

Infection and Response 6

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Time: **67 minutes**

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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.

(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.

(3)

(Total 7 marks)

Q2.

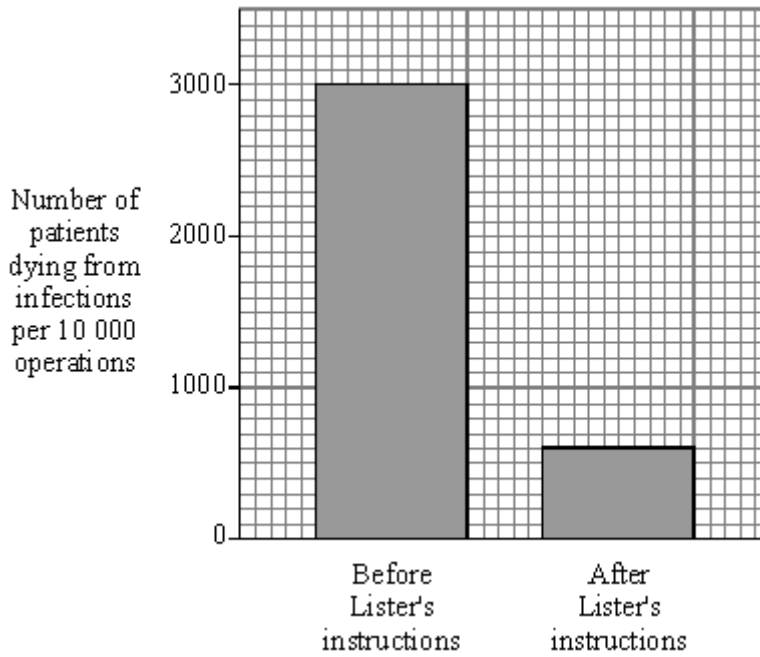
In the eighteenth century, surgeons did not wear special clothing or wash their hands before operations. Many of their patients died from infections.

- (a) Suggest why patients often died from infections after operations.

(1)

- (b) In the nineteenth century, Joseph Lister told surgeons to use sprays of carbolic acid in operating theatres and to wash their hands.

The graph shows the effect that using Lister's instructions had on the number of patients who died from infections after surgery.



Describe how Lister's instructions affected the number of patients dying from infections after surgery.

(2)
(Total 3 marks)

Q3.

The table shows changes in resistance to the antibiotic penicillin in one species of bacterium between 1991 and 1996.

| Years | Percentage of cases where bacteria were resistant to penicillin |
|-----------|---|
| 1991 – 92 | 7 |
| 1993 – 94 | 14 |
| 1995 – 96 | 22 |

A doctor was asked to treat a patient who had a sore throat.

- (i) How does penicillin help to treat infection?

(1)

- (ii) Use the data in the table to suggest why the doctor should **not** prescribe penicillin.

(2)

(Total 3 marks)

Q4.

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.

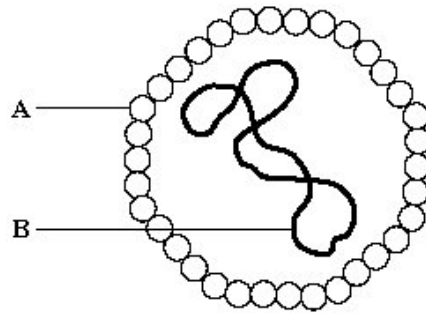


Diagram 1

(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.

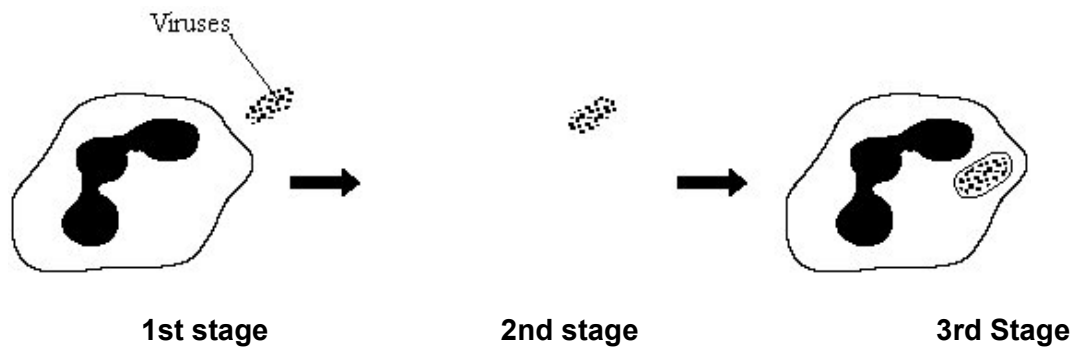


Diagram 2

(1)

