1 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**.

_____

_____

_____

_____

(2)

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

_____

_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

(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.

_____

_____

_____

_____

(2)

(Total 9 marks)

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

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

Why?

_____

(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.

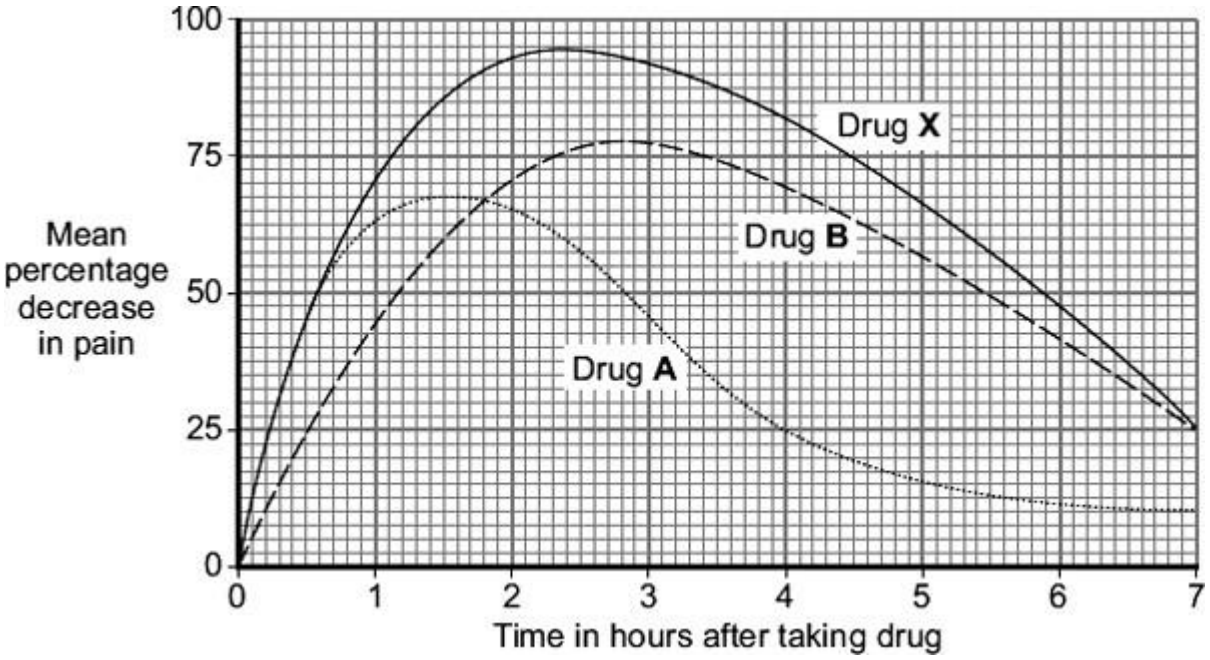
Suggest **two** of the factors that should be matched.

_____

_____

(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**.

_____

_____

(1)

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

_____

_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

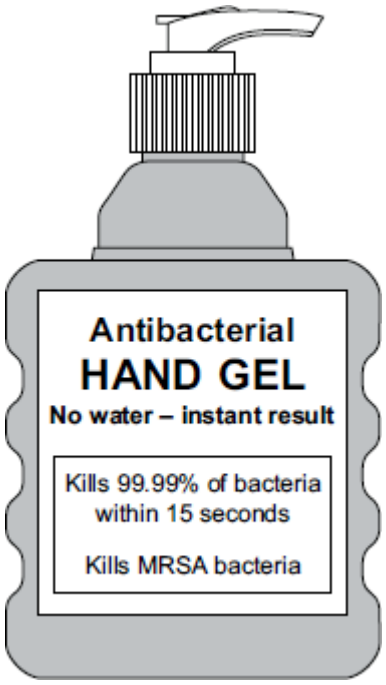
_____

(3)

(Total 10 marks)

3 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.

_____

_____

_____

_____

(2)

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

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

4 (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.

