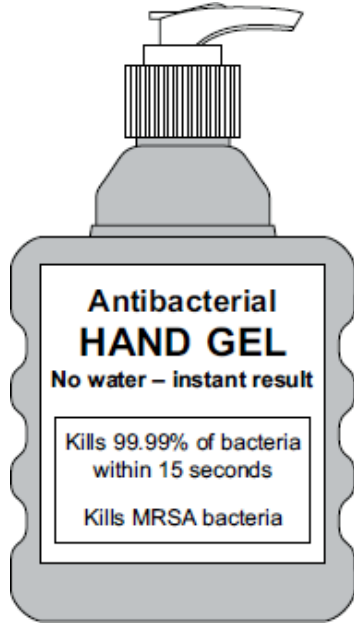


**Q1.** MRSA strains of bacteria are causing problems in many hospitals.

(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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.....

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.....

.....

(3)

(Total 5 marks)

**Q2.** 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.

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2 .....

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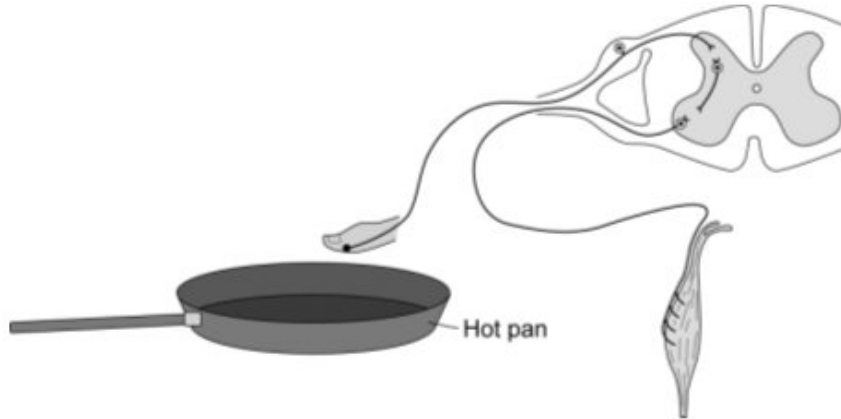
(2)

(Total 5 marks)

**Q3.** A person accidentally touches a hot pan.

Her hand automatically moves away from the pan.

The diagram shows the structures involved in this action.



(a) Describe fully how the structures shown in the diagram bring about this reflex action.

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.....  
.....

(6)

(b) (i) The nerve pathway in this reflex action is about 1.5 metres in length. A nerve impulse travels at  $75 \text{ m s}^{-1}$ .

Use this information to calculate the time taken for this reflex action to occur.

Show clearly how you work out your answer.

.....  
.....

Time intervals ..... s

(2)

(ii) The actual time interval is longer than the interval you have calculated in part (i).

Suggest an explanation for the difference.

.....  
.....

(1)  
(Total 9 marks)

**Q4.** Hormones are used in contraceptive pills.

(a) Explain how a contraceptive pill works.

.....  
.....  
.....  
.....

(2)

- (b) Read the information about the trialling of the first contraceptive pill.

The Pill was developed by a team of scientists led by Gregory Pincus. The team needed to carry out large scale trials on humans.

In the summer of 1955, Pincus visited the island of Puerto Rico. Puerto Rico is one of the most densely populated areas in the world. Officials supported birth control as a form of population control. Pincus knew that if he could demonstrate that the poor, uneducated women of Puerto Rico could use the pill correctly then so could women anywhere in the world.

The scientists selected a pill with a high dose of hormones to ensure that no pregnancies would occur while test subjects were taking the drug. The Pill was found to be 100% effective when taken properly. But 17% of the women in the study complained of side effects. Pincus ignored these side effects.

The women in the trial had been told only that they were taking a drug that prevented pregnancy. They had not been told that the Pill was experimental or that there was a chance of dangerous side effects.

Evaluate the methods used by Pincus in trialling the contraceptive pill.

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(5)  
(Total 7 marks)

**Q5.** It has been suggested that about 7 % of the UK adult population smoke cannabis regularly.

Smoking cannabis is illegal.

Give other reasons why young people should **not** start smoking cannabis.

