Dalkeith High School

CfE Higher Human Biology

Unit 4

Immunology & Public Health

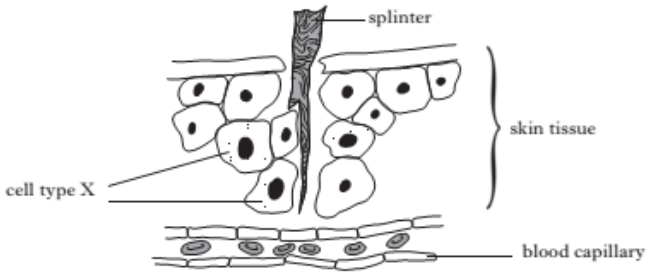
Past Paper Questions

Non-Specific Defences

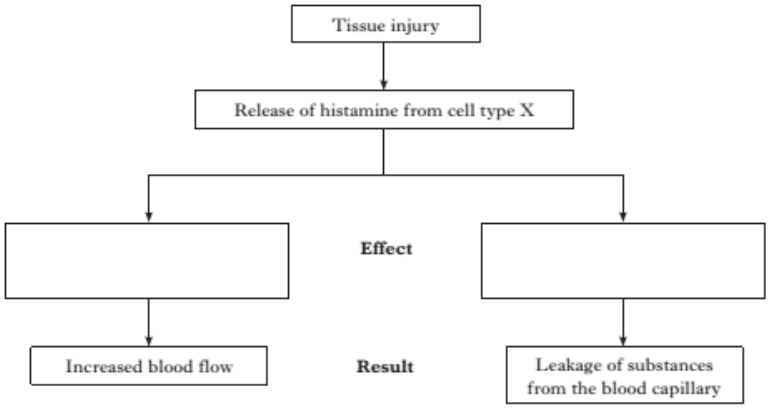
1. Which of the following types of white blood cell is involved in a non-specific immune response which causes apoptosis in invading pathogens?
   A. Phagocytes
   B. B Lymphocytes
   C. T lymphocytes
   D. Natural Killer cells

2. Various types of white blood cell are involved in the non-specific immune response.
   a) Describe the role of each of the following cells in the non-specific defence of the body.
      i) Mast cells (2)
      ii) Natural killer (NK) cells (1)
   b) Explain how the presence of phagocytes is important in the activation of T lymphocytes. (2)

3. The diagram below shows an injury in which skin is pierced by a splinter.

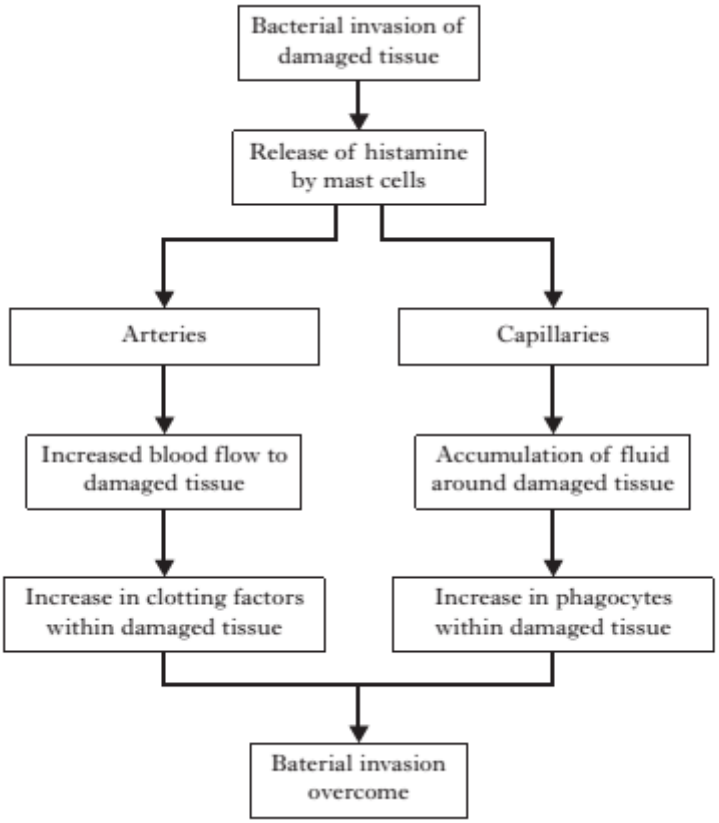


The flow diagram shows some of the events which result from this injury.



   a) Identify cell type X. (1)
   b) Complete the flow diagram to show the effects of histamine release. (2)
   c) Name one substance which leaks from the blood capillary and describe how it protects against infection. (2)

4. The flow chart below outlines some non-specific defence responses which occur when tissue is damaged and invaded by bacteria.

