Q1. Dr Semmelweiss collected data about the number of deaths in the two maternity wards in the hospital where he worked.

- From 1833 to 1838 there were the same number of doctors and midwives delivering babies in both **Ward 1** and **Ward 2.**
- From 1839 to 1847 medical students and doctors delivered babies in **Ward 1**; midwives delivered babies in **Ward 2**.

Dr Semmelweiss also noticed that doctors often came straight from examining dead bodies to the delivery ward.

The table shows the number of patients and the number of deaths in the two wards.

Years	Ward	Number of patients	Number of deaths	Death rate as deaths per 1000 patients
1833–1838	Ward 1	23 509	1505	64.0
	Ward 2	13 097	731	55.8
1839–1847	Ward 1	20 204	1989	98.4
	Ward 2	17 791	691	

(a) (i) Use the formula

$$\textbf{death rate} = \frac{\textbf{number of deaths} \times 1000}{\textbf{number of patients}}$$

to calculate the death rate for **Ward 2** in the years 1839 - 1847.

.....

.....

Death rate = ... deaths per thousand

(2)

(ii) Suggest a hypothesis for the difference in the death rates on **Ward 1** and **Ward 2** in the years 1839 - 1847.

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(2)

(b) Antibiotics are now used in hospitals.

What is an antibiotic, and what does it do?

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(2)

(c) MRSA is causing problems in hospitals.

Give **one** reason why.

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(1)

(d) How can the work of Semmelweiss help to reduce the problems caused by MRSA?

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.....

(1)
(Total 8 marks)

Q2. Many diseases are caused by viruses. Children are given vaccines to protect them against viral disease.

(a) Complete the following sentences.

It is difficult to kill viruses inside the body because

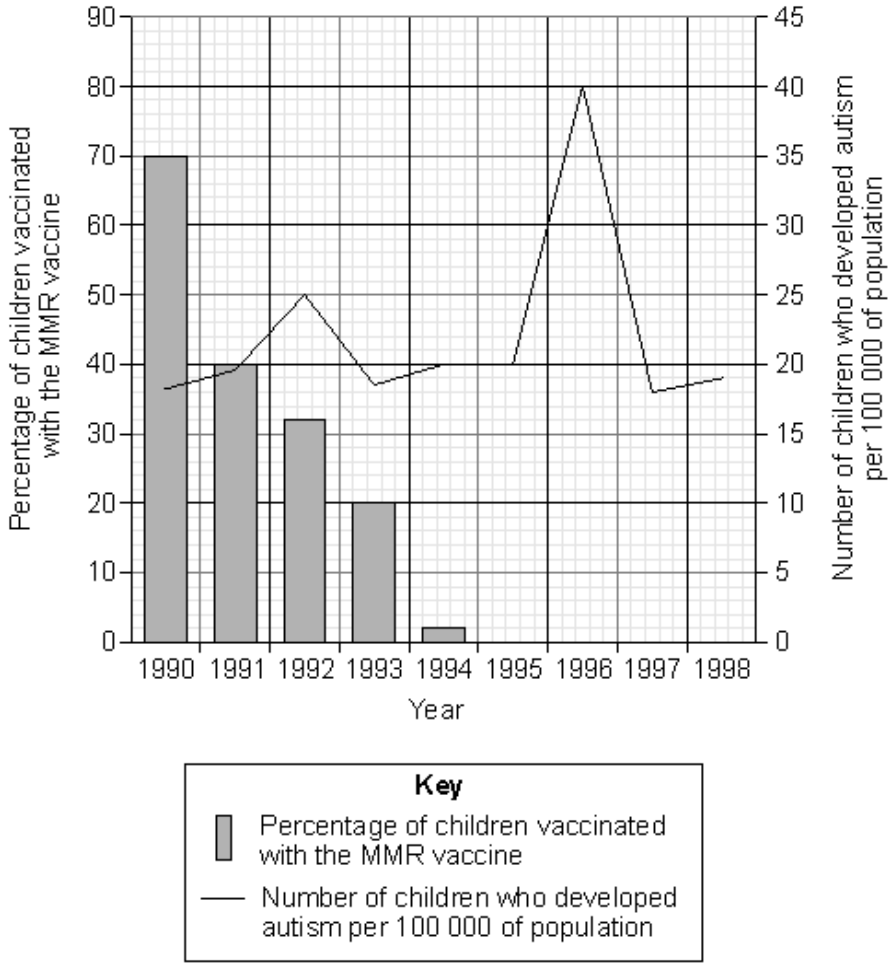
viruses ..... .

