1 Microorganisms can cause disease.

(a) Draw **one** line from each disease to the correct description.

HIV	Can be spread by not washing hands thoroughly.
	Can increase the chance of infection such as pneumonia.
Malaria	Part of the life cycle includes an insect.
	spread by cough and sneezes.
Salmonella	Treated with stem cell.
	Treated with fungicides.

(3)

(b) Gonorrhoea is a sexually transmitted disease.

A bacterium causes gonorrhoea.

What are the symptoms of gonorrhoea?

Tick **two** boxes.

- Headache ☐
- Pain when urinating ☐
- Rash ☐
- Vomiting ☐
- Yellow discharge ☐

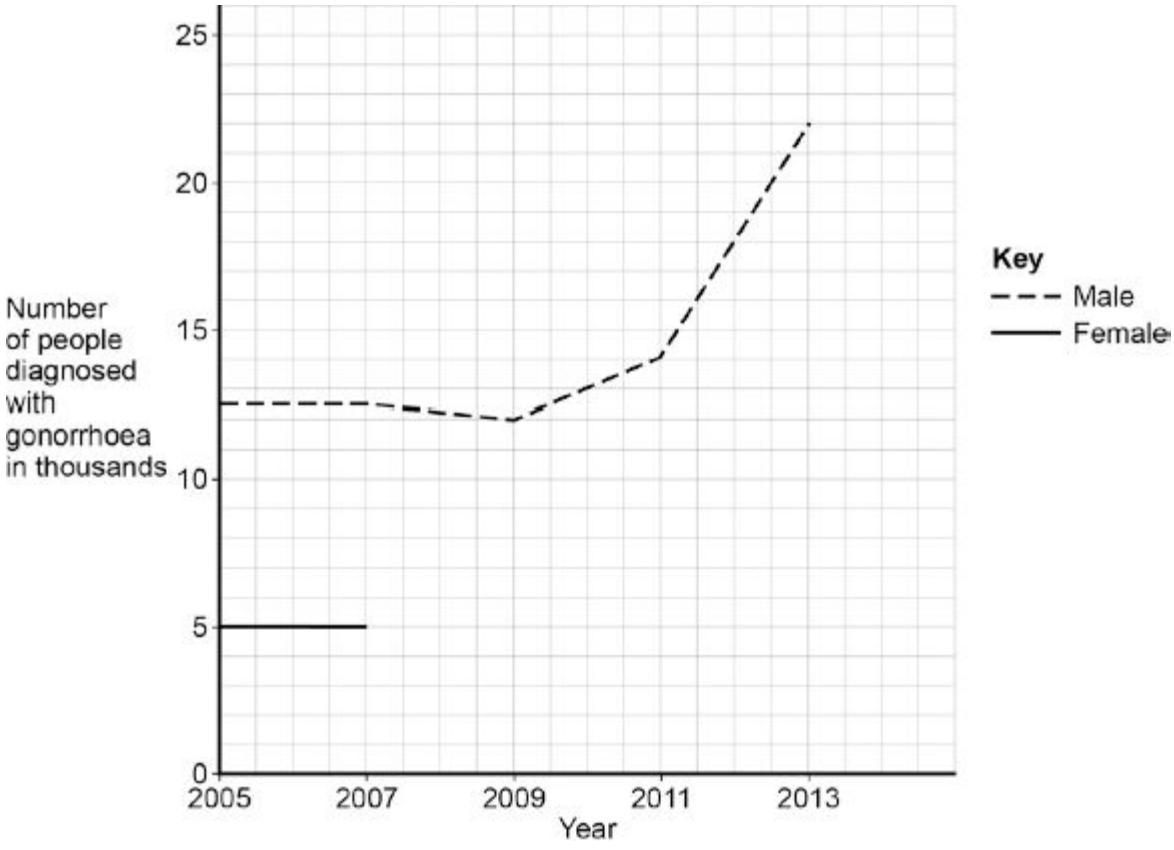
(2)

(c) The table below shows the number of people in the UK diagnosed with gonorrhoea in different years.

	Number of people diagnosed with gonorrhoea in thousands	
Year	**Female**	**Male**
2005	5.0	12.5
2007	5.0	12.5
2009	5.5	12.0
2011	6.0	14.0
2013	7.5	22.0

Use the data in the table to complete the graph below.

- The numbers for males have already been plotted.
- Only some of the numbers for females have been plotted.



(3)

(d) Describe the patterns in the numbers of males and females with gonorrhoea from 2005 to 2013.

Use the data in the graph.

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(3)

(e) Gonorrhoea is treated with an antibiotic.

HIV is another sexually transmitted disease.

Explain why prescribing an antibiotic will **not** cure HIV.

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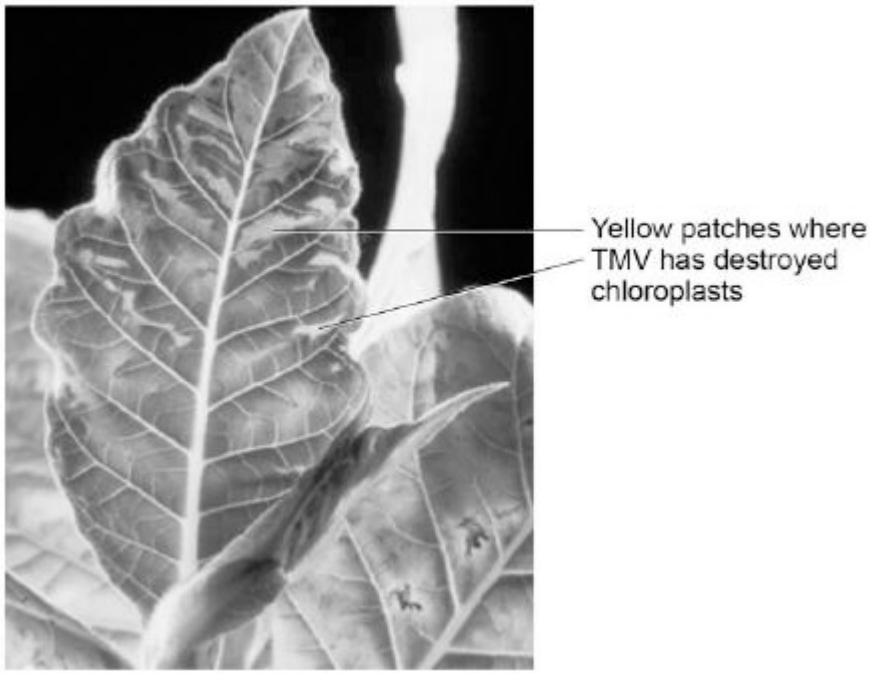
(2)
(Total 13 marks)

2 Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.



(a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

.....

.....

(1)

(b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

.....

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(1)

(c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

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(2)

(d) TMV can cause plants to produce less chlorophyll.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

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(4)
(Total 8 marks)

3 Microorganisms cause infections.

The human body has many ways of defending itself against microorganisms.

(a) Describe **two** ways the body prevents the entry of microorganisms.

1 .....

.....

2 .....

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(2)

(b) In 2014 the Ebola virus killed almost 8000 people in Africa.

Drug companies have developed a new drug to treat Ebola.

Explain what testing must be done before this new drug can be used to treat people.

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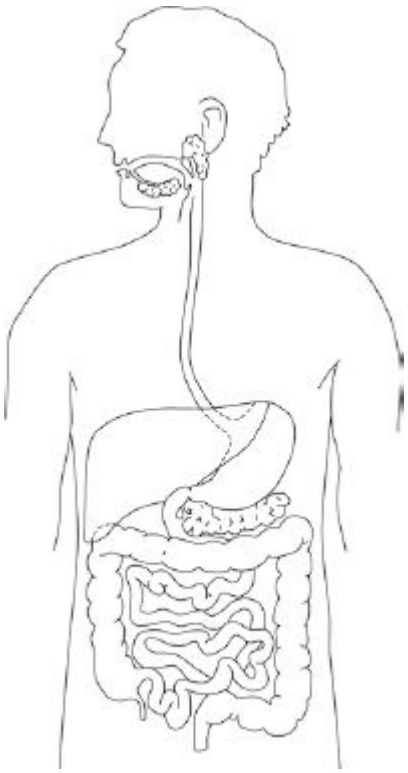
(6)
(Total 8 marks)

4 The diagram below shows the human digestive system.



(a) Label the stomach and pancreas on the diagram.

(1)

(b) Many people suffer from stomach ulcers caused by a species of bacteria called *Helicobacter pylori*.

The stomach is lined with a protective lining of mucus.

Helicobacter pylori are acid-tolerant bacteria which can damage this mucus lining.

Suggest how an infection with *Helicobacter pylori* might result in a stomach ulcer developing.

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(2)

(c) *Helicobacter pylori* can also cause stomach cancer.

Describe how a person infected with *Helicobacter pylori* could also develop liver cancer.

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(3)

(d) Gluten is a form of protein found in some grains.

Describe the test you would use to find out if protein is present in food.

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(2)

(e) Coeliac disease is a disease of the digestive system.

It damages the lining of the small intestine when foods that contain gluten are eaten.

When people with coeliac disease eat foods that contain gluten:
1. their immune system forms antibodies to gluten
2. these antibodies attack the lining of the small intestine
3. this causes inflammation in the intestines and damages the villi.

Symptoms of coeliac disease include poor growth.

Suggest why a person with coeliac disease might have this symptom.

