

Vaccine

- 1 Some individuals have allergies, which mean they cannot receive certain vaccines. These individuals may benefit from vaccination programmes through:
- A herd immunity
 - B antigenic variation
 - C non-specific immunity
 - D personalised medicine.
- 2 On which of the following does the herd immunity threshold **not** depend?
- A Type of disease
 - B Population density
 - C Effectiveness of the vaccine
 - D Quarantine of non-immune individuals
- 3 Adjuvants are often added to vaccines to
- A make the vaccine safer
 - B enhance the immune response
 - C make immunity last for a longer time
 - D ensure the vaccine contains no live pathogens.
- 4 The list contains statements about factors considered during the vaccination of a population.
- 1. The type of disease
 - 2. The population density
 - 3. The effectiveness of the vaccine
 - 4. The percentage of non-immune individuals
- Which of the statements refer to factors that can affect the herd immunity threshold?
- A 1 only
 - B 3 only
 - C 1, 2 and 3 only
 - D 1, 2, 3 and 4
- 5 Which of the following describes an adjuvant correctly?
- A An inactivated pathogen
 - B A weakened pathogen
 - C A molecule that inhibits the immune response
 - D A molecule that enhances the immune response

Vaccine

1. In 1996, a programme of immunisation against this disease was started in country B. Herd immunity was established once 85% of the population was immunised.

(i) Explain why this level of immunisation protected the whole population.

(ii) State **one** reason why it is difficult to immunise 100% of a population against a disease.

- 2 A vaccine for whooping cough was first introduced for pregnant women in Scotland in 2012.

Suggest a reason for the increase in the number of cases of whooping cough between 2014 and 2016.

- 3a) Explain why vaccines do not cause disease in vaccinated individuals.

- b) Name a substance that is added to a vaccine to make it more effective.

- c) Explain why vaccination against polio would **not** provide immunity against the influenza virus.

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Vaccine

4a) In many countries herd immunity has been established against measles.

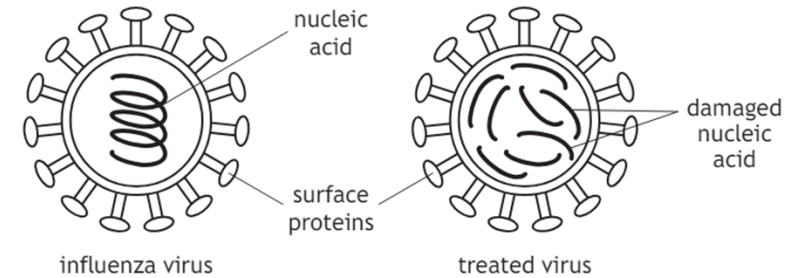
(i) Explain why people in these countries who have not been vaccinated are still protected against measles.

(ii) Suggest **one** reason why widespread vaccination programmes against measles are not possible in all countries of the world.

(b) Explain why vaccines usually contain an adjuvant.

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(a) The diagram represents the influenza virus and a treated form of the same virus, which is contained in a vaccine.



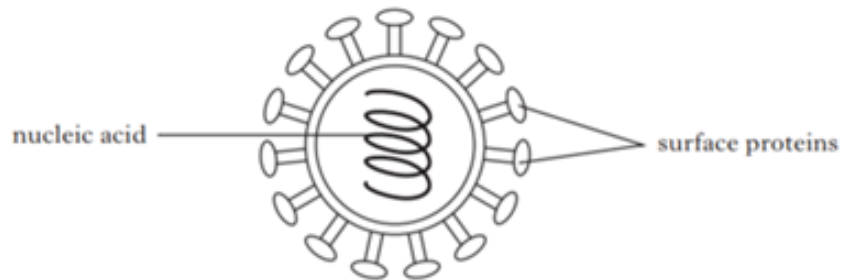
(i) Suggest why the nucleic acid molecule must be damaged in a virus used in a vaccine.

(ii) Explain why the surface proteins of the virus used in the vaccine must remain undamaged.

(iii) Describe why an adjuvant is often added to a vaccine.

Vaccine

- 6 The diagram below shows the structure of one strain of the influenza virus.



- (a) This virus can be used to prepare a flu vaccine. In order to do this the nucleic acid must be broken up but the surface proteins left intact.

Explain why it is necessary to:

- (i) break up the nucleic acid _____

- (ii) leave the surface proteins intact _____

- (b) A different vaccine is required against each strain of the influenza virus. Suggest why different vaccines are required.

- c) Researchers are attempting to develop a new vaccine which will be effective against **all** strains of the influenza virus. Trials of this new vaccine have shown that it increases the activity of T-lymphocytes in the body.

Describe one way in which T lymphocytes combat infection.

- 7 a) The number of cases of whooping cough decreases to a very low level after 2000 because of herd immunity.

Explain what is meant by the term 'herd immunity'.

2

- b) Suggest **one** reason why a widespread vaccination programme against infectious diseases might **not** be possible in country B.

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Tetanus is a disease caused by a type of bacteria. Tetanus bacteria live in soil and enter the body from the soil through wounds in the skin.

- c)) Explain why herd immunity would **not** protect unvaccinated individuals against tetanus.