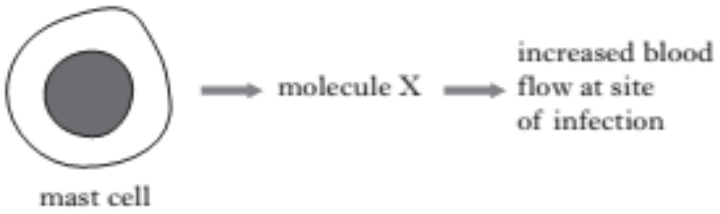


a) Describe how histamine changes the arteries and capillaries to bring about the effects shown in the flow chart. (2)

b) Name the active enzyme that is produced by the action of clotting factors. (1)

c) Describe the role of phagocytes in overcoming bacterial invasion. (2)

5. The diagram below shows a response to a viral infection by a type of cell called a mast cell.



a) i) Name molecule X. (1)

ii) Give **one** reason why increased blood flow to the infection site is beneficial in stopping the infection. (1)

b) A type of lymphocyte called a natural killer cell induces apoptosis in infected cells. Describe what happens during apoptosis. (1)

c) Another type of lymphocyte is a B-lymphocyte.
Describe how B-lymphocytes become active and respond to viral infection. (3)

6. Describe non-specific defences that the body uses to protect itself from pathogens. (8)

Specific Cellular Defences

7. Which of the cells of the immune system are mainly involved in an autoimmune response?
   A. Mast cells
   B. Phagocytes
   C. B-Lymphocytes
   D. T-lymphocytes

8. Which of the following cells secrete antibodies? 2011 Q4
   A. B-lymphocytes
   B. T-lymphocytes
   C. Red blood cells
   D. Macrophages

9. Lysosomes are abundant in
   A. Enzyme secreting cells
   B. Muscle cells
   C. Cells involved in protein synthesis
   D. Phagocytic cells

10. Which of the following is an immune response?
    A. T-lymphocytes secreting antigens
    B. T-lymphocytes carrying out phagocytosis
    C. B-lymphocytes combining with foreign antigens
    D. B-lymphocytes producing antibodies

11. The pathogen for the disease tuberculosis (TB) evades the specific immune response by
    A. Surviving within phagocytes
    B. Attacking lymphocytes
    C. Attacking phagocytes
    D. Antigenic variation

12. Failure in regulation of the immune system leading to an autoimmune disease is caused by a
    A. B lymphocyte immune response to self-antigens
    B. T lymphocyte immune response to self-antigens
    C. B lymphocyte immune response to foreign antigens
    D. T lymphocyte immune response to foreign antigens.

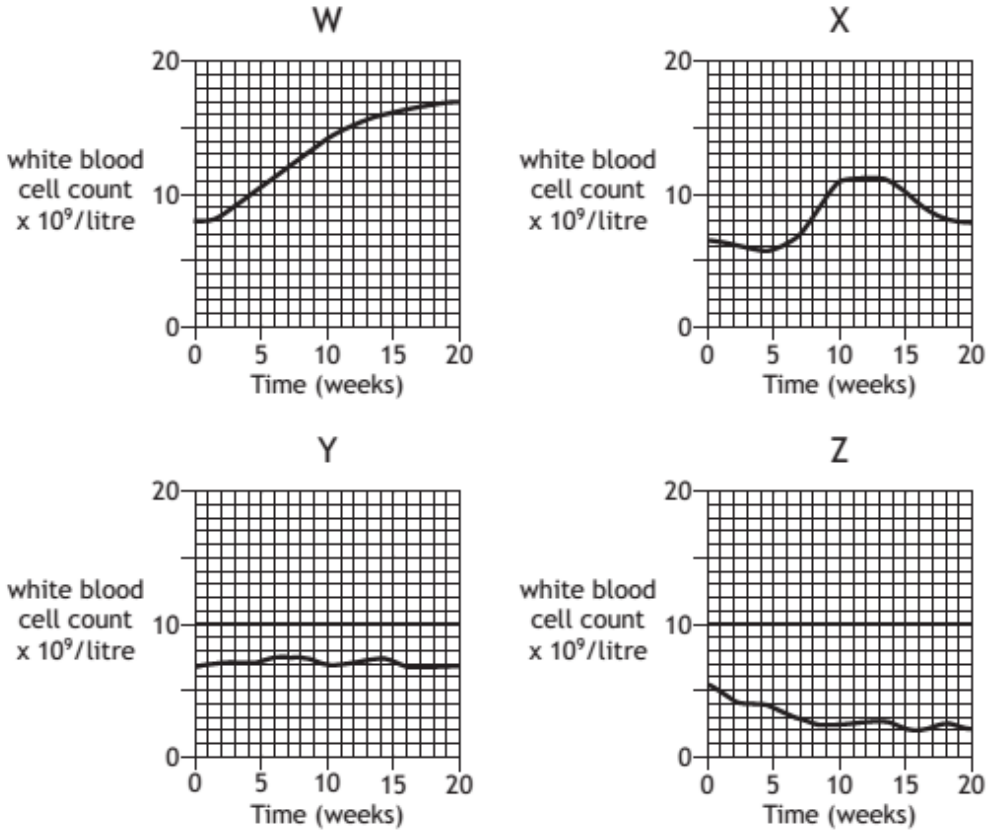
13. Blood tests to measure the number of white blood cells (leucocytes) are often used to indicate infection and/or illness.