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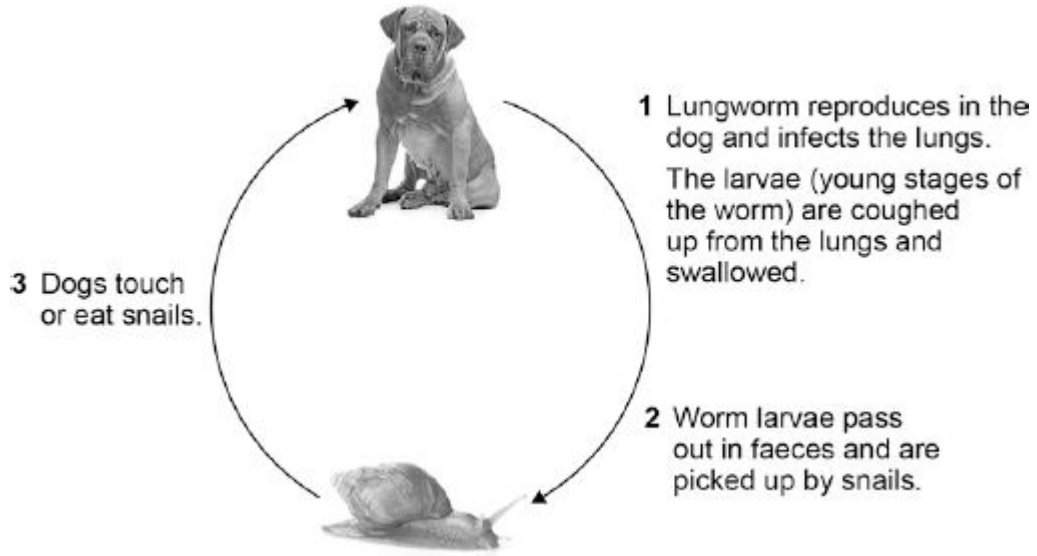
(4)
(Total 12 marks)

5 Lungworm is an infection.

Lungworm can kill dogs.

It is caused by a small worm.

The diagram below shows the lifecycle of the lungworm.



Dog © Eriklam/iStock/Thinkstock, snail © Karandaev/iStock/Thinkstock

(a) What type of organism is represented by the snail in the lifecycle of the lungworm?

Tick **one** box.

Fungus ☐

Parasite ☐

Protist ☐

Vector ☐

(1)

(b) Suggest how the spread of the lungworm disease can be prevented.

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(3)

(c) Malaria is a disease spread by mosquitoes.

Describe **two** ways to control the spread of malaria.

1 .....

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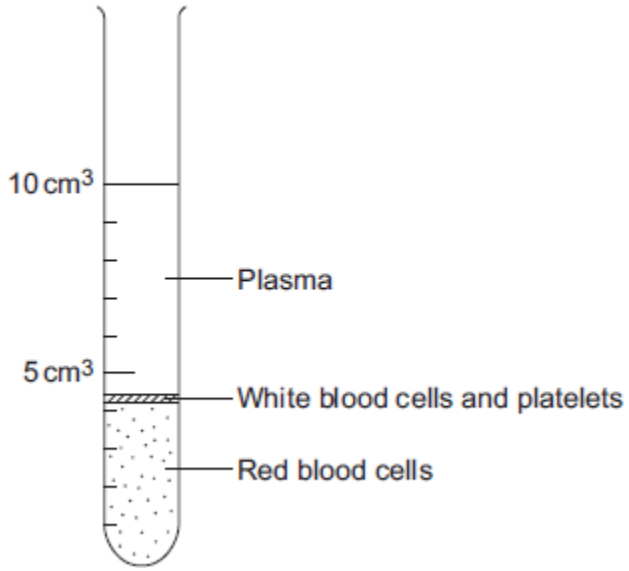
2 .....

.....

(2)
(Total 6 marks)

6 The parts of the blood can be separated from each other by spinning the blood in a centrifuge.

The image below below shows the separated parts of a 10 cm^3 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)

(c) **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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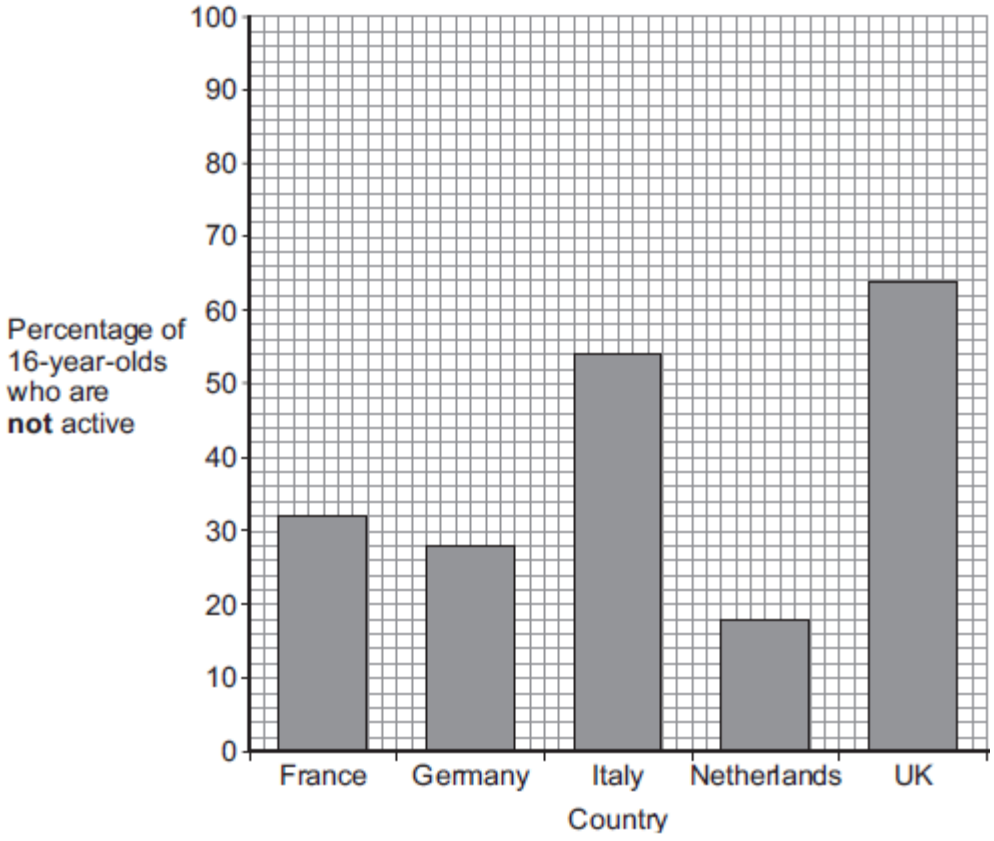
(6)
(Total 11 marks)

7 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)

(b) 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.

Amount of exercise done in minutes every week	**Health rating as %**
Less than 30	72
90	76
180	82
300	92

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

Use information from the table.

.....

.....

(1)

(c) 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)

(d) White blood cells are part of the immune system.

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

antibiotics	**antibodies**	**pathogens**	**vaccines**

(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)

8 Many people in the UK take sleeping pills.

(a) The drug thalidomide was developed as a sleeping pill in the 1950s. In the 1960s thalidomide was banned. Recently thalidomide has been used to treat other diseases.

Name **one** disease thalidomide is used to treat now.

.....

(1)

(b) The table shows information about the development of a new sleeping pill.

Type of test or trial	Preclinical	Clinical phase 1	Clinical phase 2	Clinical phase 3
Tested or trialled on	Cells, tissues or animals	20 −100 healthy volunteers	100 − 500 volunteer patients	1000 − 5000 volunteer patients
Number of compounds tested	>10 000	5 −10	2 − 3	1 (new sleeping pill)
Time taken for test or trial in years	1− 4	2− 4	1 − 3	2 − 4

(i) What is the shortest time taken to develop a new sleeping pill?

..... years

(1)

(ii) What is the **range** for the number of volunteers needed to complete all the clinical trials for the new sleeping pill?

.....

(1)

(c) Drugs are trialled to check for side effects on people.

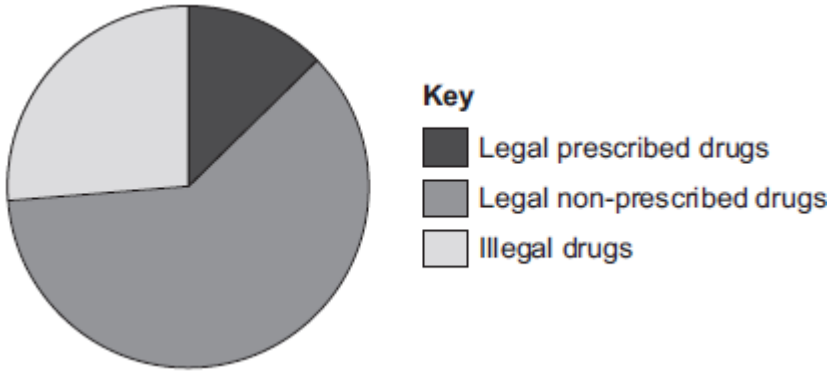
Give **one** other reason why drugs are trialled.

.....

.....

(1)

(d) The pie chart shows the impact on the health of the population caused by drugs from different sources.



(i) Legal non-prescribed drugs have a greater impact on the health of the population than illegal drugs.

Suggest **two** reasons why.

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(2)

(ii) Drugs change chemical processes in a person's body.

Why is it difficult for a person to stop taking certain drugs?

.....

.....

(1)
(Total 7 marks)

9 Antibiotics can be used to protect our bodies from pathogens.

(a) What is a pathogen?

.....

.....

(1)

(b) Bacteria may become resistant to antibiotics.

How can doctors reduce the number of bacteria that become resistant to antibiotics?

.....

.....

.....

.....

(2)

(c) Scientists grow microorganisms in industrial conditions at a higher temperature than is used in school laboratories.

(i) Which temperature would be most suitable for growing bacteria in industrial conditions?

Draw a ring around the correct answer.

25 °C **40 °C** **100 °C**

(1)

(ii) What is the advantage of using the temperature you gave in part (c)(i)?

.....

.....

(1)
(Total 5 marks)

10 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.