(3)

(Total 6 marks)

5 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?

_____

(1)

(c) The scientists did **not** prove that the advice 'wrap up warm or you'll catch a cold' is true.

Explain why.

_____

_____

_____

_____

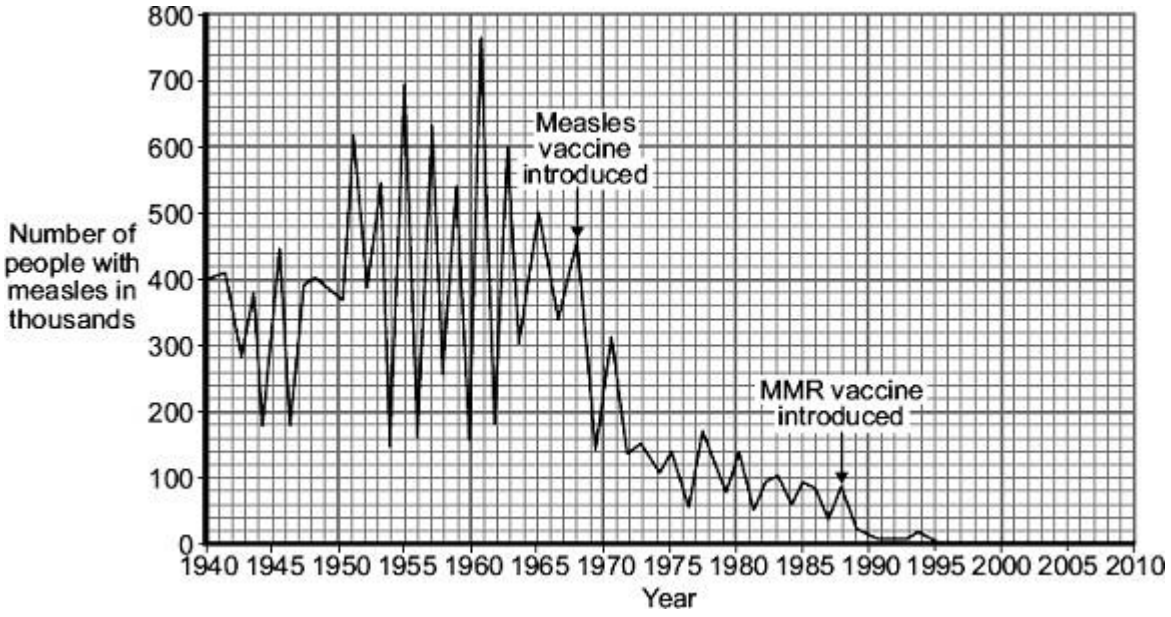
_____

_____

(3)

(Total 5 marks)

6 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.

_____

_____

_____

_____

_____

_____

_____

_____

(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.

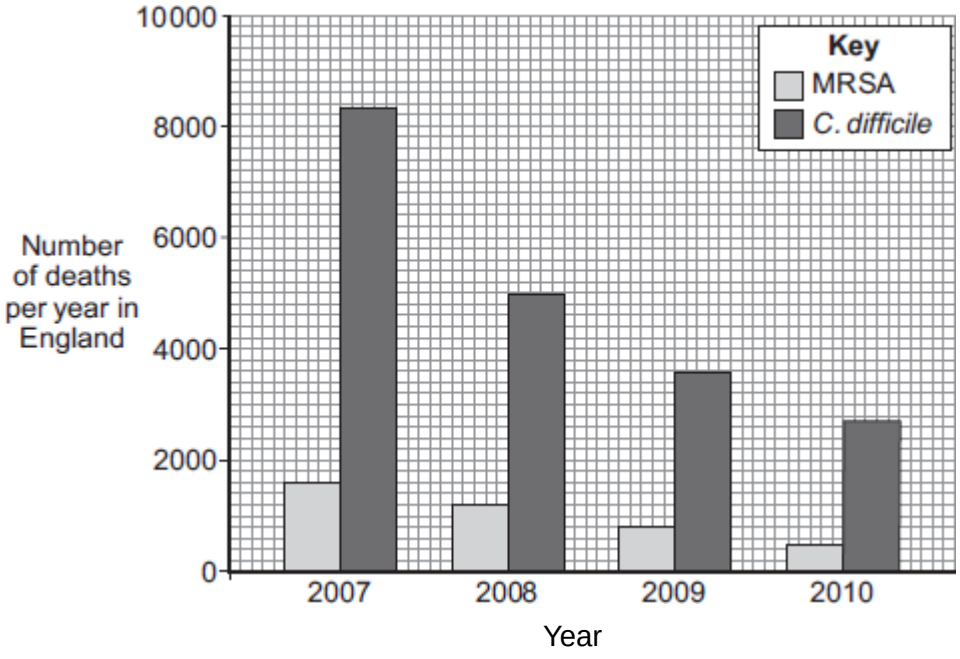
Describe what happens in the body after immunisation to stop a person catching measles in the future.