    Leucopenia, due to starvation or malnutrition, is indicated by white blood cell numbers dropping below 4 x 10^9/litre.

    Leucocytosis, due to fever or tissue damage, is indicated by white blood cell numbers temporarily increasing to 11 x 109/litre.

    Leukaemia, due to DNA damage and cell division, is indicated by white blood cell numbers permanently increasing.

    The following graphs show the white blood cell count of four patients over 20 weeks.



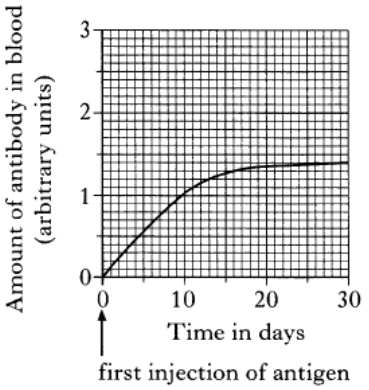
From the graphs, identify the patients.

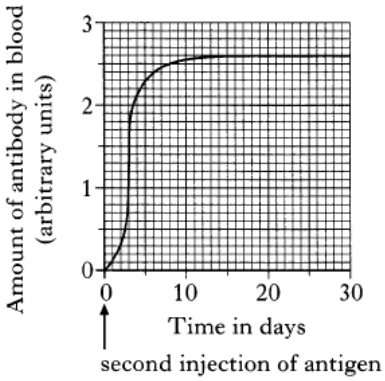
	Leukaemia	Leucocytosis	Leucopenia
A	Y	X	Z
B	Z	W	Y
C	W	X	Z
D	W	Y	X

14. Which of the following is an example of active immunity?
    A. Antibody production following exposure to antigens
    B. Antibodies crossing the placenta from mother to foetus
    C. Antibodies passing from the mother's milk to a suckling baby
    D. Antibody extraction from one mammal to inject into another

15. Lymphocytes act in the defence of the body by
    A. Ingesting toxins
    B. Ingesting pathogens
    C. Producing lysosomes
    D. Producing antibodies

16. The graphs below show the effect of two injection of an antigen on the formation of an antibody.

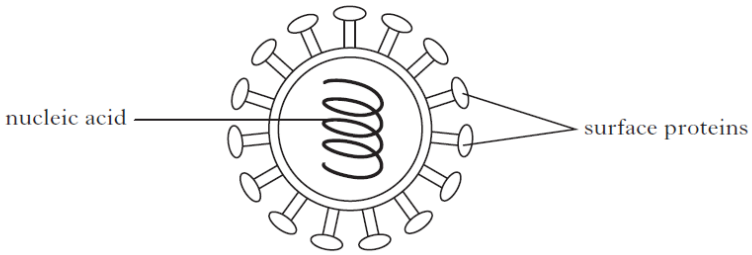




How many days after the second injection does the amount of antibody in the blood reach the maximum achieved after the first injection?