.....

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.....

(2)

(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.

Number of cases of TB per 100 000 people

Year	London	South East	South West
2000	37	5	3
2001	36	6	4
2002	42	6	6
2003	42	7	4
2004	42	7	5
2005	49	8	5
2006	44	8	3
2007	43	8	5
2008	44	8	5
2009	44	9	6
2010	42	9	5
2011	45	10	5

(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.

.....

.....

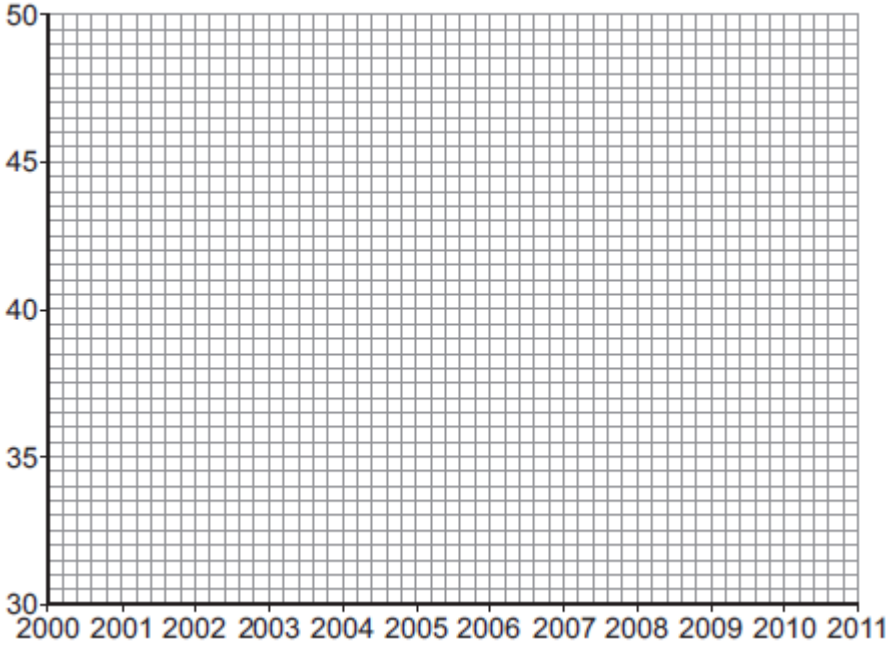
.....

.....

(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.



(4)

(ii) Suggest why a student thought the value for 2005 in London was anomalous.

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.....

(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.

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(2)
(Total 13 marks)

11 Drugs affect the human body.

(a) Draw **one** line from each drug to the correct information about the drug.

Drug	Information
	Used to boost heart rate
Cannabis	
	Used to treat leprosy
Steroid	
	May cause mental illness in some people
Stimulant	
	Used to increase muscle growth
Thalidomide	
	Used to treat measles

(4)

(b) New drugs must be tested and trialled before being used.

(i) New drugs are tested in a laboratory before they are trialled on people.

What are new drugs tested on in a laboratory?

.....

(1)

(ii) Why is it important that drugs are trialled before doctors give them to patients?

Tick (✓) **two** boxes.

To check that the drug works ☐

To check the cost of the drug ☐

To find out if the drug is legal ☐

To find the best dose to use ☐

(2)

(iii) In a double blind drug trial, only some people know which patients have been given the drug.

Who knows which patients have been given the drug?

Tick (✓) **one** box.

The patient and the doctor ☐

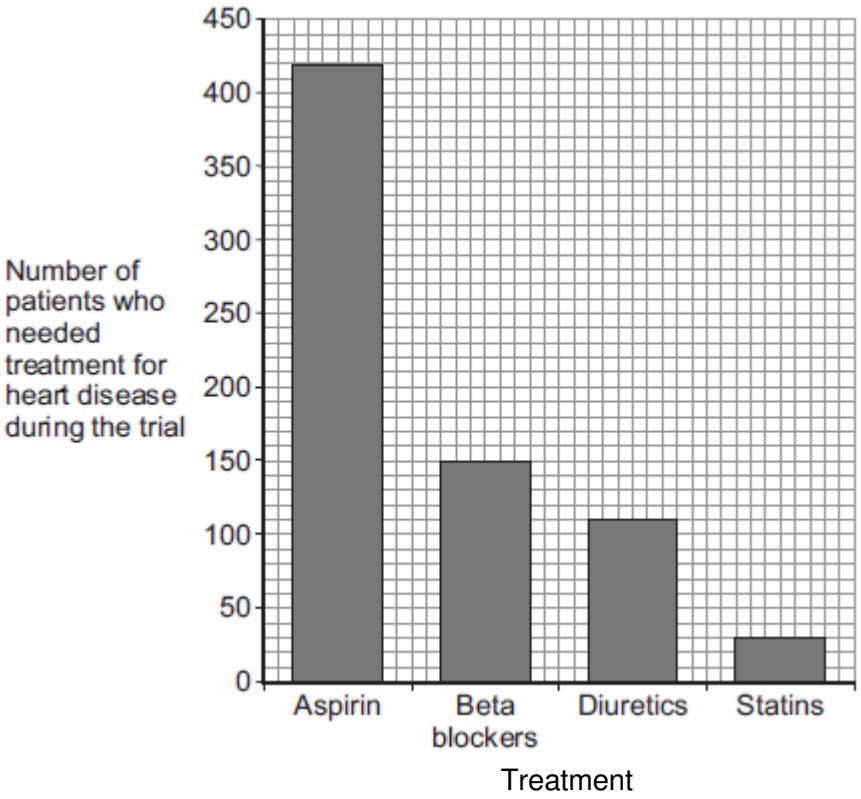
Only the doctor ☐

Only scientists at the drug company ☐

(1)

(c) Doctors trialled four different treatments for reducing the risk of heart disease.
Each treatment was trialled on the same number of patients for 5 years.
The patients did **not** have heart disease at the start of the trial.

The graph below shows the results.



(i) How many patients who took aspirin needed treatment for heart disease during the trial?

Number of patients = ...

(1)

(ii) Based **only** on the evidence in the graph, which would be the best treatment to reduce the risk of developing heart disease?

.....

(1)

(iii) Suggest **one** other factor that a doctor might consider before deciding which treatment to use for a patient.

.....

(1)
(Total 11 marks)

12 The MMR vaccine is used to protect against measles.

(a) Apart from measles, which **two** other diseases does the MMR vaccine protect against?

..... and .....

(1)

(b) Read the information.

> Measles is a dangerous disease caused by a virus.
> Normally, MMR vaccinations are given at 1 year old and again at 4 years old.
> Each vaccination is 90% effective in protecting against the measles virus.
>
> In April 2013, there were 630 cases of measles in children aged 4 and over in a small area of the UK. Of these cases, 504 children had not been vaccinated against MMR at all and only a few had been given a second vaccination.

(i) Calculate the percentage of the children who caught measles in April 2013 who had **not** been vaccinated against MMR.

.....

.....

.....

Percentage = ...

(2)

(ii) Suggest **one** advantage to the population as a whole of children having the second MMR vaccination.

.....

(1)

(c) (i) What does a vaccine contain?

.....

.....

(1)

(ii) Explain how a vaccination prevents infection.

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(3)

(d) (i) Antibiotics can only be used to treat some infections.

Explain why antibiotics **cannot** be used to treat measles.

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.....

(2)

(ii) Why do antibiotics become less useful at treating an infection if the antibiotic is overused?

.....

.....

(1)
(Total 11 marks)

13 Viruses and bacteria cause diseases in humans.

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

Organisms that cause disease are called

algae.

pathogens.

vaccines.

(1)

(b) In August 2011 the United Nations gave a warning that there was a new strain of the bird flu virus in China.

Bird flu may kill humans. The new strain of the bird flu virus could cause a *pandemic* very quickly.

(i) What is a *pandemic*?

Tick (✓) **one** box.

A disease affecting the people all over one country. ☐

A disease affecting hundreds of people. ☐

A disease affecting people in many countries. ☐

(1)

(ii) The swine flu virus is carried by pigs.

The bird flu virus is likely to spread much more quickly than the swine flu virus.

Suggest **one** reason why.

.....

.....

(1)

This notice is from a doctor's surgery.

Unfortunately, antibiotics will NOT get rid of your flu.

(c) (i) Why will antibiotics **not** get rid of flu?

.....

.....

(1)

(ii) The symptoms of flu include a sore throat and aching muscles.

What would a doctor give to a patient to relieve the symptoms of flu?

.....

(1)

(iii) It is important that antibiotics are **not** overused.

Explain why.

Use words from the box to complete the sentence.

antibody	**bacteria**	**immune**	**resistant**	**viruses**

Overuse of antibiotics might speed up the development

of ..... strains of ..... .

(2)

(Total 7 marks)

14 A student is given a tube containing a liquid nutrient medium. The medium contains one type of bacterium.

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

The student is told to grow some of the bacteria on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

You should explain the reasons for each of the steps you describe.