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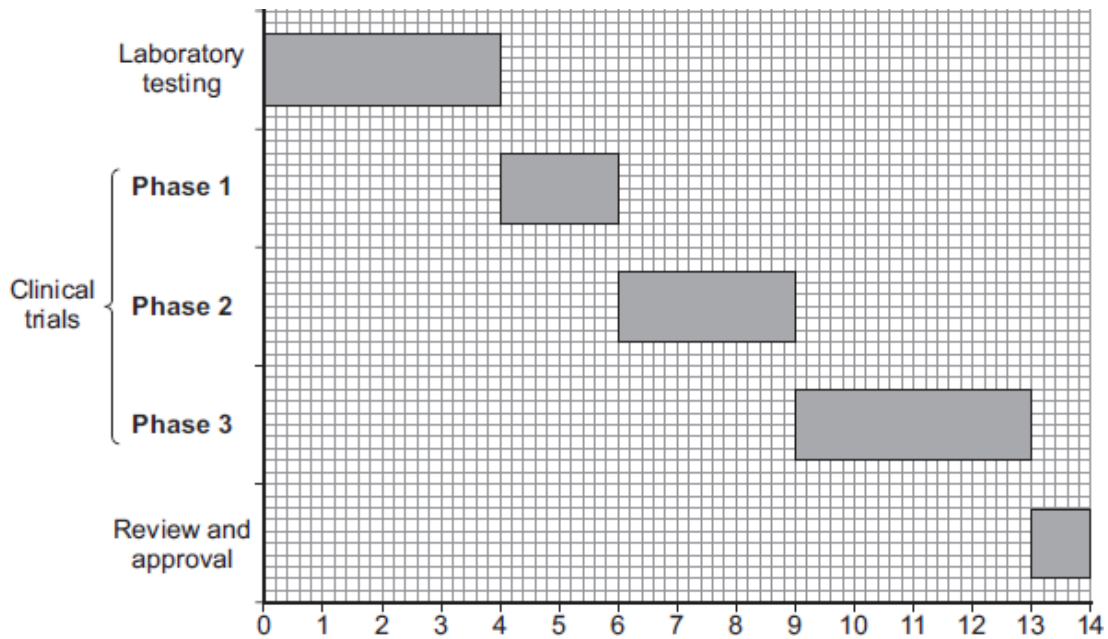
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**(Total 4 marks)**

**Q6.** New drugs have to be tested before they can be sold.

The graph shows how much time the different stages of testing took for a new drug.



(a) (i) How much more time did the clinical trials take than the laboratory testing?

.....

..... years

**(1)**

(ii) Apart from the time taken, what other difference is there between laboratory testing and clinical trials?

.....  
.....

(1)

(b) (i) During **Phase 1** clinical trials, the drug is tested on healthy volunteers using low doses.

Suggest why **only** healthy volunteers and **only** low doses are used at this stage of drug testing.

.....  
.....  
.....  
.....  
.....

(2)

(ii) In **Phase 2** and **Phase 3** clinical trials, a double blind trial is usually done.

Explain what a double blind trial is and why a double blind trial is good practice.

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.....  
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.....

(3)

(Total 7 marks)

**Q7.** Body mass index (BMI) helps to show if a person has a healthy mass for their height.

BMI is calculated using the following equation:

$$\text{BMI} = \frac{\text{body mass in kg}}{(\text{height in m})^2}$$

(a) A man is 1.8 metres tall and has a BMI of 32.

Calculate the man's mass.