    A. 3 days
    B. 6 days
    C. 20 days
    D. 30 days

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



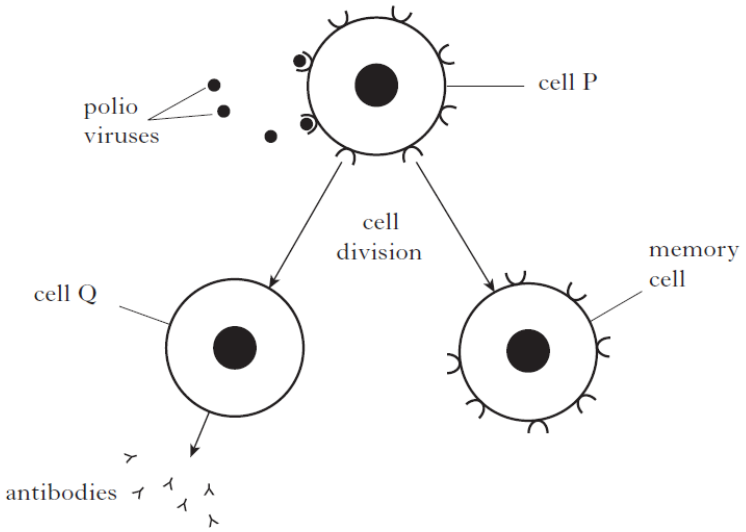
a) The virus can be used to prepare a flu vaccine. In order to do this the nucleic acid must be broken up but the surface proteins left intact. Explain why it is necessary to:
   i) Break up the nucleic acid
   ii) Leave the surface proteins intact (2)

b) A different vaccine is required against each strain of the influenza virus. Suggest why different vaccines are required. (1)

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 **two** ways in which T-lymphocytes combat infection. (2)

d) Clinical trials of vaccines use randomised, placebo-controlled protocols. Describe how these protocols are set up by the researchers. (2)

18. The diagram below shows how the immune system responds to a polio virus in a vaccine.



a) What type of immunological response involves the production of antibodies? (1)

b) i) Name cell Q. (1)

   ii) Describe **two** functions of cell P that are shown in the diagram. (1)

c) Describe the role of memory cells in the immune system. (1)

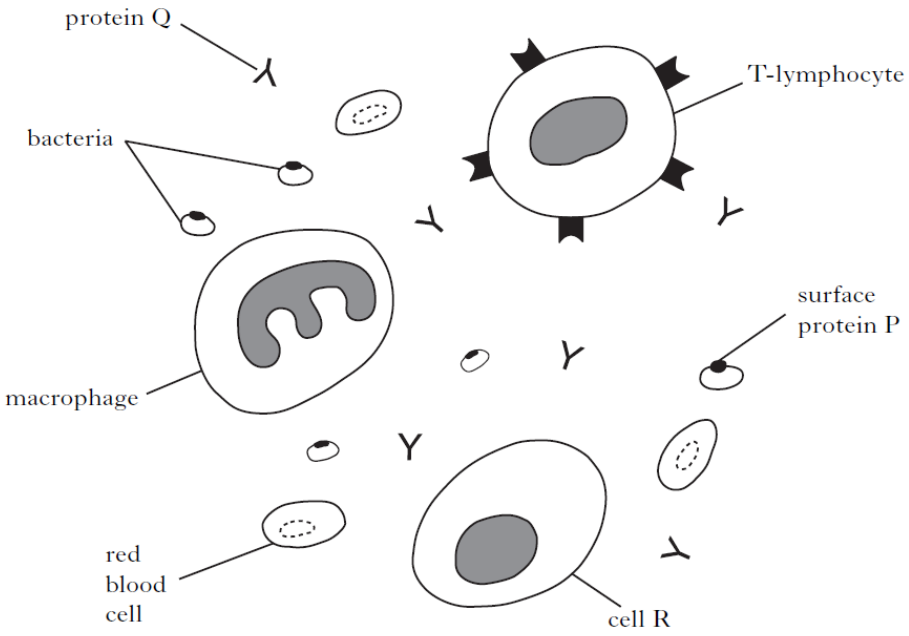
d) Explain why vaccination again polio would not provide immunity against the measles virus. (1)

e) When producing a vaccine an adjuvant is usually mixed with the pathogen. Explain why an adjuvant is added. (1)

f) Clinical trials of vaccines often use a double-blind protocol. Describe what is meant by the term double-blind. (1)

19. The diagram below shows blood from a person who has been infected by bacteria. These bacteria have triggered an immune response involving proteins P and Q.