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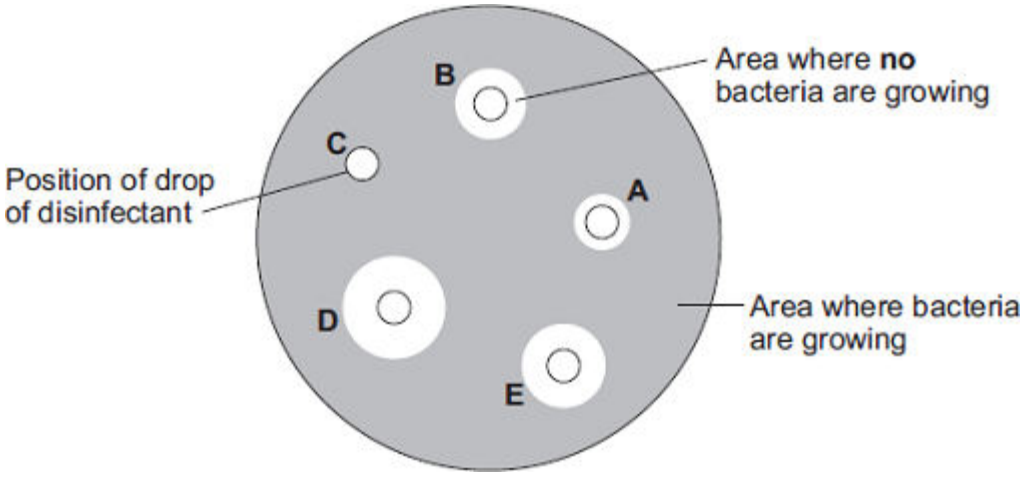
(6)

(b) After the culture had been prepared, the student added one drop of each of five disinfectants, **A**, **B**, **C**, **D** and **E**, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



(i) There are areas on the agar jelly where **no** bacteria are growing.

Why?

.....

.....

(1)

(ii) The student concluded that disinfectant **D** would be the best for using around the home.

Give **one** reason why the student might be correct.

.....

.....

.....

Give **one** reason why the student might **not** be correct.

.....

.....

.....

(2)
(Total 9 marks)

15 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?

.....

.....

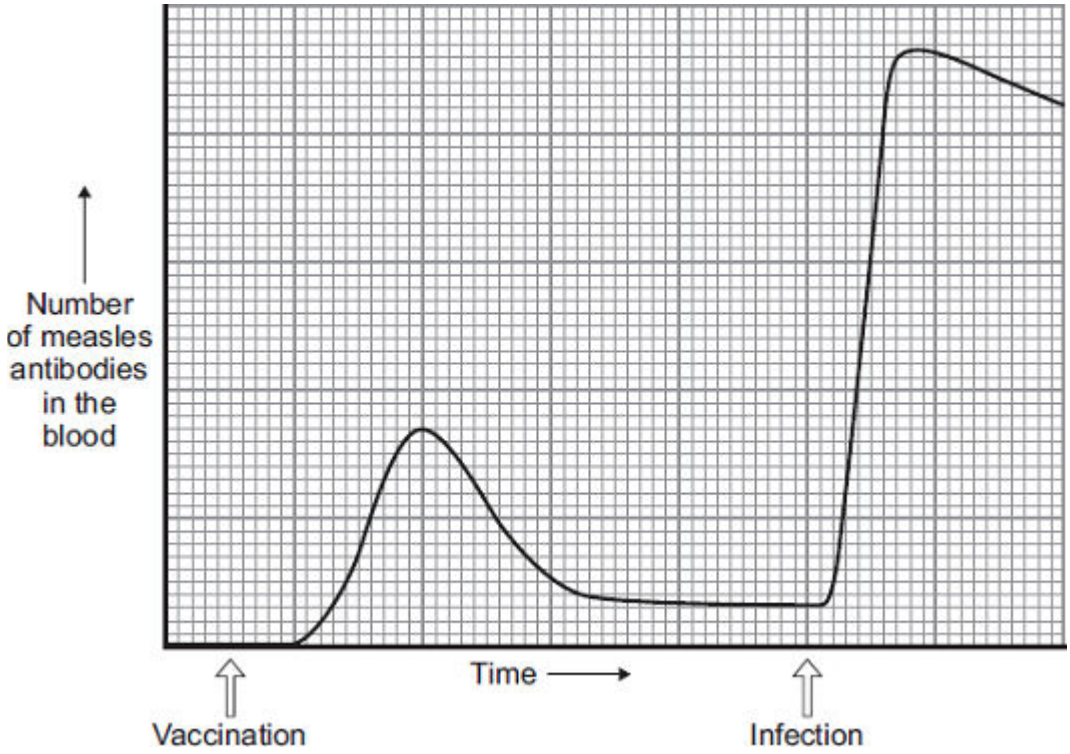
.....

.....

(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.

.....

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.....

(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)

16 (a) Use words from the box to complete the sentences about curing disease.

antibiotics	**antibodies**	**antitoxins**	**painkillers**	**statins**

The substances made by white blood cells to kill pathogens

are called ..... .

The substances made by white blood cells to counteract poisons produced by

pathogens are called ..... .

Medicines which kill bacteria are called ..... .

(3)

(b) The MMR vaccine protects people against three diseases.

Write down the names of **two** of these diseases.

1 .....

2 .....

(2)

(c) All vaccinations involve some risk.

The table shows the risk of developing harmful effects:

- from the disease if a child is **not** given the MMR vaccine
- if a child **is** given the MMR vaccine.

Harmful effect	**Risk of developing the harmful effect from the disease if not given the MMR vaccine**	**Risk of developing the harmful effect if given the MMR vaccine**
Convulsions	1 in 200	1 in 1000
Meningitis	1 in 3000	Less than 1 in 1 000 000
Brain damage	1 in 8000	0

A mother is considering if she should have her child vaccinated with the MMR vaccine.

Use information from the table to persuade the mother that she should have her child vaccinated.

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.....

.....

.....

.....

(2)
(Total 7 marks)

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

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

.....

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.....

.....

(2)

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

Explain why.

.....

.....

.....

.....

(2)

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

Explain how this makes the person immune to the disease.

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.....

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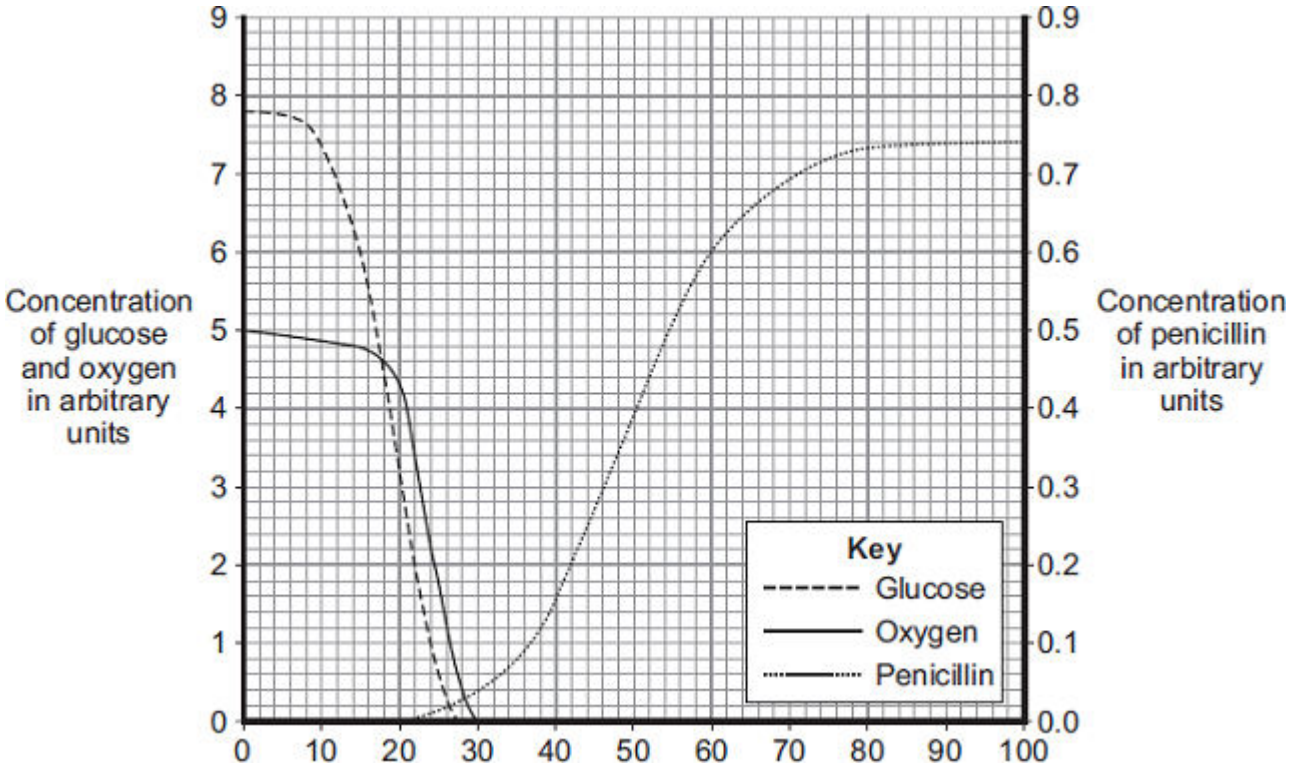
(3)
(Total 7 marks)

18 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?

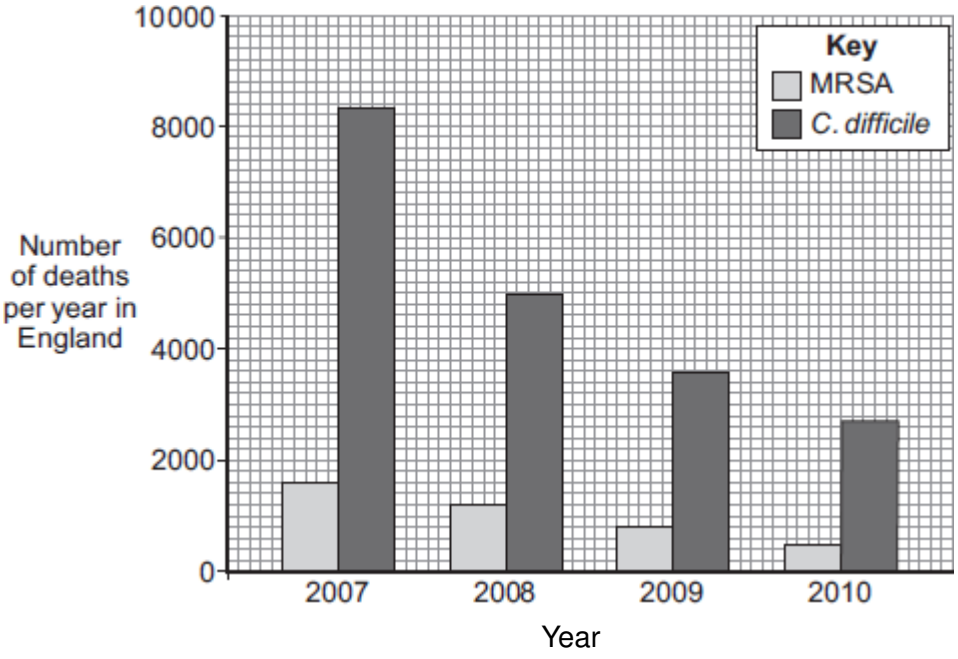
Draw a ring around **one** answer.

distillation **filtration** **respiration**

(1)
(Total 6 marks)

19 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*.