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

(1)

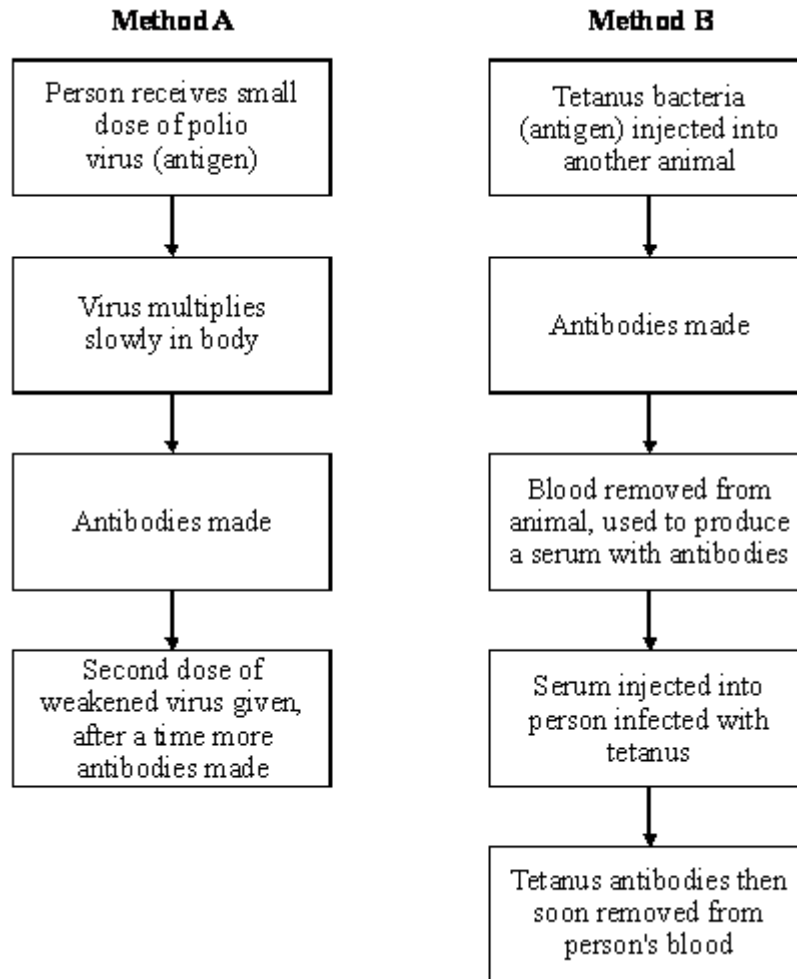
(b) Hepatitis B is more likely to be spread among people who share needles when they inject drugs. Use information given at the beginning of this question to explain why this is so.

(2)

(Total 4 marks)

Q5.

The diagram shows two methods which are used to give humans protection against disease. **Method A** shows active immunity and **Method B** shows passive immunity. **Method A** can be used against polio. **Method B** is often used against tetanus.



(a) What is the name of the substances produced by the body which destroy harmful viruses and bacteria?

_____ (1)

(b) Why does **Method A** give long lasting protection against polio?

_____ (1)

(c) Why does **Method B** not give long lasting protection against tetanus?

_____ (1)

(d) In immunisation against polio a second dose of the weakened virus is given (this is known as a booster). Suggest why this booster is necessary.

_____ (1)

- (e) **Method A** would **not** be helpful for a person who had just been infected with tetanus bacteria. Explain the reason for this.

(2)

- (f) Why is **Method B** very good for dealing quickly with an infection of tetanus?

(1)

(Total 7 marks)

Q6.

Doctors give antibiotics to patients to kill bacteria in their bodies.

