Q1. (a) (i) Some diseases can be tackled by using antibiotics and vaccination.
Explain fully why antibiotics cannot be used to cure viral diseases.

.....

.....

.....

.....

(2)

(ii) A recent study found that babies in 90 % of hospitals are infected with the MRSA bacterium.

Explain how the MRSA bacterium has developed resistance to antibiotics.

.....

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.....

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(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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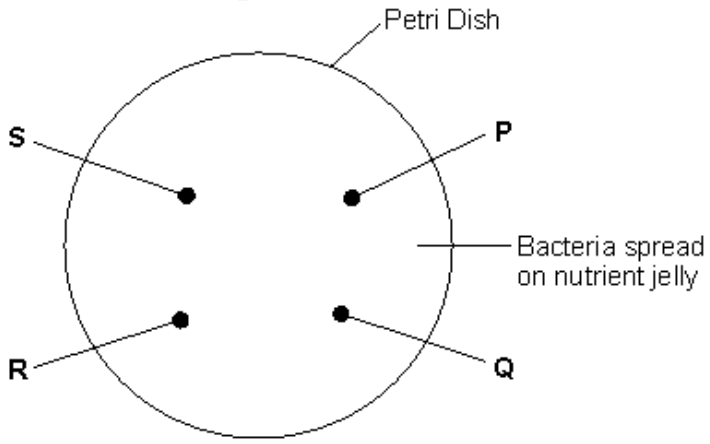
(3)
(Total 7 marks)

Q2. Students investigated how well antibacterial mouthwashes worked.
They tested four different mouthwashes, **P**, **Q**, **R** and **S**.

- They spread bacteria on nutrient jelly in a Petri dish.
- They soaked identical discs of filter paper in mouthwashes **P**, **Q**, **R** or **S**.
- They placed the discs on the growing bacteria as shown in **Diagram 1**.
- They covered the Petri dish.
- They incubated the Petri dish for two days.

Diagram 1



(a) The nutrient jelly was heated to 120 °C before being poured into the Petri dish.

Why is this necessary?

Tick (✓) **one** box.

Statement	Tick (✓)
To make bacteria grow more quickly.	
To kill microorganisms.	
To make the nutrients dissolve.	

(1)

(b) What is the maximum temperature at which bacteria should be incubated in a school laboratory?

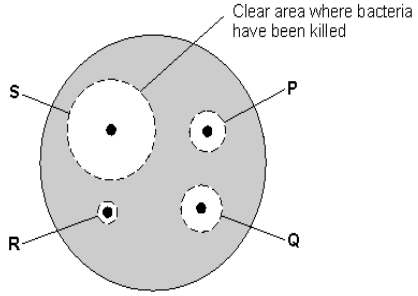
Tick (✓) **one** box.

Temperature	Tick (✓)
15 °C	
25 °C	
37 °C	

(1)

(c) **Diagram 2** shows the appearance of the Petri dish after two days.

Diagram 2



Which mouthwash, **P, Q, R** or **S** kills most bacteria? ☐

Give **one** reason for your answer.

.....

.....

(2)
(Total 4 marks)

Q3. 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

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

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.

.....

.....

.....

.....

(2)

(b) Antibiotics are now used in hospitals.

What is an antibiotic, and what does it do?

.....

.....

.....

(2)

(c) MRSA is causing problems in hospitals.

Give **one** reason why.

.....

.....

(1)

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

.....

.....

(1)
(Total 8 marks)

Q4. 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 ..... .

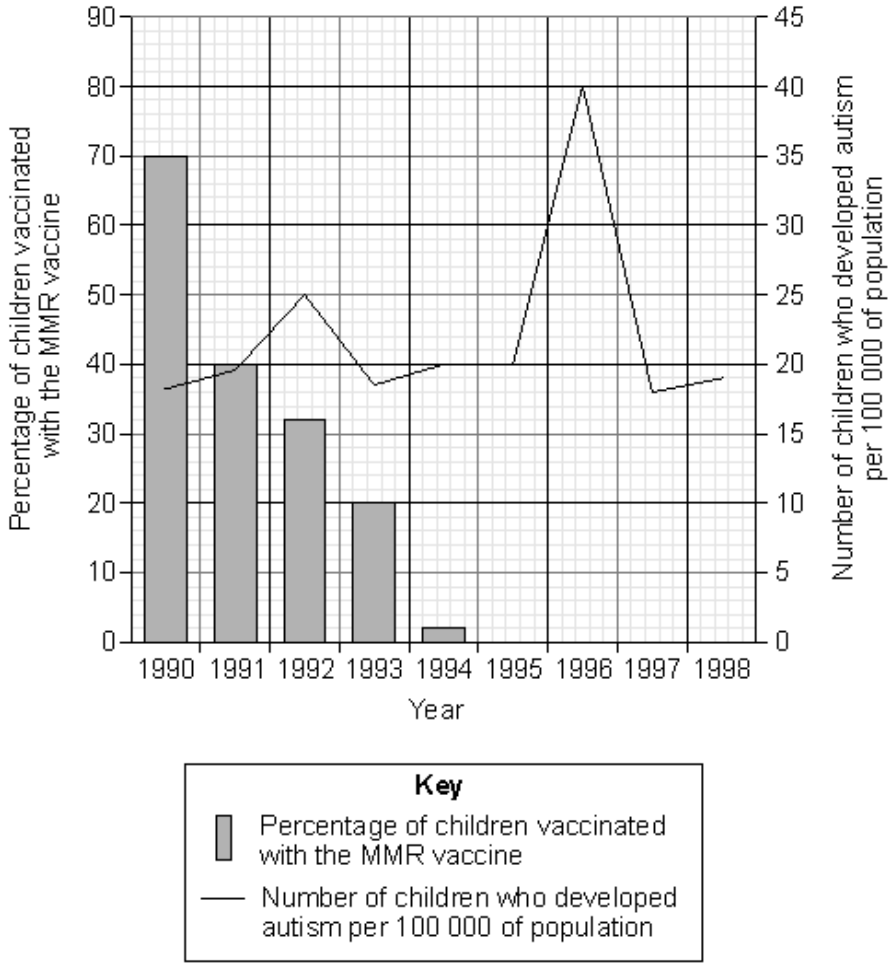
A vaccine contains an ..... form of the virus.