.....

.....

.....

.....

(2)

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

Explain your answer.

.....

.....

.....

.....

(2)

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

.....

.....

.....

Percentage change in deaths caused by MRSA = ... %

(2)

(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.

.....

.....

(1)

(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.

.....

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.....

.....

(3)
(Total 10 marks)

20 Malaria is caused by the malaria parasite.

(a) Describe what happens during the *liver infection stage* of the life cycle of the malaria parasite.

.....

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(3)

(b) Read the information about the development of a vaccine against malaria.

Scientists have removed two important genes in a malaria parasite. This malaria parasite causes the type of malaria most deadly to humans. When the genes are removed the malaria parasite stays in the liver infection phase, stopping the parasite spreading to the blood stream where the parasite can cause severe disease and death.

Scientists are using the genetically modified malaria parasites to develop a vaccine against malaria. Similar vaccines have been tested in mice and produce 100 per cent protection against malaria infection. Scientists hope that the vaccine will produce similar results in humans.

Although two genes have been removed, the parasite is alive and able to stimulate the body's protective immune system to recognise malaria parasites coming into the body. Scientists think the weakened parasites used in the vaccine will not become harmful again because the genes have been removed from the genetic material and the parasite could not recreate the gene.

Evaluate the use in humans of the new vaccine against the malaria parasite.

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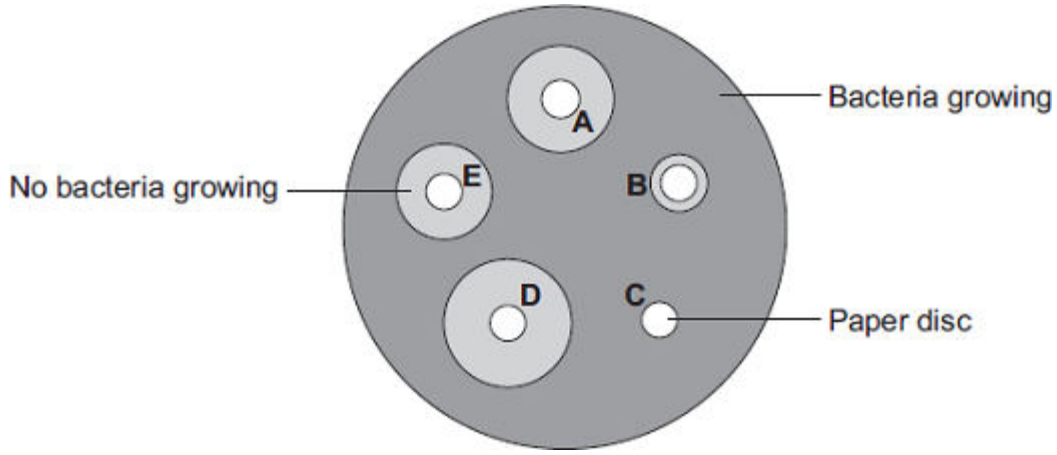
(3)
(Total 6 marks)

21 Students in a school investigated the effect of five different antibiotics, **A**, **B**, **C**, **D** and **E**, on one type of bacterium.

The students:

- grew the bacteria on agar jelly in a Petri dish
- soaked separate paper discs in each of the antibiotics
- put the paper discs onto the bacteria in the Petri dish
- put the Petri dish into an incubator.

The diagram shows what the Petri dish looked like after 3 days.



(a) (i) What is the maximum temperature the incubator should be set at in the school?

Draw a ring around your answer.

10°C **25°C** **50°C**

(1)

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

The incubator should **not** be set at a higher temperature because the higher temperature might help the growth of

pathogens.
toxins.
viruses.

(1)

(b) Which antibiotic, **A**, **B**, **C**, **D** or **E**, would be best to treat a disease caused by this type of bacterium?

Write your answer in the box. ☐

Give the reason for your answer.

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.....

(2)

(c) Antibiotics **cannot** be used to treat diseases caused by viruses.

Why?

Tick (✓) **one** box.

Viruses are not pathogens ☐

There are too many different types of virus ☐

Viruses live inside cells ☐

(1)
(Total 5 marks)

22 In the 1800s, many women died from disease after giving birth.

Dr Semmelweis compared the death rates of women in two hospital wards, **Ward A** and **Ward B**.

Table 1 shows some of the results.

Table 1

Year	Percentage (%) of women who died	
	Ward A	**Ward B**
1834	7.7	7.4
1836	7.5	7.8
1844	8.4	2.1
1846	11.3	2.8

Before 1840
Doctors and nurses worked in **Ward A** and in **Ward B**.
The doctors often worked in other wards with patients who had diseases.
The doctors did **not** wash their hands.

After 1840
Doctors only worked in **Ward A** and **not** in **Ward B**.
Only nurses worked in **Ward B**.
The nurses did **not** work in other wards with patients who had diseases.

(a) (i) Look at the data for **Ward A** and **Ward B** after 1840.

Describe the effect on death rate of having **only** nurses working in **Ward B** and **not** doctors.

To gain full marks you must refer to the data in **Table 1**.

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(2)

(ii) Suggest an explanation for the difference you described in part (a)(i).

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(2)

(b) In 1847, Dr Semmelweis told the doctors to wash their hands each time before they began to work in **Ward A**.

Table 2 shows the death rates in the two wards, after 1847.

Table 2

Year	Percentage (%) of women who died	
	Ward A	**Ward B**
1848	2.7	2.8
1849	2.0	1.9

Dr Semmelweis was right to tell the doctors to wash their hands.

What evidence is there to support Dr Semmelweis telling the doctors to wash their hands?

Use information from **Table 1** and **Table 2** in your answer.

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(3)

(c) In modern hospitals less than 0.1% of women die from disease after giving birth.

Medical understanding has improved since the 1850s to reduce the death rate.

Other than improvements in hygiene, give **two** reasons for the low death rate from infectious diseases in modern hospitals.

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(2)
(Total 9 marks)

23 Nicotine is a drug in tobacco smoke. Smoking tobacco is harmful.

(a) (i) Many smokers find it difficult to stop smoking.

Complete the sentence.

It is difficult to stop smoking because nicotine is very ..... .

(1)

(ii) Nicotine affects synapses in the brain.

What is a synapse?

.....

.....

(1)

(b) A drug company has developed a new drug, Drug **A**, to help people stop smoking.

Doctors tested the drug in a double-blind trial with over 2000 volunteers who weresmokers.

The volunteers wanted to stop smoking.

The volunteers were divided into three groups. Each volunteer took a tablet once a day for 12 weeks:

- group 1 took Drug **A**
- group 2 took Drug **B** (a drug already in use to stop people smoking)
- group 3 took a placebo.

The smoking habits of each group were recorded for a year.

(i) What is a placebo?

.....

(1)

(ii) Why is a placebo group used in drug trials?

.....

.....

(1)

(iii) Which people knew what was in each tablet, in this trial?

Tick (✓) **one** box.

Both doctors and volunteers ☐

Doctors but not volunteers ☐

Neither doctors nor volunteers ☐

(1)

(iv) It is important that the three groups of volunteers should be similar.

Give **two** factors that should be similar in the groups of volunteers.

1 .....

2 .....

(2)

(c) The table shows the results of the trials.

Tablet	**Percentage of volunteers who had stopped smoking**	
	After 12 weeks	**After 1 year**
Drug **A**	44	23
Drug **B**	30	15
Placebo	18	10

A doctor looked at the results of the tests.

The doctor suggested that a smoker who wanted to give up smoking should use Drug **A**.

Why?

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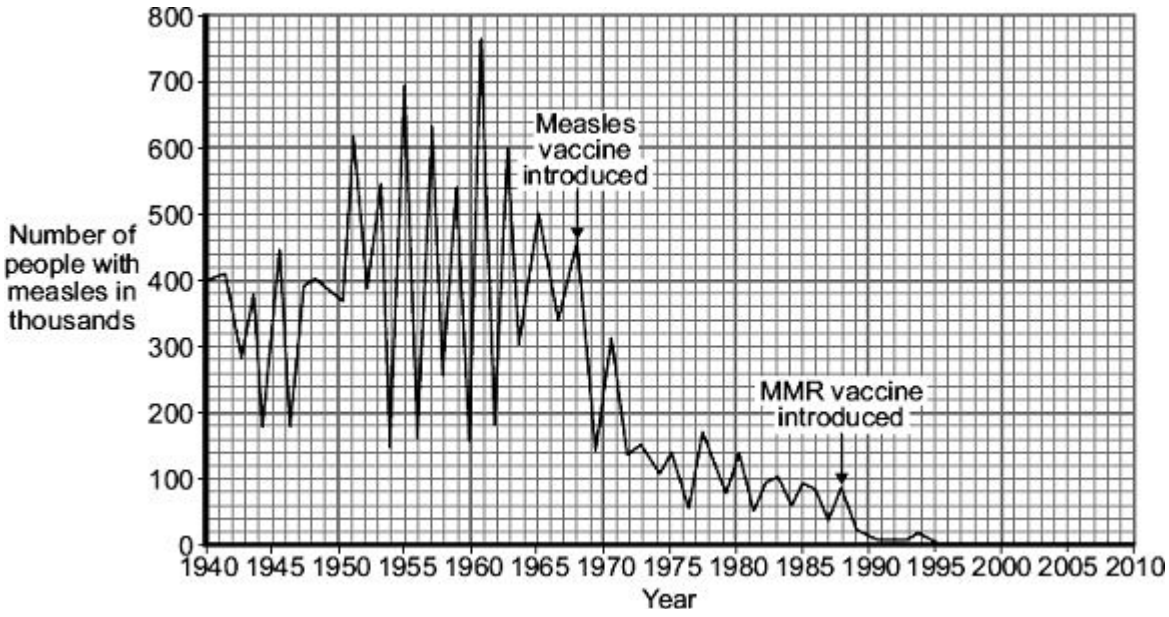
(1)
(Total 8 marks)

24 The graph shows the number of people with measles in the UK between 1940 and 2010.



(a) Compare how effective introducing the measles vaccine was with introducing the MMR vaccine.