The vaccine stimulates the white blood cells to produce ..... .

(3)

(b) In the 1990s many people thought that the MMR vaccine caused autism in some children. This is why the Japanese government stopped using the MMR vaccine.

The graph gives information about the percentage of Japanese children who developed autism during the 1990s.



The data in the graph support the view that there is **no** link between MMR vaccination and autism.

Explain why.

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(4)
(Total 7 marks)

Q3. Read the passage about the use of antibiotics in food production.

> People do not always agree about the use of antibiotics in food production.
>
> Some farmers put low doses of antibiotics in feed for animals such as cattle and sheep. Antibiotics help to keep animals disease-free. Antibiotics also help animals to grow.
>
> The use of antibiotics in livestock feed means that there is a higher risk of antibiotic-resistant bacteria developing. These could be dangerous to human health.

(a) Explain how a population of antibiotic-resistant bacteria might develop from non-resistant bacteria.

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(3)

(b) Suggest **two** reasons why it is an advantage to keep farm animals disease free.

1 .....

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2 .....

.....

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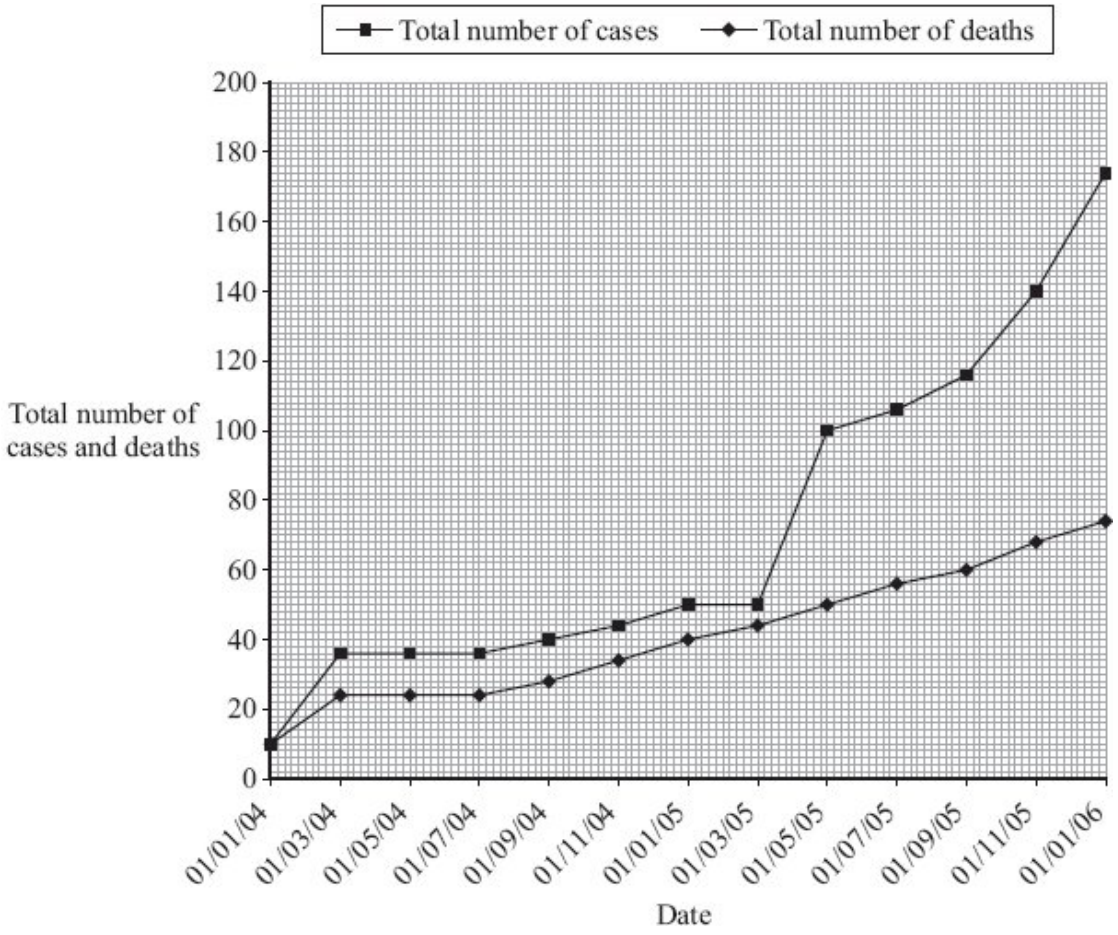
(2)
(Total 5 marks)

Q4. 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.