The diagram is not drawn to scale.



a) i)Identify proteins P and Q. (1)

ii) Cell R produced protein Q. Name this type of cell. (1)

iii) Describe the role of the following cells in combating infection

A) T-lymphocyte (1)

B) Phagocyte (1)

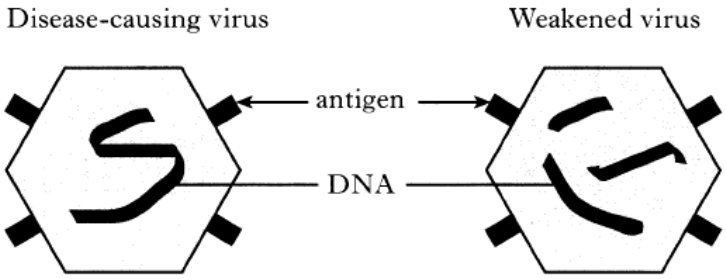
b) Complete the following sentences by underlining one option from each pair of options shown in bold.

i) Immunity gained after contracting a bacterial infection is an example of **active/passive** immunity that is **naturally/artificially** acquired. (1)

ii) Immunity gained from the injection of a tetanus vaccine is an example of **active/passive** immunity that is **naturally/artificially** acquired. (1)

c) What happens during an autoimmune response? (1)

20. The diagrams below show a disease-causing virus and one of the same type which has been weakened to make it less harmful.



a) A woman is vaccinated with the weakened form of the virus.
   i) Explain why she does not develop the disease from the vaccination. (1)
   ii) What feature of the weakened virus results in her gaining immunity from the disease? (1)
   iii) Explain why this form of immunity is described as being both artificial and active. (2)

b) The table contains information about viruses,
   Tick the appropriate boxes to show characteristics which apply to all viruses. (2)

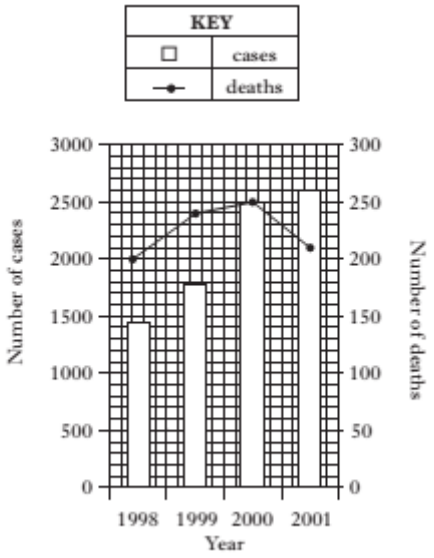
Characteristic	Tick
Contains a nucleus	
Surrounded by a protein coat	
Can be seen under a light microscope	
Contains nucleic acid	
Can only reproduce inside other cells	

The Transmission and Control of Infectious Diseases

21. Which line in the table below classifies correctly the terms which describe the spread of infectious diseases?

	Regular cases in an area	Occasional cases in an area	High number of cases in an area	Cases occur in many countries
A	Endemic	Sporadic	Epidemic	Pandemic
B	Epidemic	Sporadic	Pandemic	Epidemic
C	Endemic	Epidemic	Sporadic	Pandemic
D	Pandemic	Endemic	Epidemic	Sporadic

22. The graph below shows the number of cases of meningitis and deaths due to meningitis in the UK from 1998 to 2001.



In which year was the number of deaths from meningitis less than 10% of the number of cases?