Use data from the graph.

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(3)

(b) The MMR vaccine was introduced in 1988.

Other than measles, which **two** diseases does the MMR vaccine protect against?

1 ..... 2 .....

(2)

(c) To immunise someone against measles, a small quantity of the inactive measles pathogen is injected into the body.

Describe what happens in the body after immunisation to stop a person catching measles in the future.

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(3)
(Total 8 marks)

25 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?

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(1)

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

Give **three** reasons why.

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(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.

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(6)
(Total 10 marks)

26 Read the article.

> 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.

(1)

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

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(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)

27 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?

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(1)

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

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(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)

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

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(4)

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

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

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(1)

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

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

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(2)
(Total 7 marks)

29 Scientists at a drug company developed a new pain-killing drug, drug **X**.

(a) Painkillers do **not** cure infectious diseases.

Why?

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(1)

(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.

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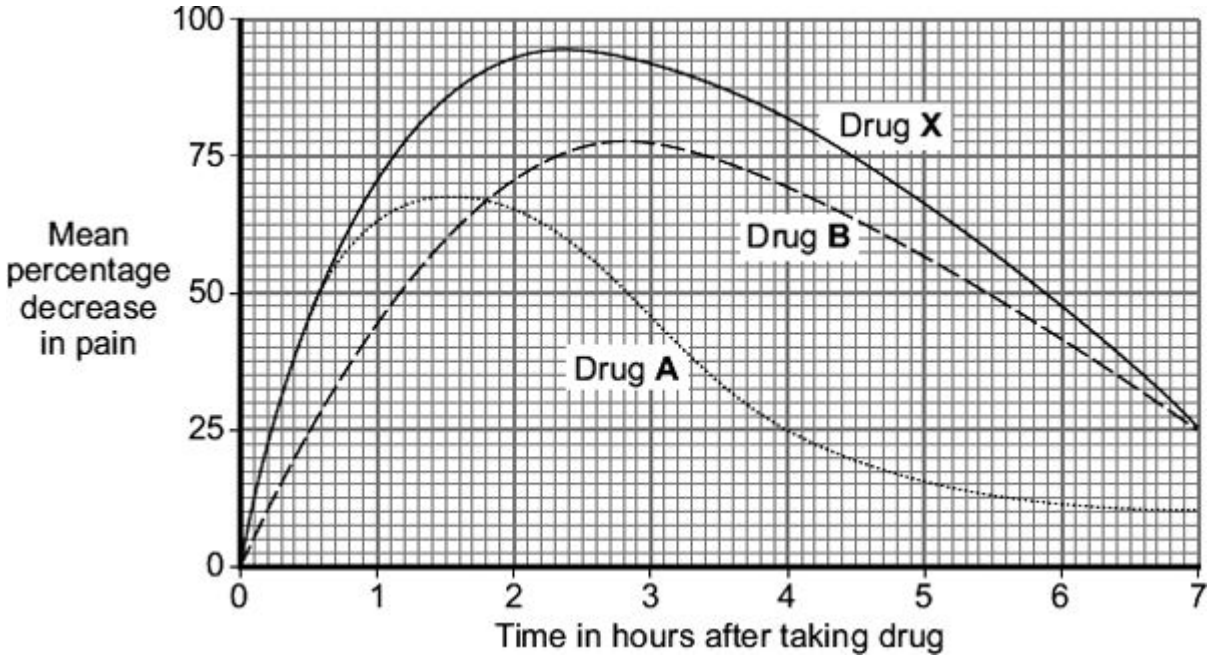
(2)

(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

(1)

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

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(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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(3)
(Total 10 marks)

30 People may be immunised against diseases using vaccines.

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

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(2)

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

Explain why.

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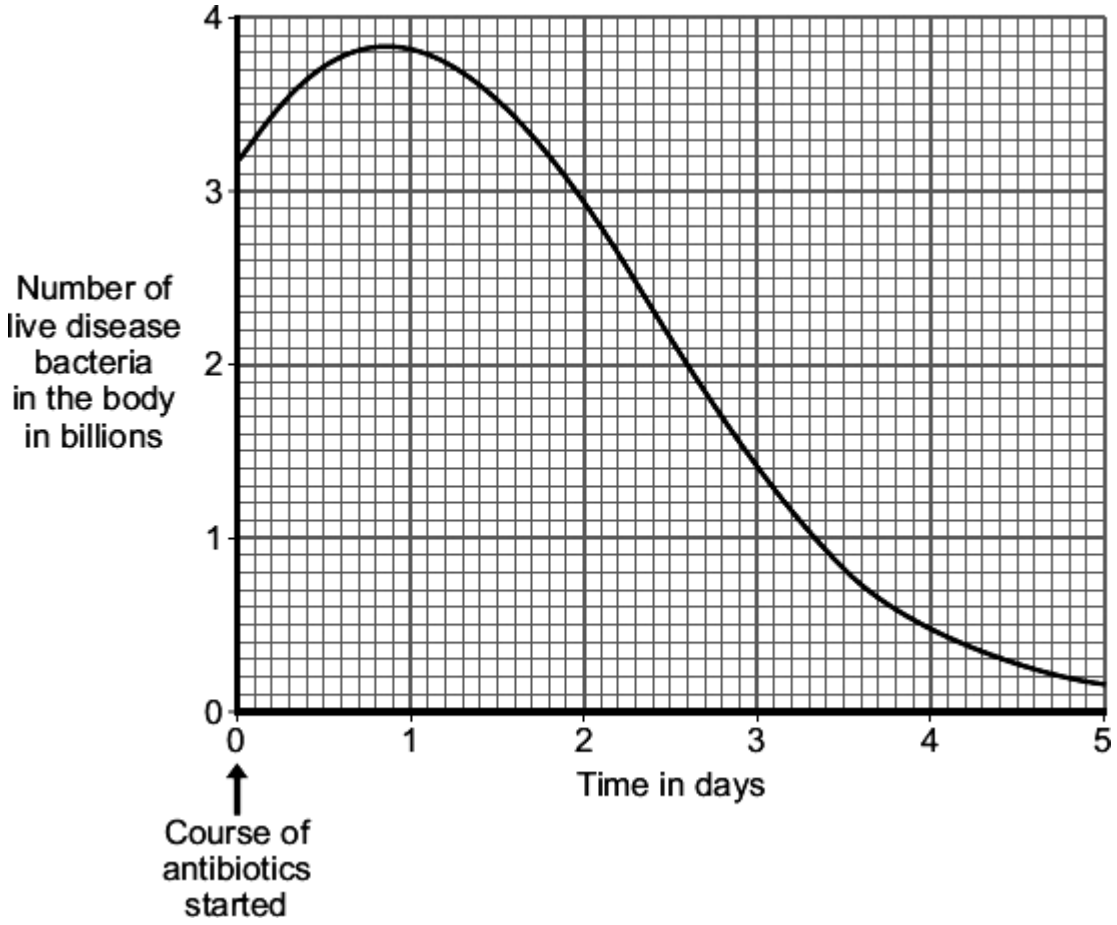
(3)

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

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



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

Explain why.

Use information from the graph.

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(2)

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

The new strain may spread rapidly.

Explain why.

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(3)
(Total 10 marks)

31 (a) **List A** gives the names of three substances. The substances can help ill people.

List B gives information about the three substances.

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

List A **Substance**	**List B** **Information**
	White blood cells produce this substance
Antibiotic	
	This substance is used to kill bacteria
Antitoxin	
	This substance lowers blood cholesterol levels
Painkiller	
	This substance relieves only the symptoms of a disease

(3)

(b) Complete the sentences.

A vaccine contains an ..... form of a pathogen.

(1)

The MMR vaccine protects children against measles,

mumps and .....

(1)

(Total 5 marks)

32 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.

Percentage change in mass of each volunteer	Number of volunteers
gained mass or lost 0 to 3.9 %	1900
lost 4.0 to 4.9 %	1100
lost 5.0 to 9.9 %	1500
lost 10 % or more	1500

(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.

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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.

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(1)

(Total 5 marks)

33 (a) **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**.

List A **Stage**	**List B** **Information**
	Used to find if the drug is toxic
Tests on humans including a placebo	
	The first stage in the clinical trials of the drug
Tests on humans using very small quantities of the drug	
	Used to find the optimum dose of the drug
Tests on animals	
	Used to prove that the drug is effective on humans

(3)

(b) Read the passage.

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.

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(3)
(Total 6 marks)

34 Many strains of bacteria have developed resistance to antibiotics.

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

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

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

Show clearly how you work out your answer.

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.....

Percentage increase = ...

