore attack / killing toxins

- reasonable reference to memory cells or rapid production of antibodies upon re-infection

(a) testing for toxicity / see if it is safe / see if it is dangerous / to see if it works

  ignore side effects unqualified

(b) (i) testing for side effects / testing for reactions (to drug)

  ignore to see if it works
  do not accept dosage

(ii) any one from

  ignore immune system

  • dose too low to help patient
  • higher risk for patient
  • might conflict with patient’s treatment / patient on other drug
  • effect might be masked by patient’s symptoms / side effects clearer

(c) to find optimum dose

  allow testing on larger sample or it makes results more reliable
  allow to find out if drug is effective / find out if drug works on ill people (not just if drug works)

(d) (i) (tablet / drug / injection) that does not contain drug

  allow control / fake / false
  allow tablet / injection that does not affect body
  do not accept drug that does not affect body

(ii) neither patients nor doctors
(a) produces toxins / damage cells / reproduce rapidly or reproduce in cells

ignore invade cells

(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)

(a) any two from:

- arthritis
  allow damaged joints

- diabetes
  accept high blood sugar

- high blood pressure

- strokes
  allow blocked blood vessels / thrombosis

- allow breathing difficulties
  ignore cancer
  ignore high cholesterol
(b) (i) any two from:

* to gain marks there must be a comparison
* ignore comparison at single age

* lower number of women deaths up to age of 75-80
* higher number of women deaths after 80
  * ignore women die older or men die younger
* men's peak higher
* men's peak at an earlier age
* men's death start earlier than women
* more men than women die of heart disease

(ii) any two from:

* men smoke more (cigarettes)
  * ignore alcohol
* more men smoke
* men under more stress
* men less active
* more men overweight / eat more / less diet conscious or different fat distribution
  * ignore reference to body size
* genetic factors
* men might have lower metabolic rate
  * ignore references to hormones
* men less likely to visit doctor even though they have symptoms

(c) points can be in any order

* laboratory tests / tests on tissues
* or
* tests on animals
* or
* tests for toxicity
  * ignore computer simulations

* tests for side effects on volunteers / healthy people / small numbers
widespread testing
or
testing for optimum dose
or
test on patients / sick people
or
test to see if it is effective
   accept use of placebo

(a) antibodies
   allow antitoxins / memory cells
   do not allow antigens

immune
   ignore protection
   allow resistant

(b) (i) fell
   numerical qualification to zero / nothing / by 100%
   allow stopped in 1995

(ii) (no)
   ignore circle

% vaccination fell or when no vaccination
but autism numbers did not fall / stayed high / increased
or
‘(yes) might support it if time lag between vaccination and autism
symptoms’ / ‘time lag for diagnosis’ (1)
6 year time lag quantified (1)

(a) (i) 12
   correct answer with or without working
   if answer incorrect evidence of (number of deaths) × 6 or 2 seen
   gains 1 mark
(ii) (ward 2) more deaths / infections on ward 1

or

less deaths / infections on ward 2

(b) (i) both bars correctly plotted

ie plots in spaces between 2.8 and 3.2 and 0.8 and 1.2

ignore width and shading

(ii) less deaths / infections

(iii) bacteria / germs / microbes / infection killed / washed off

accept less infections passed on

(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

(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

[6]
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

(a) 
(i) lives inside cells

(ii) inactive

(iii) antibodies

(b) 
(i) 1950

(ii) 8 (years)

(iii) any one from: eg

- disease could be reintroduced (from abroad)
  disease might come back insufficient
- disease would spread if it came back
- protection on holiday abroad
- high proportion of immune people needed to prevent epidemic
(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

(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

(ii) (yes)

being paid by parents / lawyers

(a) (i) antibiotic or named antibiotic  

忽略 antibodies  

接受 antiseptic  

接受 disinfectant

(ii) painkillers  

接受 named painkillers eg aspirin

(b) (i) 5.5 / 5 ½ weeks
(ii) rose gains 1 mark

rose, then fell then rose again gains 2 marks

a further 1 mark for one quantitative statement eg

• rose for 3 weeks / to 14–15 units
• dropped to 4 weeks / 9 units
• rose to 7 weeks / 64–65 units

(iii) (no)

level begins to fall / is falling (after 7 weeks)

(a) (bacteria) produce toxins / poisons

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

(b) any two from:

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

(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
(34) any two from:

- virus is neutral
- resistant to (most) antibiotics
- contagious or easily passed on or reference to open wounds
- patients ill therefore less able to combat disease

(b) (i) chloride of lime / hand washing killed bacteria (picked up from corpses)

allow disease / germs / infection / disinfectants

(ii) people to wash hands after contact with patient

so bacteria / pathogen / MRSA not transferred to other patient

[5]

(35) (a) (i) 56

accept 54 – 58

(ii) increased

reasonable qualification eg slowly then more quickly

or
to 174 / 176

or
by 138 / 140

(b) any two from:

- no immunity or antibodies ineffective

accept no resistance

- no vaccines or humans not immunised

- idea of large scale contact or large scale travel
do not accept passed on
ignore no cure

[5]