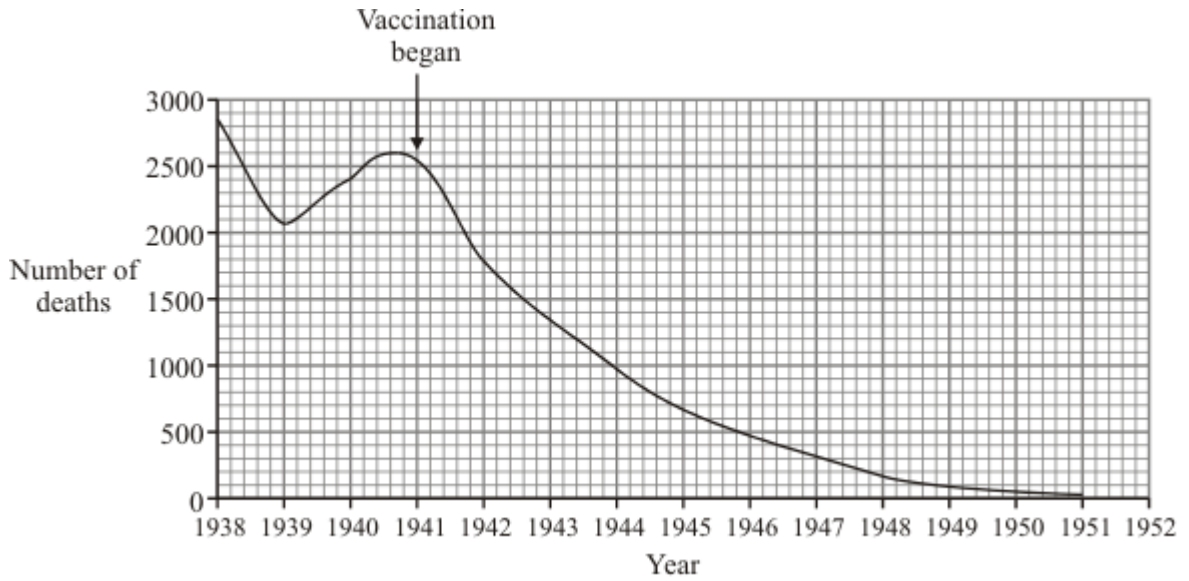
Explain how the overuse of antibiotics has led to the evolution of antibiotic-resistant bacteria.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

(Total 3 marks)

Q7.

Diphtheria is a disease of the human breathing system. The graph shows the number of deaths from diphtheria in the United Kingdom between 1938 and 1951. Vaccination against diphtheria was begun in 1941.



- (a) What evidence in the graph suggests that vaccination protects people from diphtheria?

(1)

- (b) Complete the passage by choosing the correct words from the box.

| | |
|------------------------|--------------------------|
| antibodies | bacteria |
| | platelets |
| red blood cells | white blood cells |

During vaccination, harmless _____ are injected into the body.

This causes _____ to make _____

which help to protect the body against diphtheria.

(3)

(Total 4 marks)

Q8.

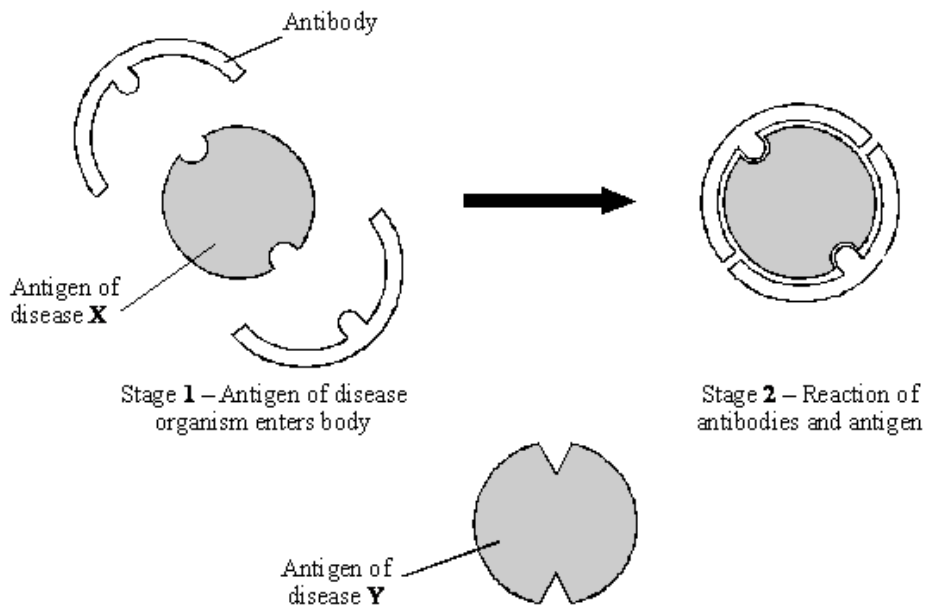
Penicillin is an antibiotic which stops bacteria from reproducing. It was used a lot in the past to treat bacterial infections in humans and other animals. In many hospitals there are now strains of penicillin resistant bacteria.