(2)

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

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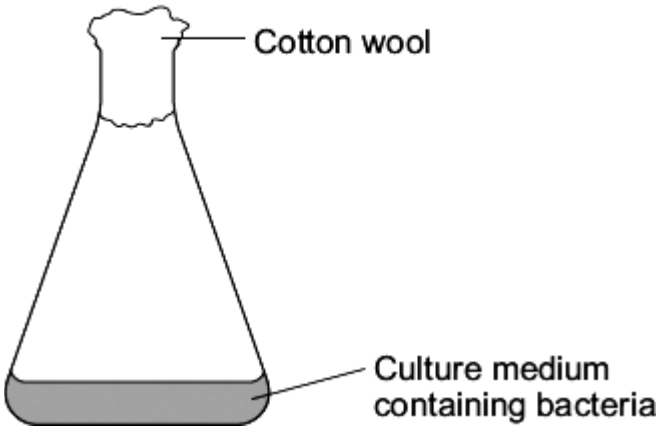
(3)
(Total 5 marks)

35 Some students grew one species of bacterium in a flask.

Diagram 1 shows the flask.

Diagram 1



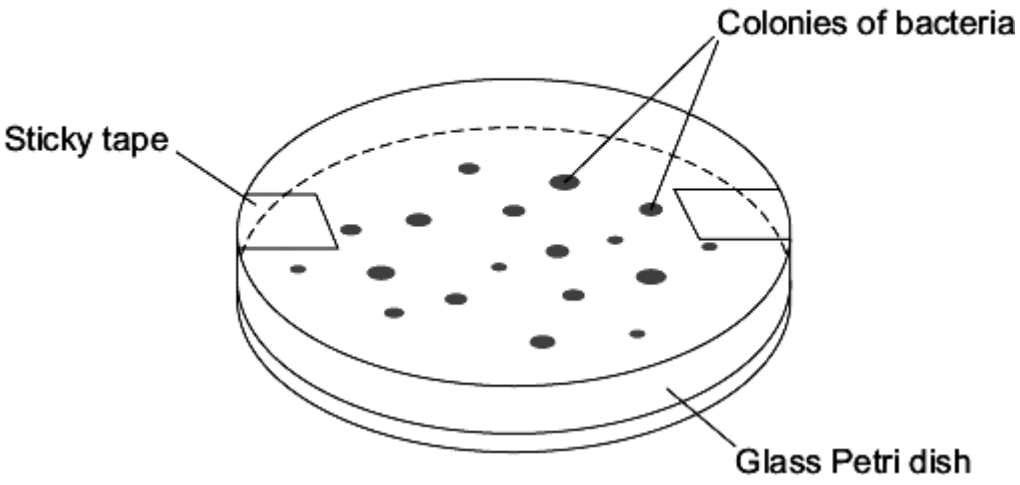
The students wanted to find the number of bacteria in 1 cm^3 of the culture medium.

The students:

- diluted 1 cm^3 of the culture medium from the flask with 999 cm^3 of water
- added 1 cm^3 of diluted culture to sterilised nutrient agar in a Petri dish
- placed the Petri dish in an incubator at 25 °C.

Diagram 2 shows the Petri dish after 3 days in the incubator.

Diagram 2



(a) Each colony of bacteria is formed where one bacterium landed on the agar jelly.

How is each colony formed?

.....

.....

(1)

(b) Complete the following calculation to find how many bacteria there were in 1 cm^3 of the undiluted culture.

Number of colonies of bacteria in the Petri dish = ...

These colonies were formed from 1 cm^3 of the culture diluted × 1000.

Therefore, number of bacteria in 1 cm^3 of undiluted culture = ...

(2)

(c) It is important to sterilise the culture medium and all the apparatus before use.

Explain why.

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.....

(2)

(d) The bacteria would grow faster at 35 °C. In a school laboratory, the Petri dish should **not** be incubated at a temperature higher than 25 °C.

Why?

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(1)

(e) The students decided to repeat their investigation.

Why?

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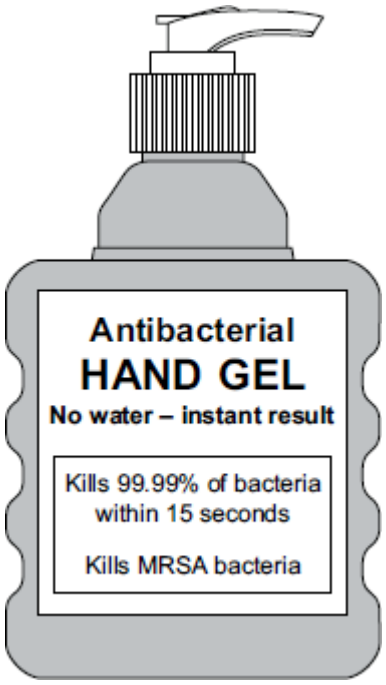
.....

(1)

(Total 7 marks)

36 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.

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(2)

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

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(3)
(Total 5 marks)

37 Scientists have trialled a new statin called rosuvastatin.

- 17 802 people took part in the trial.
- All of these people had high levels of a protein called CRP in their blood.
- The higher the level of CRP in the blood, the higher the risk of a heart attack.
- None of these people had heart conditions at the beginning of the investigation.
- None of these people had high LDL (low density lipoprotein) levels.
- All of these people were aged 50 or above.
- Half the people were given a rosuvastatin tablet each day; the other half were given a placebo.
- The trial was stopped 7 months early when it was found that the people given rosuvastatin were 54% less likely to have a heart attack than people given the placebo.

(a) Give **two** control variables in this investigation.

1 .....

2 .....

(2)

(b) What would the placebo be in this investigation?

.....

.....

(1)

(c) The trial gave reliable results.

Give **one** reason why.

.....

.....

(1)

(d) The trial was stopped 7 months early.

Give **one** reason why.

.....

.....

(1)

(e) The manufacturers of rosuvastatin paid for the trial.

However, the manufacturers took no part in the trial.

Suggest **one** reason why the manufacturers did not take part in the trial.

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(1)

(f) The table shows some of the results of the trial.

Substance	**Concentration in blood in mg per 100 cm^3 after 3 years of trial**	
	People given rosuvastatin	People given placebo
LDL cholesterol	53	106
HDL cholesterol	50	49
Saturated fats	106	123

Rosuvastatin reduces the risk of heart attacks.

Use the data in the table to explain why.

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(2)
(Total 8 marks)

38 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)

39 Vaccines protect us against diseases.

(a) Against which **three** diseases does the MMR vaccine protect us?

Tick (✓) **three** boxes.

Malaria ☐

Measles ☐

Meningitis ☐

Mumps ☐

Rabies ☐

Rubella ☐

(3)

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

Vaccines cause white blood cells to produce

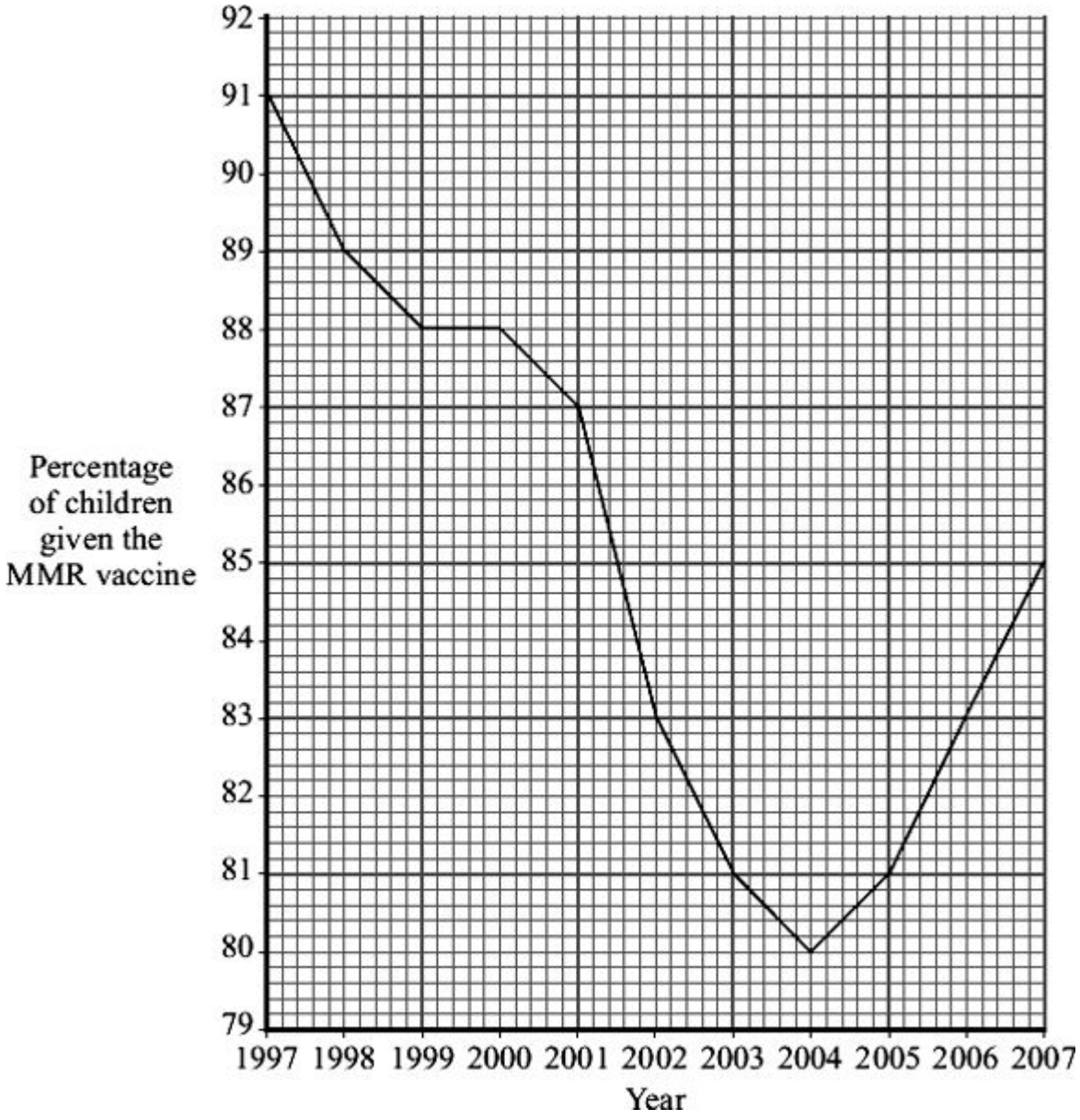
antibodies.

cholesterol.

penicillin.