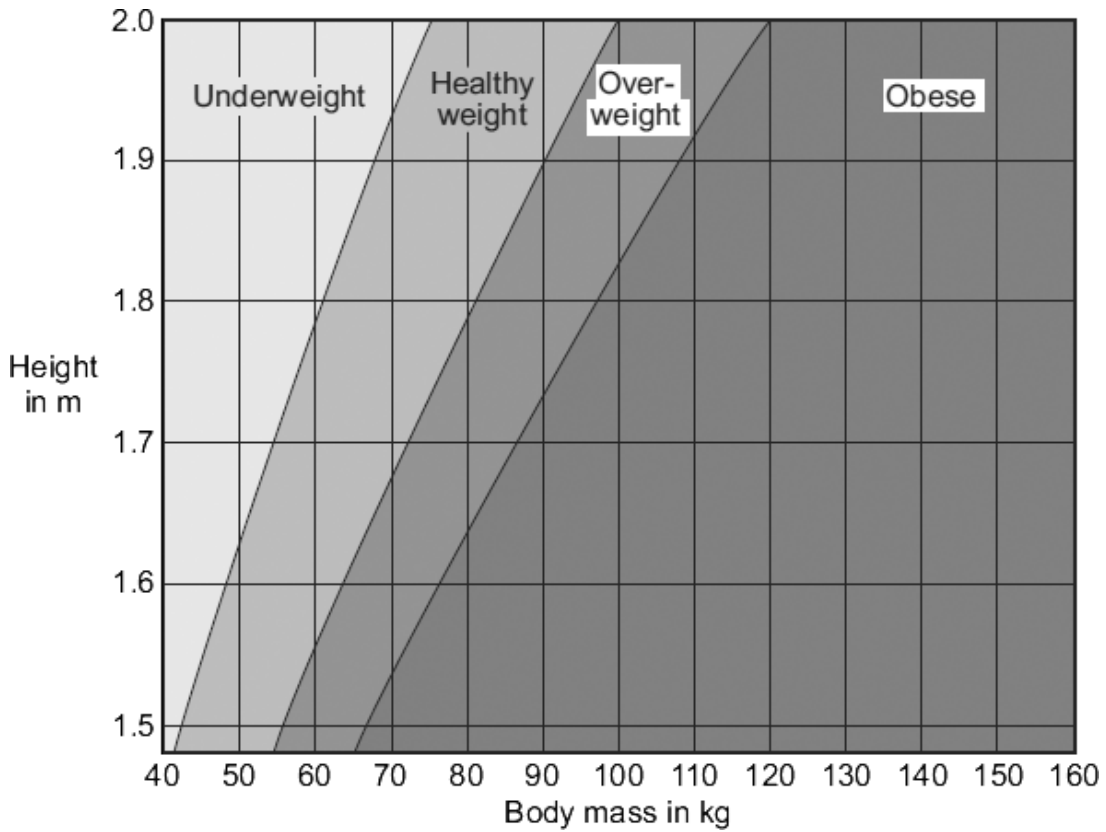
.....  
.....

Mass = ..... kg

(2)

(b) An obesity chart is used to find if a person has a healthy weight.

Obese people are very overweight.



Use the obesity chart to suggest changes that the man in part (a) should make to his lifestyle.

Give reasons for your suggestions.

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(4)  
(Total 6 marks)

**Q8.** People can be immunised against a pathogen by injecting them with a vaccine.

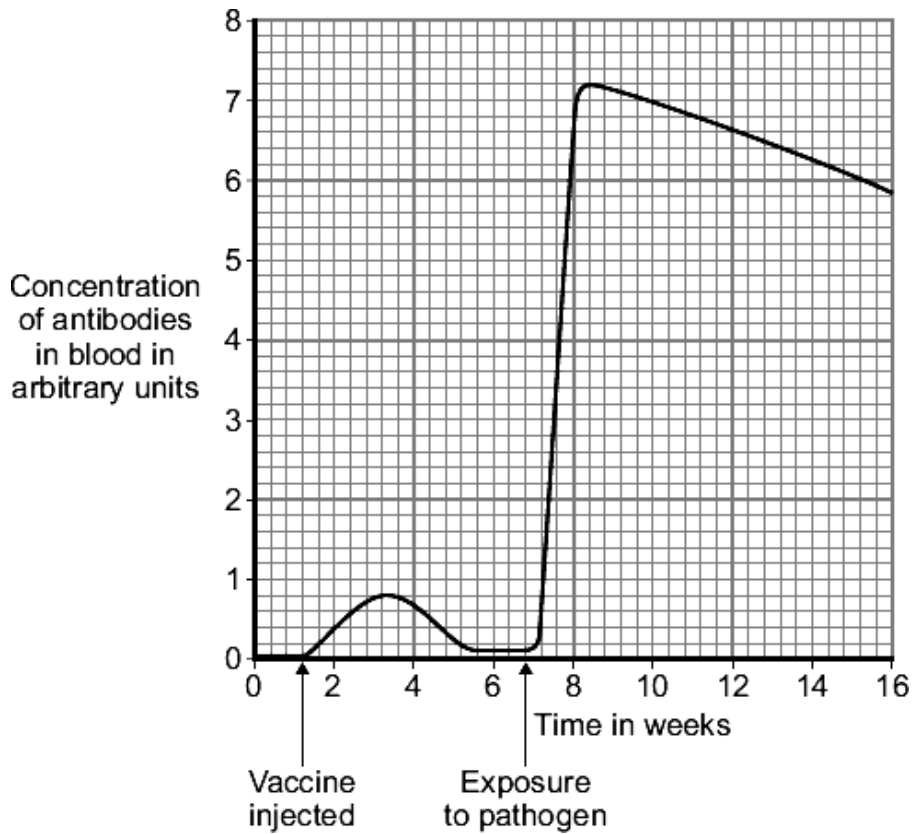
(a) What does a vaccine contain?