Explain how natural selection could have produced these strains of penicillin resistant bacteria.

(Total 5 marks)

Q9.

(a) Antibodies help to defend the body against disease. The diagram represents the reaction of antibody and antigen for disease X.

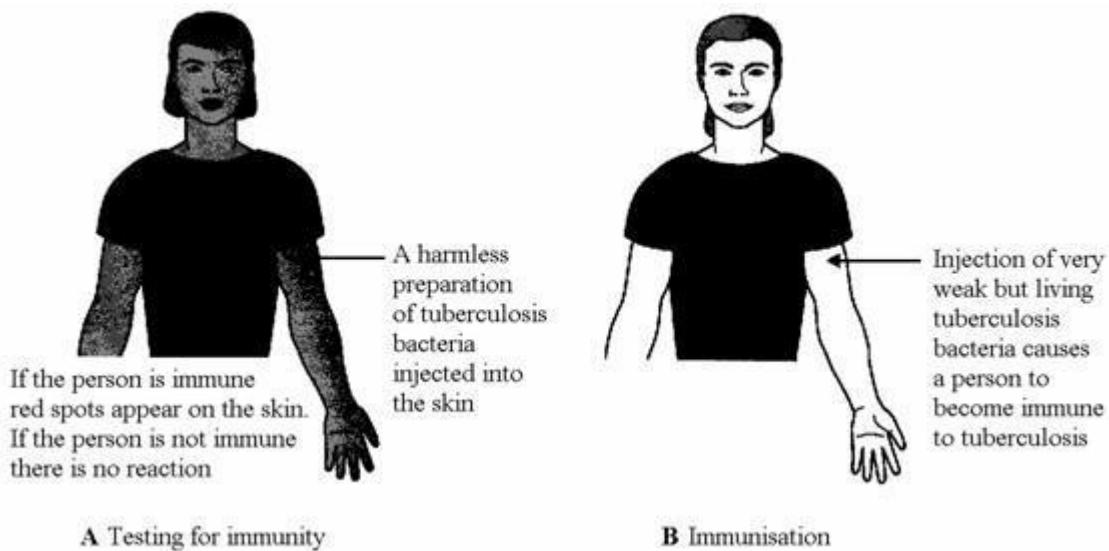


Using the diagram to help you, suggest why the body's defence against disease X would not be effective against disease Y.

(2)

- (b) Tuberculosis is a disease which is caused by a bacterium. The body is able to produce antibodies to destroy the bacteria which cause the disease. Some people are naturally immune. A person can be tested to find if they are immune.

Use information in the diagrams to help you answer the questions.



- (i) Suggest the possible cause of the reaction when a person who is already immune is tested, as shown in diagram **A**.

(2)

- (ii) Explain why the injection of tuberculosis bacteria (diagram **B**) causes immunity but does not cause the disease.

(3)

(Total 7 marks)

Q10.

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.