(1)

The graph shows the percentage of children given the MMR vaccine in the UK between 1997 and 2007.



(c) (i) Describe the pattern shown by the data on the graph.

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.....

.....

(2)

(ii) Suggest **one** explanation for the change in the percentage of children given the MMR vaccine between 1997 and 2004.

.....

.....

(1)

(Total 7 marks)

40 Medicinal drugs are used to treat diseases.

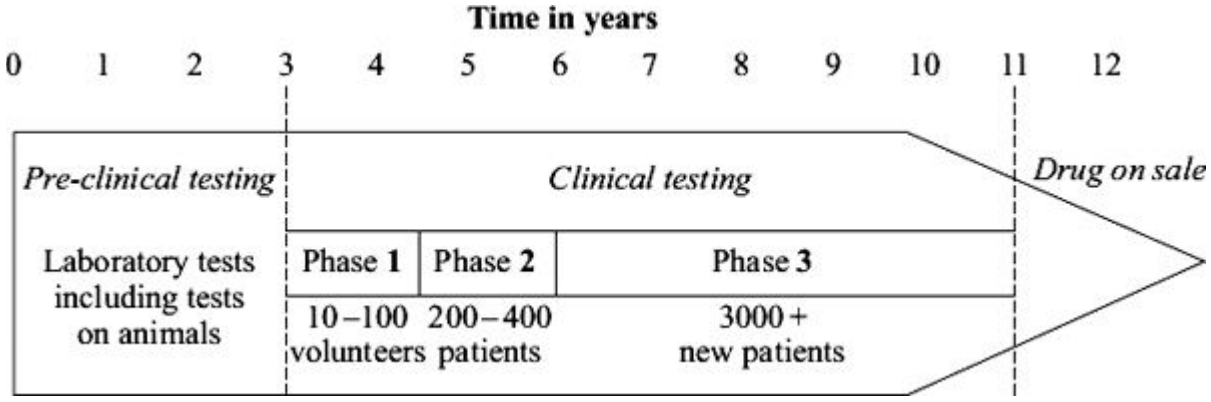
(a) Draw **one** line from each drug to its correct use.

Drug	Use
	Used as a fertility drug
Painkiller	
	Used to relieve disease symptoms
Statin	
	Used to treat leprosy
Thalidomide	
	Used to lower blood cholesterol

(3)

(b) New drugs need to be tested before going on sale.

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



(i) How long do trials on humans take? ..... years

(1)

(ii) What is the minimum number of humans the drug is tested on throughout *clinical testing?*

.....

(1)

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

(i) A new drug is first tested in the laboratory to find

- if it is toxic.
- if it is cost effective.
- the optimum dose.

(1)

(ii) The drug is then tested on a few volunteers to find

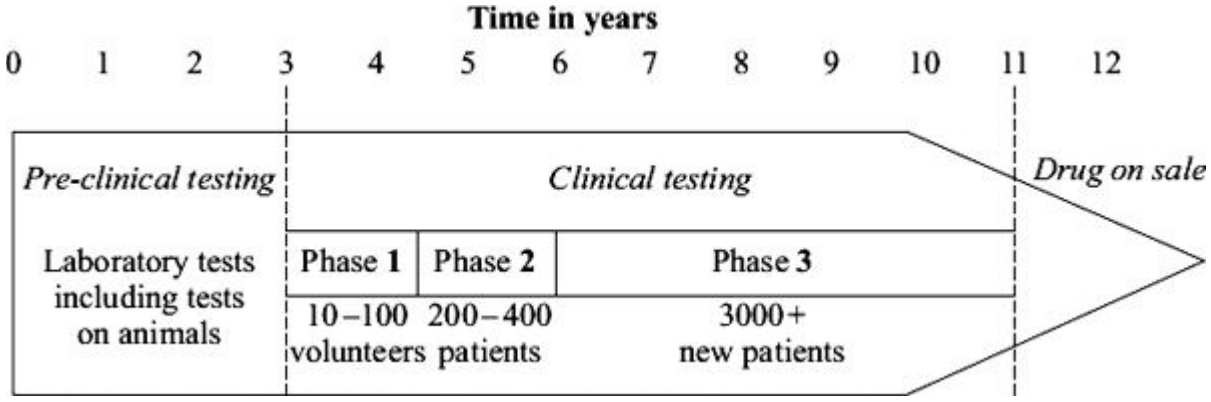
- if it is cost effective.
- if it has side effects.
- the optimum dose.

(1)

(Total 7 marks)

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

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



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

.....

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(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?

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(1)

(ii) In Phase **1** testing, healthy volunteers are used rather than patients.

Suggest **one** reason for this.

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(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)

42 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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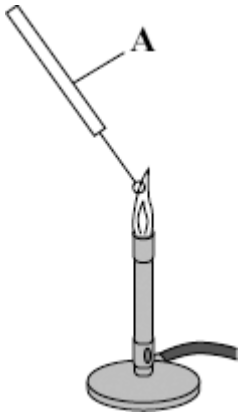
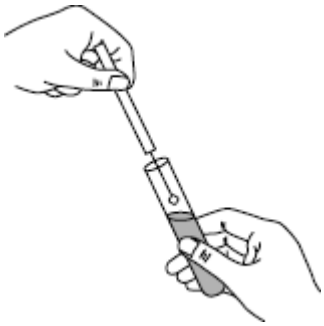
(3)
(Total 4 marks)

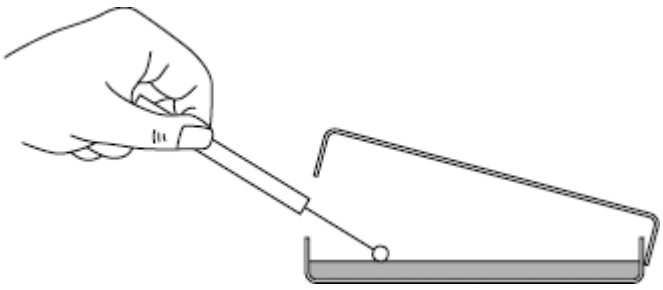
43 (a) It is important to prevent contamination when growing microorganisms.

The diagram shows the transfer and culturing of microorganisms.

Stage V  A Petri dish with agar is heated to 150 °C for 50 minutes, then cooled

Stage W 

Stage X 

Stage Y 

Stage Z  Petri dish kept at 25 °C for 48 hours

(i) Name the apparatus labelled **A** in stage **W**.

Draw a ring around **one** answer.

inoculating loop **pipette** **thermometer**

(1)

(ii) Give the letters of the **two** stages from **V**, **W**, **X**, **Y** and **Z**, which are carried out to kill microorganisms.

Stages ☐ and ☐

(2)

(iii) Give the letter of the stage, **V**, **W**, **X**, **Y** or **Z**, where incubation takes place.

Stage ☐

(1)

(b) A culture medium used for growing microorganisms contains various nutrients.

Which nutrient is the main source of energy for the microorganisms?

Draw a ring around **one** answer.

carbohydrates **mineral ions** **vitamins**

(1)
(Total 5 marks)

44 Diet and exercise affect health.

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

Obesity can lead to heart disease.

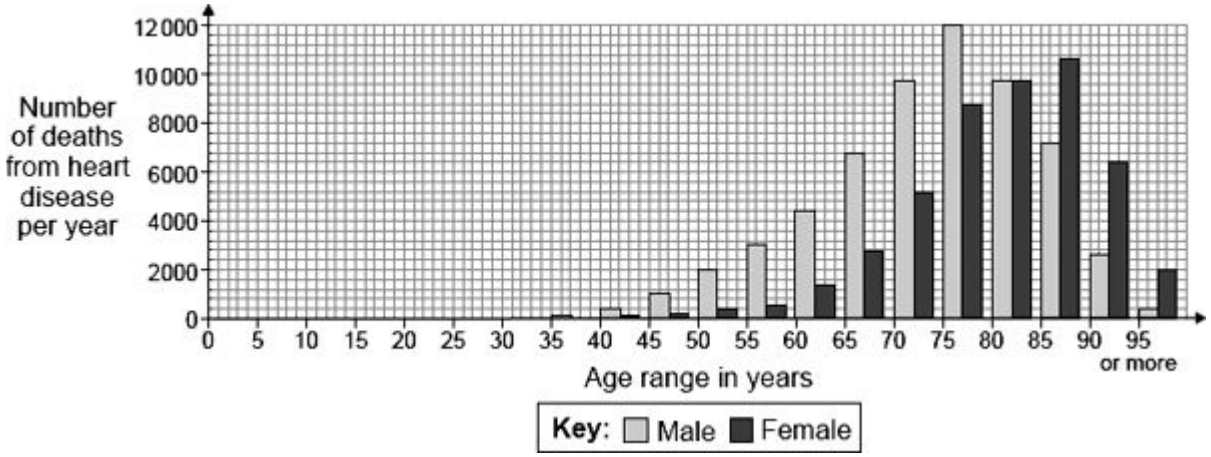
Other than heart disease, name **two** conditions which are linked to obesity.

1 .....

2 .....

(2)

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



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 .....

.....

(3)
(Total 9 marks)