.....  
.....

(1)

(b) A person was injected with a vaccine. A few weeks later the person was exposed to the pathogen they had been immunised against.

The graph shows how the concentration of antibodies in the blood changed after injection of the vaccine and after exposure to the pathogen.



(i) Describe in detail the differences between antibody production after the injection of the vaccine **and** after the person was exposed to the pathogen.

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(3)

(ii) Suggest an explanation for the differences you have described in part (b)(i).

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(3)  
(Total 7 marks)

**Q9.** 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.

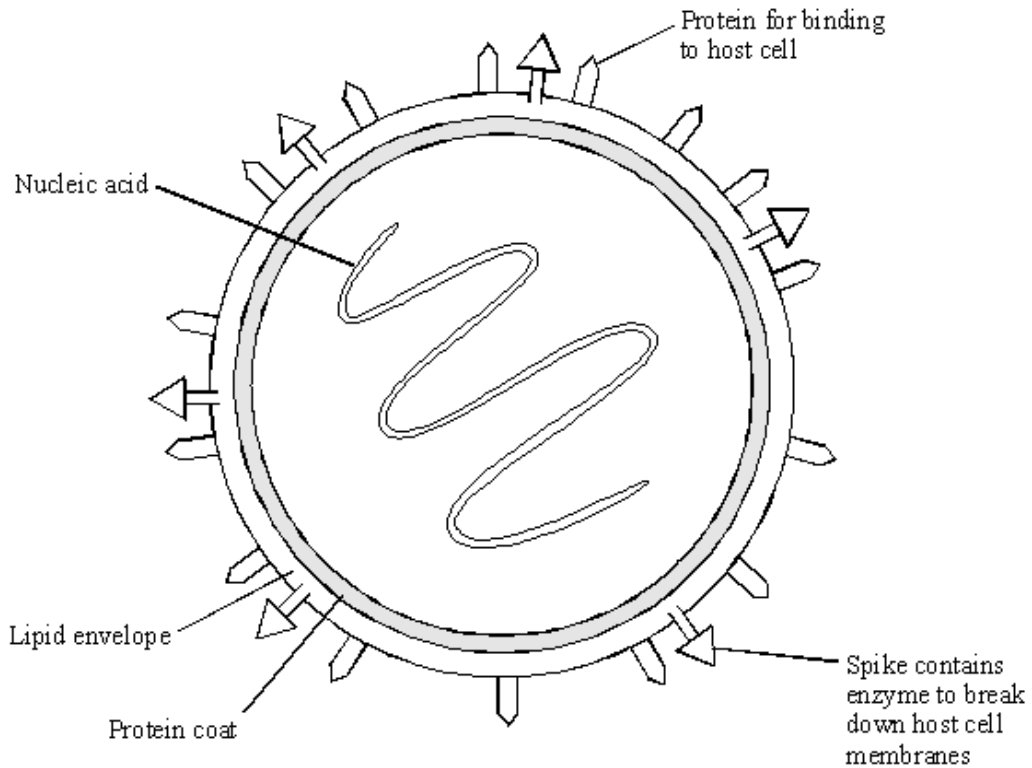
.....  
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.....

(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) 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]
- 
- M2.** (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]

- M3.** (a) stimulus / heat detected by temperature receptors in skin 1
- impulses travel along sensory neurone to spinal cord / CNS 1
- chemical transmission across synapse 1
- via relay neurone 1
- impulses to muscle / effector via motor neurone 1
- muscle / effector contracts, moving the hand away 1

- (b) (i) 0.02 s
- correct answer gains 2 marks*
- if answer incorrect, evidence of 1.5 / 75 gains 1 mark* 2
- (ii) impulse slowed down because of time taken for diffusion of the chemical across the synapse 1

[9]

- M4.** (a) inhibits FSH (production / secretion) 1
- (therefore) no eggs mature / released
- if no other marks gained allow 1 mark for no eggs produced* 1
- or**
- effect of FSH on ovary described
- references to LH are neutral*

(b)

*maximum 4 marks if no conclusion*

Pros max 2marks from 4 marks e.g.