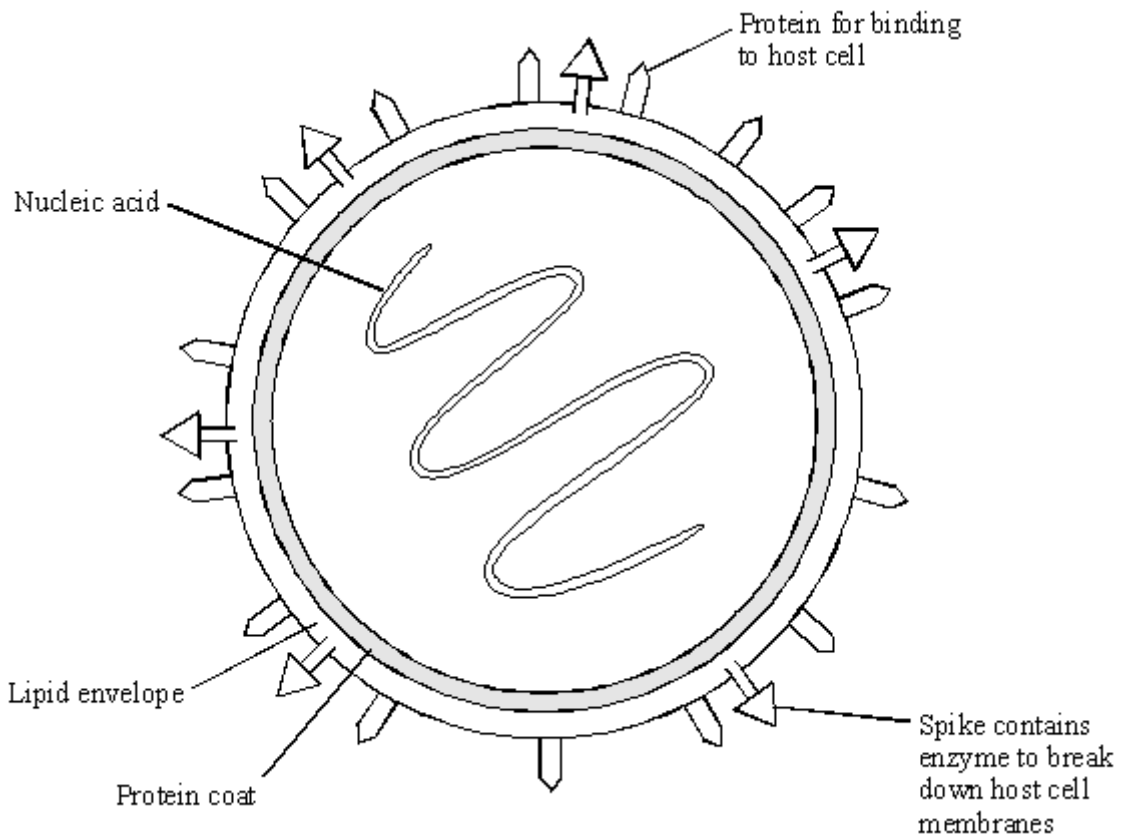
- (i) Explain how this immunity is produced in the body following vaccination, and how further illness from the same virus is prevented.

(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.



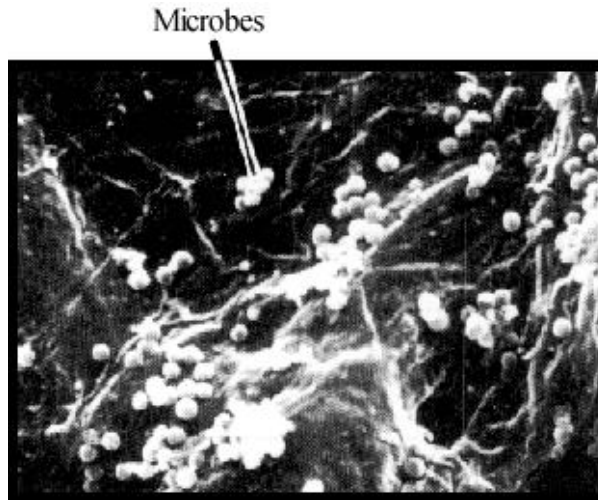
Influenza epidemics can arise because the nucleic acid of the virus frequently changes. This results in changes in the virus structure and so a new strain of the virus is formed. A person who has had influenza or who has been vaccinated may not be immune to the new strain.

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

(3)
(Total 10 marks)

Q11.

The photograph below shows human skin highly magnified. Groups of microbes can be seen on the skin.



Give **two** ways in which the body protects itself from these microbes.

1. _____

2. _____

(Total 2 marks)

Q12.

(i) Give **two** ways in which white blood cells protect us from disease.

1. _____

2. _____

(2)

(ii) Explain, as fully as you can, how immunisation protects us from disease.

(3)

(Total 5 marks)

Mark schemes

Q1.

- (a) (i) viruses live inside cells 1
- viruses inaccessible to antibiotic
allow drug / antibiotic (if used) would (have to) kill cell 1
- (ii) mutation 1
- ignore mutation caused by antibiotic*
- natural selection **or** no longer recognised by antibiotics
accept description of natural selection 1
- (b) (stimulate) antibody production 1
- ignore antitoxin*
- (by) white cells 1
- rapidly produce antibody on re-infection
ignore antibodies remain in blood 1

[7]

Q2.

- (a) dirty clothes/equipment/hands passed bacteria
allow bacteria from any sensible source e.g. surgeon, floor
- OR**
- ease of entry of bacteria (during operations)
*do **not** accept germs* 1
- (b) fewer died 1
- indication of reduced number **or** proportion
e.g. 3000 → 600
down by 2400
20% of previous deaths 1

[3]

Q3.