A. 1998
B. 1999
C. 2000
D. 2001

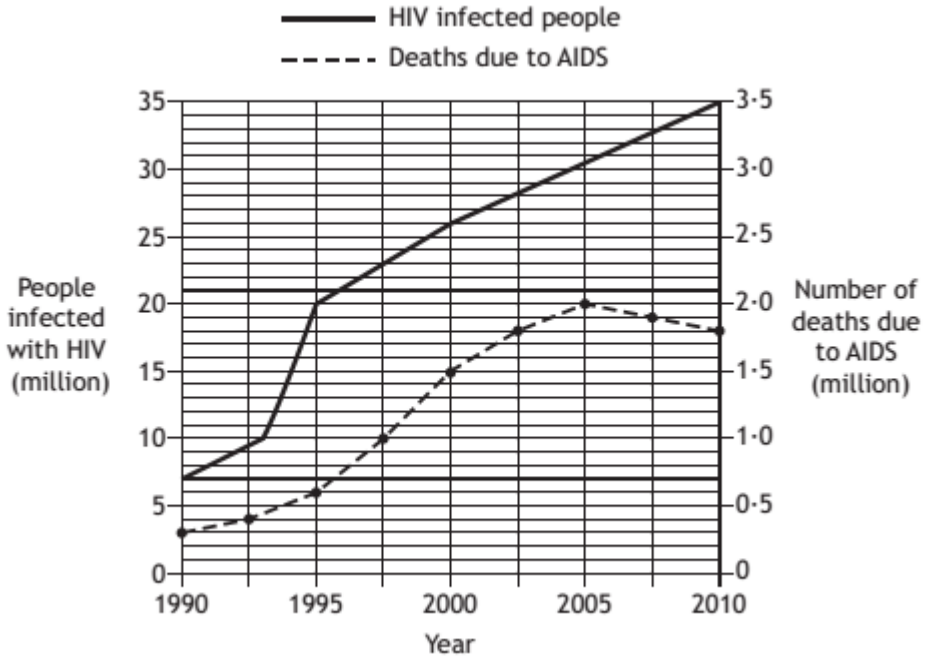
23. The table below contains information about the number of cases of influenza in a city over five years.

Year	*Influenza cases in January*	*Influenza cases in July*
2001	580	120
2002	620	345
2003	1200	350
2004	120	145
2005	400	100

Which of the following conclusions can be drawn from the data in the table?

A. There are always more cases of influenza in January than in July.
B. The number of cases of influenza decreased by 75% between January and July of 2005.
C. The greatest percentage decrease in influenza cases occurred between January and July of 2003.
D. The greatest percentage increase in influenza cases occurred between July 2002 and January 2003.

24. HIV is a virus which invades the cells of the immune system.
People infected with HIV may not show symptoms for many years.
AIDS is the condition which may develop from HIV infection, resulting in death.
The graph below shows the number of people in the world infected with HIV, from 1990 to 2010. It also shows the number of people who died from AIDS during this period.



a) State how many people were infected with HIV in the year 2000. (1)

b) State how many people died from AIDS when 20 million people in the world were infected with HIV. (1)

c) Calculate the percentage of HIV-infected people who died from AIDS in 2010. (1)

d) Describe the evidence from the graph which suggests that the rate of people becoming infected with HIV was greatest between 1993 and 1995. (1)

25. Give an account of infectious diseases under the following headings:

i) The classification of the spread of diseases; (3)

ii) The transmission of disease; (3)

iii) The control of disease transmission. (4)

26. Give an account of transmission and control of infectious diseases. (8)

Active Immunisation and Vaccination and the Evasion of Specific Immune Response by Pathogens

27. 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.

28. 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.

29. When a disease occurs regularly in an area it is classifies as being
    A. Sporadic
    B. Endemic
    C. Epidemic
    D. Pandemic

30. 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.

31. 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

32. 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

33. A scientist investigated the effectiveness of four different types of influenza vaccine. A total of 2000 volunteers from a Scottish community were divided into four groups.
    Each group was injected with a different vaccine.
    The number who developed influenza during the following years was recorded.
    The results are shown in the table below.

Type of influenza vaccine	*Developed influenza*	*Did not develop influenza*	*Total*
P	35	495	530
Q	25	455	480
R	24	496	520
S	17		

    a) i) Suggest **one** way in which the scientist could minimise variation between the four groups of volunteers. (1)
    (ii) **Copy and complete the table** for the volunteers who received type S vaccine. (1)
    (iii) State which of the vaccines P, Q or R was most effective in this investigation. (1)
    b) Explain why vaccines usually contain an adjuvant. (1)
    c) In 1918 fifty million people died in a global outbreak of influenza.
    State the term used to describe such an outbreak. (1)

34.

a) Concerns about the MMR vaccine caused the percentage of children in the UK immunised against measles, mumps and rubella to fall below the critical level of 80% between 2000 and 2005. As a result, outbreaks of these viral diseases occurred in various parts of the country.

i) State what is present in an injection of vaccine. (1)

ii) Explain how the process of vaccination prevents a child from showing symptoms of mumps during future outbreaks of the disease. (1)

iii) Suggest why these diseases spread more rapidly when the vaccination level falls below 80%. (1)

b) Unlike the MMR vaccine, a vaccine against influenza should be given annually.

State the reason for this. (1)