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(2)

(b) 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.

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(2)
(Total 5 marks)

Q5. Hepatitis B is a liver disease caused by a virus. The virus is found in body fluids such as blood, saliva and urine. Diagram **1** shows the structure of the virus in cross section.

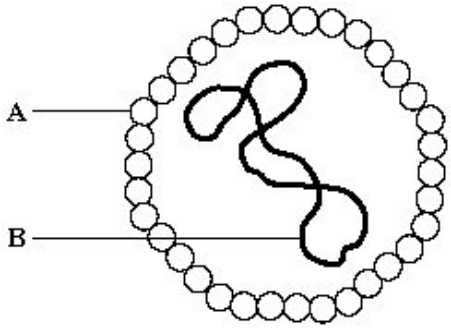
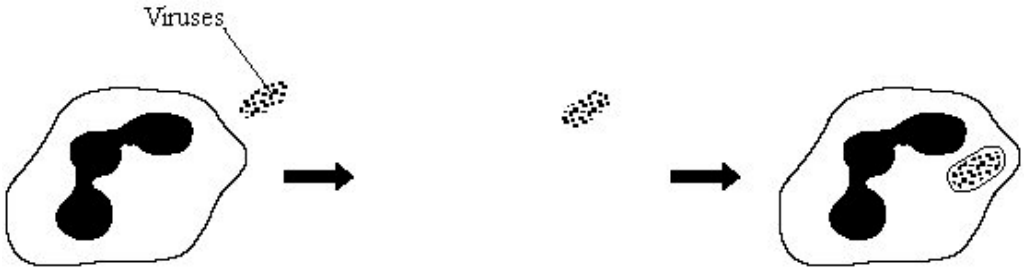


Diagram 1

(a) The human body has several natural defences against viruses. Some of these prevent viruses from entering the body. Others act once the viruses have entered.

(i) Diagram **2** shows a white blood cell attacking a group of viruses.

Complete diagram **2** by drawing the 2nd stage.



1st stage **2nd stage** **3rd Stage**

Diagram 2

(1)

(ii) What type of chemical is released by some white blood cells to attack viruses?

.....

(1)

(b) Hepatitis B is more likely to be spread among people who share needles when they inject drugs. Use information given at the beginning of this question to explain why this is so.

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.....

.....

.....

(2)
(Total 4 marks)

Q6. The influenza virus damages the cells lining the respiratory tract causing sore throats.

Coughing and sneezing spread the virus.

(a) Give the correct term for this method of spreading an infection.

.....

(1)

(b) In an immunisation programme such as that for MMR (Measles, Mumps and Rubella), suggest why it is essential for a large proportion of the child population to be vaccinated in order to protect the few individuals who are unable to be vaccinated.

.....

.....

(1)

(c) In some modern influenza vaccines the protein surface sub-units are separated from the virus coat and used for the vaccine. This stimulates an effective immune response in the same way as inactive pathogens.

(i) Explain how this immunity is produced in the body following vaccination, and how further illness from the same virus is prevented.

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.....

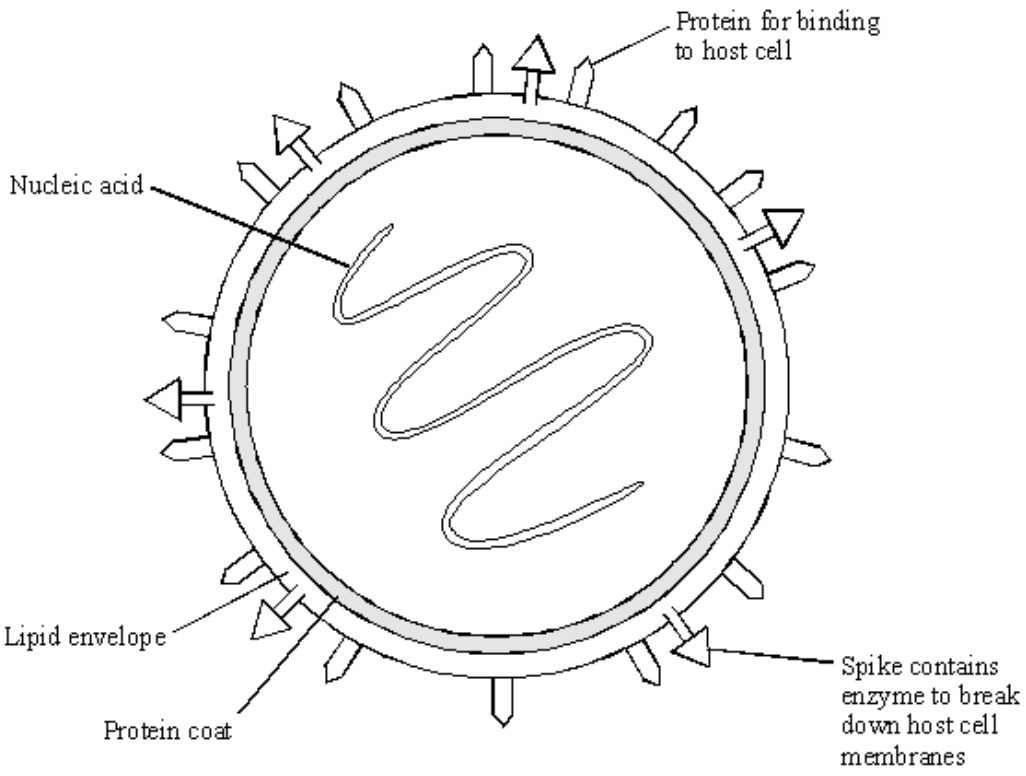
(4)