- (i) kills / destroys bacteria **or**

prevents growth of bacteria
do not allow germs
do not allow fights or gets rid of

1

(ii) any **two** from:

bacteria may be resistant / immune (treatment futile)
or bacteria would not be killed

accept descriptions from table

accept "fights" here

do not accept people resistant

may select for resistant type

may cause increased incidence of resistance or Penicillin less effective in future

sore throat might be due to a virus – Penicillin would not work

2

[3]

Q4.

(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]

Q5.

(a) antibodies;

if incorrect term used then penalise in (a) then regard as continuous error for rest of question

1

(b) antibodies remain (for several years)

or are not removed

accept last a long time or not destroyed

or continues to make antibodies

or causes increased number of antibodies or more antibodies

or stays in body or person has made own antibodies

or if memory cells named must link to antibody production

1

- (c) antibodies removed (from blood);
*accept destroyed or
 unable to make or
 replace antibodies or
 they are not human antibodies or
 person has not made own antibodies* 1
- (d) so more antibodies made;
*accept so enough antibodies made
 or so correct amount of antibodies
 present or to keep antibodies high
 or so body keeps making
 antibodies* 1
- (e) any **two** from
 already has tetanus bacteria in body;
accept could boost infection or make it worse
 would take too long or
 a long time for antibodies to be made;
*accept too slow forming antibodies
 or cannot form correct amount of
 antibodies*
 disease would have effect before
 antibodies made;
*accept antibodies are specific
 or will work for one disease but not another* 2 max
- (f) injection of ready made antibodies;
*accept does not have to wait for antibody formation or has
 large amount of antibodies quickly
 or has enough antibodies quickly
 or antibodies start working straight away* 1

[7]

Q6.

Quality of written communication

*for correct use of at least **two** scientific terms eg mutation,
 resistant (**not** just 'antibiotic-resistant', **not** 'immune') /
 selection / natural selection / survival / reproduction / gene /
 allele / DNA*

1

any **two** from:

mutation occurs in bacteria or change in DNA / gene occurs
cancel if mutation 'caused by' antibiotic

(when antibiotic used) only resistant bacteria survive or non-resistant

bacteria are killed **or** reference to 'natural selection'

resistant bacteria pass on the gene / allele

allow pass on the mutation

*do **not** accept just 'pass on resistance'*

2

[3]

Q7.

(a) decrease in number of deaths (after vaccination started)

1

(b) in correct sequence:

bacteria

1

white blood cells

1

antibodies

1

[4]

Q8.

mutation or description of mutation (gives resistance to penicillin)

1

some survive (penicillin)

1

(survivors) reproduce **or** multiply

1

asexual reproduction **or** binary fission **or** cloning

accept mitosis

1

gene for resistance **or** the mutation is passed on (to offspring)

allow reference to bacteria being immune

ignore reference to survival of fittest

1

[5]

Q9.

(a) shape of antibody is not complementary;

*accept shapes of antibody and antigen do not match or antibody does not correspond to antigen **Y** **or** is not the same shape as antigen **Y** **or** antibody different shape*

1

so unable to attach or join to antigen **Y**

accept they do not fit

1

- (b) (i) antibodies in blood or in skin or in body;
accept already have the antibodies 1
- react with (injected) antigens or bacteria;
accept skin affected by antigen-antibody complex or blood vessels in skin enlarge or dilate
do not accept attack instead of react 1
- (ii) any **three** from
- bacteria weak so do not cause disease
accept not harmful
do not accept bacteria are dead
- cause antibody production;
- memory cells remain;
accept a suitable description
- so body can quickly produce more antibodies in a real infection;
accept antibodies remain in blood or in body 3

[7]

Q10.

- (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]

Q11.

blood clots to seal cuts;
kills microbes which enter

each for 1 mark

(allow higher level answers)

[2]

Q12.

(i) 2 of:

ingest microbes;)allow higher level answers

produce antibodies;)allow cause and effect

produce antitoxins)eg antitoxins neutralise poisons = 2

each for 1 mark

2

(ii) injection of dead/weak microbes;

stimulates antibody production;

these can be produced again quickly on new infection

or remain for long time to 'combat' new infection

each for 1 mark

3

[5]

Q13.

(a) use antibiotics; or named one to kill bacteria; (not microbes)

each for 1 mark

2

(b) some ingest/digest bacteria (not microbes) OWTTE

some produce antibodies;

which destroy bacteria/viruses;

some produce antitoxins;

which counteract poisons released by bacteria
each for 1 mark

5

[7]