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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.....

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(4)
(Total 7 marks)

Q5. Influenza is a disease caused by a virus.

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

.....

.....

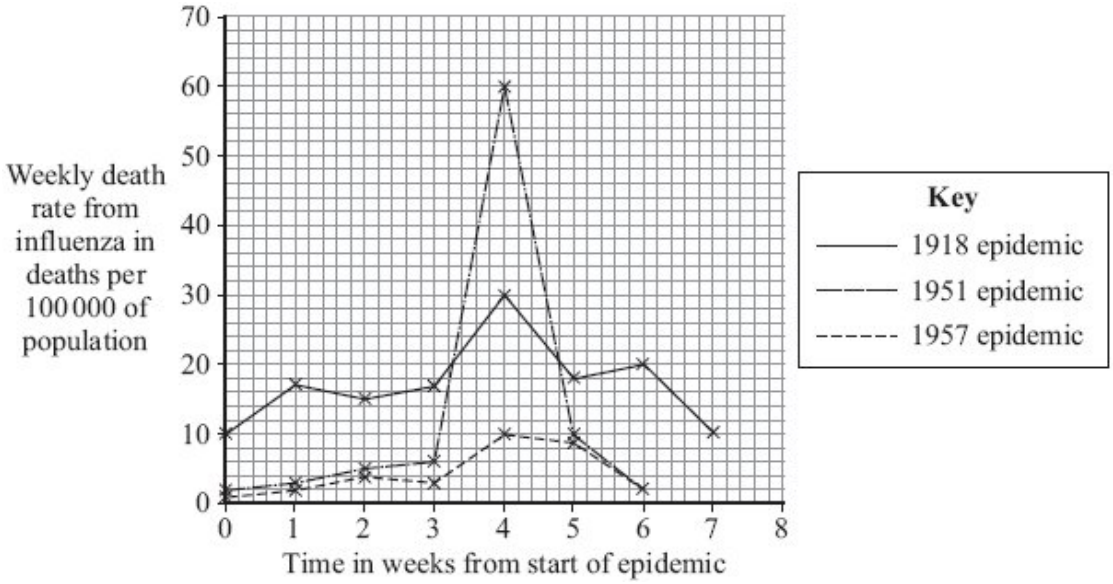
.....

.....

(2)

(b) In some years there are influenza epidemics.

The graph shows the death rate in Liverpool during three influenza epidemics.



(i) The population of Liverpool in 1951 was approximately 700 000.

Calculate the approximate number of deaths from influenza in week 4 of the 1951 epidemic.

Show clearly how you work out your answer.

.....

.....

Number of deaths .....

(2)

(ii) In most years, the number of deaths from influenza in Liverpool is very low.

Explain, in terms of the influenza virus and the body's immune system, why there were large numbers of deaths in years such as 1918 and 1951.

.....

.....

.....

.....

.....

.....

(3)

(Total 7 marks)

Q6. 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.

.....

.....

.....

.....

.....

(3)

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

1 .....

.....

.....

2 .....

.....

.....

(2)
(Total 5 marks)

M1. (a) (i) viruses live inside cells

1

viruses inaccessible to antibiotic

allow drug / antibiotic (if used) would (have to) kill cell

1

(ii) mutation

ignore mutation caused by antibiotic

1

natural selection **or** no longer recognised by antibiotics

accept description of natural selection

1

(b) (stimulate) antibody production

ignore antitoxin

1

(by) white cells

1

<u>rapidly</u> produce antibody on re-infection

ignore antibodies remain in blood

1

[7]

M2. (a) to kill microorganisms

extra boxes ticked cancels the mark

1

(b) 25 °C

extra boxes ticked cancels the mark

1

(c) **S**

1

widest clear area

1

[4]

M3. (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]

M4. (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]

M5. (a) any **two** from

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

2

(b) (i) 420

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

2

(ii) any **three** from:

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

3

[7]

M6. (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]