(ii) This type of immunity resulting from an influenza injection is described

as ..... immunity.

(1)

(d) The diagram shows the structure of an influenza virus.



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

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

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.....

.....

(3)

(Total 10 marks)

M1. (a) (i) 38.84

*correct answer with or without working gains **2** marks*
*(691 × 1000) / 17 791 gains **1** mark*

2

(ii) women in Ward 1 infected

1

by pathogens / bacteria / viruses passed on by doctors (who have been in contact with dead bodies)

1

(b) medicine / drug

1

that kills bacteria

1

(c) resistant to / not killed by antibiotics

1

(d) Semmelweiss showed that infection could be passed on via touch and so hand washing by doctors / nurses / patients / visitors reduces the risk of infection

1

[8]

M2. (a) live inside cells

1

inactive

1

antibodies

1

(b) the percentage of children vaccinated fell to zero in 1995

1

but the number of children developing autism rose and fell during the period when % vaccinations was falling

1

number of children developing autism peaked after MMR vaccination had ceased

1

which suggests that something other than MMR vaccination was causing autism

1

[7]

M3. (a) idea that bacteria mutate **or** that there is variation in bacteria

1

leading to bacteria /resistant cells that survive antibiotic

1

these bacteria (resistant cells) go on to breed

1

*do **not** allow bacteria get used to antibiotics **or** idea that antibiotics change the bacteria **or** bacteria become immune **or** references to adaptation or evolution*

(b) the treated animals do not use energy overcoming illness

1

an economic reason, eg treated animals do not infect other animals / farm workers

1

[5]

M4. (a) (i) 56

accept 54 – 58

1

(ii) increased

1

reasonable qualification eg slowly then more quickly
or
to 174 / 176
or
by 138 / 140

1

(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

2

[5]

M5. (a) (i) diagram shows extensions of intact cell membrane around viruses

1

(ii) antibodies

allow enzymes re (ii)
allow interferon
ignore antitoxins / proteins

1

(b) virus is transferred

1

(virus in) blood / body fluids – transfer (via needles)

1

[4]

M6. (a) droplet infection **or** aerosol infection

*do **not** accept airborne*
accept airborne droplets

1

(b) so there is no large group which could catch the infection/pass on the infection

converse – if large numbers can't pass it on the virus is less likely to reach those few who are susceptible

1

(c) (i) any **four** of the following points:-

example of a 3 mark answer: Lymphocytes produce specific antibodies…...

comment on specificity applied to antibodies or lymphocytes

(recognition by) lymphocytes;

(white cells) make antibodies;

antibodies destroy/neutralise the virus/antigen/protein subunit;

*do **not** accept antibodies KILL viruses*
accept white blood cells replicate
accept some white cells form memory cells/live a long time;
accept subsequent infection results in very rapid antibody production;

max 4

(ii) active;

1

(d) any **three** of the following points

Structure change in:
protein for binding to host cell;

accept changes in surface proteins (of protein coat)

spike containing enzyme;

changes in antigen

Fit: existing/circulating/old antibodies don't match new virus strain shape/new antigen/new binding protein;

Wrong antibodies: injection does not stimulate antibodies against all strains/different antigens;

accept wrong antibodies for 1 mark

max 3

[10]