(3)

(Total 8 marks)

7 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.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

8 Malaria is caused by the malaria parasite.

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

_____

_____

_____

_____

_____

_____

(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.

(3)

(Total 6 marks)

1 (a) (i) lower percentage (of women) who died

allow fewer (women) died

1

numerical reference to a pair of figures to show this

allow any difference in a pair of figures

1

(ii) doctors were not <u>transferring</u>

ignore reference to nurses

1

pathogens / bacteria / viruses / microorganisms / microbes

allow fungi

ignore disease / germs / infection

1

(b) any **three** from:

- lower percentage of patients died (when doctors washed hands or in ward A)

  allow fewer for lower percentage
- large decrease or reference to proportional decrease

  ignore raw data
- little / no difference / similar to ward B
- continued drop (in ward A)

3

(c) any **two** from:

- better understanding / knowledge <u>ofimmunity</u>

  accept ref to immunisation / vaccination
- better / new drugs

  accept examples, e.g. antibiotics / penicillin (discovered)

  allow better / new medicines
- sterilisation of equipment **or** isolation of patients **or** some infectious diseases wiped out **or** earlier identification / treatment of infections

  ignore references to general hygiene

2

[9]

2 (a) don't kill pathogens / bacteria / viruses / microbes / microorganisms

allow don't contain antibiotics

ignore antibodies / attack / fight

allow <u>only</u> treat symptoms / pain

ignore kill disease / germs

1

(b) any **two** from:

- age
- gender
- extent / severity of pain
  or how long had pain <u>before trial</u>
- 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

2

(c) (i) 75

ignore calculations / %

1

(ii) fast<u>er</u> pain relief / decrease

allow pain relief soon<u>er</u>

***or** it works quick<u>er</u>*

***or** more pain relief at start / in first 1 / 1 $\frac{3}{4}$ hours*

1

(iii) decrease of pain higher / more

ignore more effective unless qualified by time > 1 $\frac{3}{4}$ hours

allow effect lasts longer

1

decrease of pain is longer lasting

1

(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

3

[10]