- large scale trial gave better results
- chose uneducated women so that if these women could use it correctly, women elsewhere would be able to cons max 3 marks from 4 marks e.g.
- used pill with high dose of hormone – **either** so results not valid for general use of hormone **or** dangerous
- side effects ignored
- women not told pill was experimental / pill might have side effects
- no placebo
- should have tried a range of doses
- should have done pre-trial to check for side effects

4

conclusion 1 mark e.g.

trials flawed therefore cons outweigh pros

accept reverse e.g. trials flawed but pros outweigh cons

1

[7]

**M5.** any **four** from:

*ignore it's illegal*

- (misuse) can cause heart / circulatory / breathing problems  
*ignore makes you ill / physical problems*
- causes cancer  
*lung cancer only scores 1 mark*
- it may cause mental illness / depression  
*allow damages brain (cells)*  
*Ignore affects brain*
- it may be addictive
- can suffer withdrawal symptoms without it  
*allow crave the drug*
- may lead to use of hard drugs
- social / financial problems eg affects relationships / stealing  
*allow wastes / costs a lot of money*  
*if no other marks gained allow 1 mark for it may cause health problems (later in life)*

4

[4]

**M6.** (a) (i) 5 (years)

1

- (ii) lab tests on cells / tissues / animals **and** clinical trials in humans  
*allow 1 block of lab tests **and** 3 blocks of clinical trials*  
**or**  
*number of phases*

1

(b) (i) (healthy volunteers)

any **one** from:

- too great a risk for ill person / patient
- patient might be taking another drug
- side effects easier to see  
*ignore references to the immune system*

1

(low dose)

any **one** from:

- to reduce any risk
- to look for side effects  
*allow to avoid harm*

1

(ii) placebo and drug tested

*allow fake drugs / sugar pills*

1

neither patients nor doctors know (who has taken placebo or drug)

*this full statement would gain 2 marks*

1

(so) avoids bias

**or**

(therefore) controls for psychological effects

**or**

(so) can tell if drug works rather than placebo effect

1

[7]

**M7.** (a) 104 / 103.68 / 103.7

*1 mark for mass =  $32 \times 1.8 \times 1.8$*

2

(b) *if weight category stated mark according to this otherwise mark according to mass calculated in part (a)*

increase exercise

1

(to) expend more energy

*allow use / burn more energy / fat*

**or**

(to) increase metabolic rate

1

eat less

*allow eat less calories*

*ignore eat a balanced diet*

1

(increase exercise **or** eat less) to lose (body) mass / weight

*credit lose (body) mass / weight only once*

*these answers are all valid for a mass of 82 kg or greater given in part (a) or if obese / overweight given in part (b)*

*if answer to part (a) is 62–81 kg or healthy weight given in part (b) accept:*

- *no changes needed for 1 mark*
- *because he is a healthy weight for 1 mark*

*if answer to part (a) is 61 kg or less or underweight in part (b) accept:*

- *eat more food for 1 mark*
- *to gain body mass for 1 mark*

1

[6]

**M8.** (a) dead / inactive form of pathogen / microorganism / bacterium / virus

*ignore disease (for organism)*

*ignore toxins / antibodies*

1

(b) (i) any **three** from:

(after exposure):

- greater number of antibodies produced / higher concentration
- antibodies stay (in higher concentration) for longer
- antibodies produced quicker
- quantitative, eg 9 times higher / 0.8 to 7.2  
*scores 2 marks for increased to 9 times higher / from 0.8 to 7.2*

3

(ii) white cells

*allow lymphocytes / leucocytes*

*do **not** accept phagocytes / macrophage*

1

*have had previous exposure to pathogen / recognise pathogen on re-entry / familiar with pathogen / reference to memory cells*

*ignore knows how to kill pathogen*

*ignore live pathogen introduced on exposure*

1

*therefore antibodies produced (more) rapidly*

*this marking point dependent on previous marking point*

1

[7]

**M9.** (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]