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Vaccine Answers

1. A
2. D
3. B
4. C
5. D
1. a (i) individuals who have not been immunised are unlikely to contact into contact with infected individuals
(ii) rejection of vaccine/poverty/access to vaccines
- 2 Not yet hit herd immunity OR rejection of vaccine OR antigenic variation.
3. a) pathogen is weakened/dead/inactivated
b) adjuvant
C) they have different foreign antigens
- 4 a) (i) Individuals who have not been immunised are unlikely to contact into contact with infected individuals
(ii) rejection of vaccine/poverty/access to vaccines
b) to enhance immune response OR make vaccine more effective.
- 5.a (i) To prevent the individual being vaccinated getting sick.
(ii) surface proteins are the foreign antigens = 1 mark Foreign antigens trigger immune response/ Lymphocytes (1 mark)
(iii) To enhance the immune response/make
- 6 a) to weaken/kill/inactivate the virus
(ii) to trigger production of lymphocytes/immune response
b) antigenic variation
c) destroy infected cells with apoptosis
- 7a) A large percentage of the population has been immunise
Individuals who have not been immunised are unlikely to contact into contact with infected individuals
b) poverty/lack of access to vaccine/vaccine rejection
c) Not passed person to person

Clinical Trials

- 1 In a clinical trial of a vaccine, researchers placed volunteers into two groups.

Each group contained individuals of matched ages.

The researchers then gave group A an injection of the vaccine and group B an injection of a dilute sugar solution.

Which of the following protocols was used in this trial?

- A Placebo controls
- B Pedigree analysis
- C Double blind design
- D Randomised allocation

- 2 New vaccines are subject to clinical trials before being licensed for use.

Which of the following is **not** a feature of the protocol used for clinical trials?

- A A placebo is used.
- B Many trial groups are used.
- C A randomised procedure is used.
- D A double-blind procedure is used.

- 3 Which experimental design feature reduces the magnitude of experimental error in a clinical trial?

- A A placebo control
- B A suitable group size
- C Double-blind protocols
- D Using randomised groups

- 4 Forty individuals were selected to take part in a clinical trial for a new drug to treat a lung condition.

They were split into two groups. One group was treated with the drug while the other group was treated with a placebo.

Which row in the table would have allowed a valid comparison of the treatments?

	Group treated with drug	Group treated with placebo	Key
A			male smoker male non-smoker female smoker female non-smoker
B			
C			
D			

Clinical Trials

- 1 Statins are drugs which reduce the production of cholesterol in the liver. A year-long trial was carried out to investigate the effects of taking a newly-developed statin on blood cholesterol levels.

Sixty individuals with raised blood cholesterol levels were selected and divided into two groups of thirty.

Individuals in Group 1 were prescribed a capsule, containing 20 mg of the statin, to take each day. Individuals in Group 2 were the control group. At two-monthly intervals, blood samples were taken from all individuals and their blood cholesterol levels measured.

- a) Suggest what was prescribed to the individuals in Group 2 during this trial.

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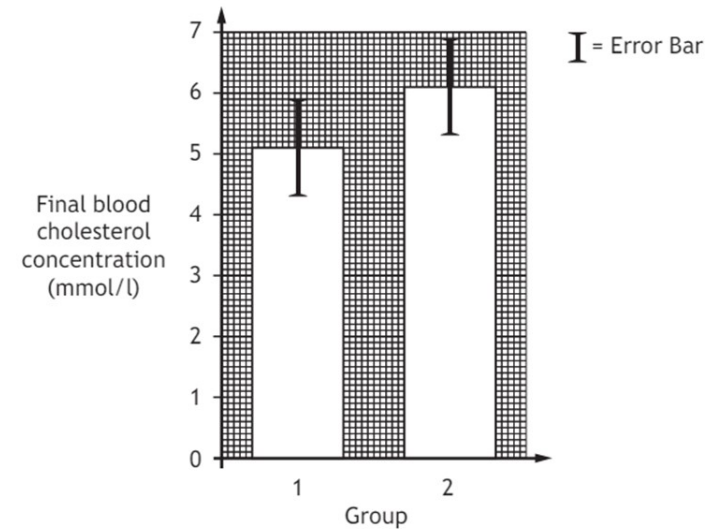
- b) Describe the design features which would have been used to ensure that this was both a randomised and a double-blind trial.

2

randomised

double-blind

2



- a) Using evidence from the bar graph, suggest why it was decided that this statin was not worth further development.

1

- b) Clinical trials of vaccines often use a double-blind protocol. Describe what is meant by the term double-blind.

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- c) Clinical trials of vaccines use randomised, placebo-controlled protocols. Describe how these protocols are set up by the researchers.

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Clinical Trials Answers

1. A

2. B

3. B

4. D

1. a) placebo: exact same capsule but no statin/active ingredient b) randomised: all individuals have an equal chance of being allocated into group 1 or 2
Double blind: neither the participants nor the researchers know which group participants are in.

- 2 a) error bars overlap in the 2 groups OR no statistically significant difference between the two groups
b) neither the participants nor the researchers know which group participants are in.
c) All individuals have an equal chance of being placed in the placebo or drug/vaccine group. (1 mark)
One group receives the vaccine/drug while the other gets a drug/vaccine with out the active ingredient