3 (a) kills / destroys bacteria / MRSA

*do **not** allow germs*

1

prevents / reduces transfer

allow stops MRSA entering ward

1

(b) mutation

*do **not** accept antibiotics causes mutation*

1

(causes) resistance

allow not effective
ignore immunity

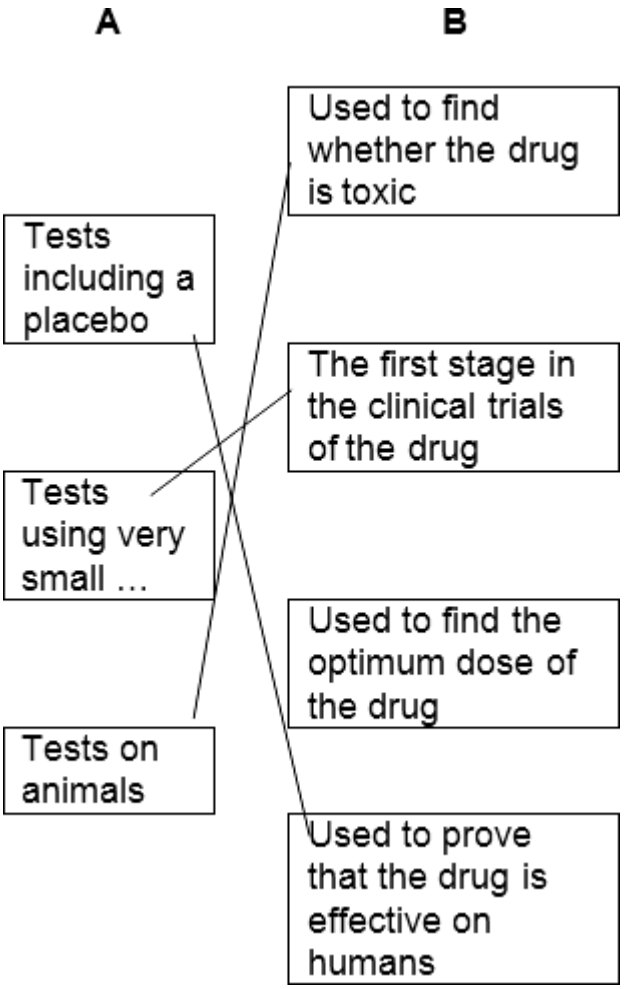
1

to antibiotics

1

[5]

4 (a)



1 *mark for each correct line*

mark each line from left hand box

two lines from left hand box cancels mark for that box

3

(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 <u>not</u> 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

3

[6]

5 (a) hearsay

1

(b) (volunteers with feet in) <u>empty</u> bowls

accept bowl with no (iced) water

*do **not** accept mention of bowl with iced water*

1

(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'

3

[5]

6 (a) both lead to reduction / fall (in measles cases)

can be implied

1

measles vaccine caused a big drop **or** correct use of figures

1

MMR wipes out measles **or** drops to (almost) zero **or** doesn't fall as much as measles vaccine **or** correct use of figures.

1

(b) mump(s)

1

rubella / german measles

either order

allow phonetic spelling

1

(c) white blood cells

allow lymphocytes / leucocytes

ignore memory cells

1

(wbc) produce antibodies

ignore antitoxins / antigens / antibiotics / engulfing

1

in future / if re-infected antibody production rapid / fast(er) / quick(er)

allow ecf from antitoxins / antigens / antibiotics

ignore engulfing

ignore reference to specificity

1

[8]

7 (a) (i) decrease

1

rate of decrease slows

1

(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

1

Explanation:
stops / reduces the bacteria being transferred / spreading

1

(iii) 800 – 500 / 800 × 100 =

1

37.5 (%)

*correct answer with or without working gains **2** marks*

1

(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

1

(b) mutation occurred giving resistance (to methicillin)

*do **not** accept overuse caused mutation*

1

resistant bacteria not able to be treated / not killed

1

these bacteria multiplied / reproduced / spread quickly

1

[10]

8 (a) sporozoites (from mosquito saliva) divide / multiply / reproduce

ignore schizonts
*do **not** accept sexual reproduction*

1

become thousands / many (of merozoites)

1

merozoites released (from liver) into blood / red blood cells

1

(b) any **three** from:

*answer must include at least one pro **and** one con for full marks*

- reduces <u>incidence</u> of disease **= pro**
- success in mice indicates likely success in humans **= pro**

  accept stops people getting malaria
- but success in mice does not ensure success in humans **or** needs to be trialled in humans

  or need to check for side effects **= con**
- removal of genes should prevent parasite multiplying in liver **or** release of parasites into blood **= pro**

  allow you should not get malaria / the disease from these parasites
- the injected parasite stimulates antibody production **= pro**
- but still possible danger since living parasite injected into human **= con**
- possible liver damage **= con**

3

[6]