# Communicable diseases, disease prevention & the immune system

## Question Paper 1

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|---|---|
| Level | A Level |
| Subject | Biology |
| Exam Board | OCR |
| Module | Biodiversity,evolution and disease |
| Topic | Communicable diseases, disease prevention & the immune system |
| Booklet | Question Paper 1 |

**Time allowed:** **54 minutes**

**Score:** **/40**

**Percentage:** **/100**

**Grade Boundaries:**

| A* | A | B | C | D | E |
|---|---|---|---|---|---|
| >69% | 56% | 50% | 42% | 34% | 26% |

## Question 1

Lymphocytes form an important part of the specific immune system in humans. They can be classified into B lymphocytes and T lymphocytes.

**(a)** For each of the statements in the table below, use **ticks or crosses** to identify whether the statement belongs to B lymphocytes, or to T lymphocytes, or to both B and T lymphocytes.

The first one has been done for you.

| Statement | B lymphocytes | T lymphocytes |
|---|---|---|
| Matured in bone marrow | 3 | ✗ |
| Form part of immune response | | |
| Differentiate into memory cells | | |
| Produce chemicals that can cause lysis of infected cells | | |
| Form plasma cell clones | | |

**[4]**

**(b)** Fig. 4 shows the concentration of antibodies in a patient's bloodstream following an influenza (flu) vaccination, and then a subsequent infection with the influenza virus.

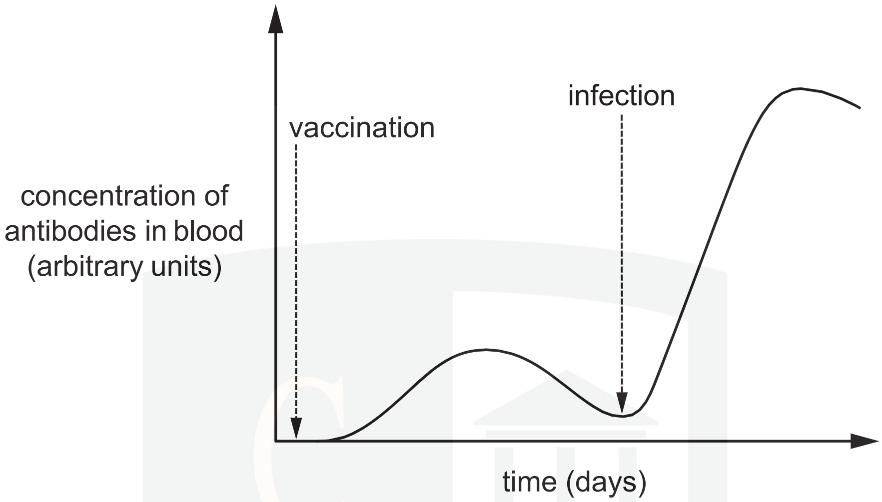


**Fig. 4**

Describe where the primary and secondary immune responses are taking place on Fig. 4 and explain the differences between the two processes. **[3]**

**(c)** In West Africa during 2015 there was a serious outbreak of the viral disease Ebola which spread by contact with infected bodily fluids.

- At the start of the outbreak there was a severe lack of trained health workers in the affected areas and much of the nursing was carried out in the family home or at local clinics.
- Many residents lived in close proximity to one another and sanitation was often of a poor standard.
- In times of illness it was common for people to travel to stay with close relatives, often in nearby villages or towns.
- As the outbreak spread, some residents left their villages to flee from the disease.
- Local mourning and burial practices involved gathering at the family house to pay respects to the deceased. Prior to burial the deceased was usually bathed by close family members.

A number of common factors affect the spread of communicable diseases in humans and some of them are relevant to the spread of Ebola. From the information above, discuss these factors and suggest what actions could have been put in place to address them. **[6]**

**[Total: 13]**

## Question 2

Vaccinations are effective in preventing the spread of a range of diseases.

**(a)** Explain why vaccinations are an example of active immunity. **[2]**

**(b)** Measles is a potentially fatal disease.

- Since 1988 children in the UK have been vaccinated against measles using the MMR vaccine.
- In 1998 a study was published which linked the MMR vaccine to the development of a condition known as autism. Some parents refused to have their children vaccinated with MMR.
- The study linking MMR to autism has since been discredited.

**Table 3.1** shows some data about the percentage of children vaccinated with MMR and the incidence of measles in England and Wales.

| Year | Proportion of children vaccinated with MMR (%) | Confirmed cases of measles |
|---|---|---|
| 1997 | 92 | 177 |
| 1998 | 91 | 56 |
| 1999 | 88 | 92 |
| 2000 | 88 | 110 |
| 2001 | 87 | 70 |
| 2002 | 84 | 319 |
| 2003 | 82 | 437 |
| 2004 | 80 | 188 |
| 2005 | 81 | 78 |
| 2006 | 84 | 740 |
| 2007 | 85 | 990 |
| 2008 | 85 | 1370 |
| 2009 | 85 | 1144 |
| 2010 | 88 | 380 |

**Table 3.1**

**(i)** Between 1997 and 1999 the mean percentage of children vaccinated with MMR was 90.3.

Calculate the mean number of confirmed cases of measles between 1997 and 1999.

Give your answer to one decimal place. **[1]**

**(ii)** In 2005, despite relatively low vaccination rates, the number of confirmed cases of measles was only 78.

Use your answer to part **(i)** to calculate the percentage change in the number of confirmed cases of measles from the mean value of 1997–1999 to 2005.

Give your answer to one decimal place. **[2]**

**(iii)** In early 2006, a newspaper claimed that the drop in MMR vaccination rates had not led to the predicted increase in measles cases.

Evaluate the validity of the newspaper's claim. Use processed data to support your argument.

**[3]**

**(c)** The MMR injection is actually a combination of three different vaccines. It

protects children against measles, mumps and rubella pathogens.

Explain why it is not possible to protect against the different pathogens using only one vaccine.

**[3]**

**[Total: 11]**

## Question 3

There will be outbreaks of new infectious diseases in the future. They will arise from mutations in the genomes of existing organisms. The mutating organisms may not at present be pathogenic, or they may be animal pathogens that mutate to become able to infect humans.

**(a)** What feature of a pathogen such as *Mycobacterium tuberculosis* could be altered by a mutation, making a vaccine ineffective?

**[1]**

**(b)** **(i)** Outline the processes that lead to the production of antibodies against an unfamiliar bacterium.

**[3]**

**(ii)** Explain how helper T cells act to speed up these processes. **[2]**

**(c)** **Fig. 16.1** shows the concentration of new antibodies in the blood of a person infected for the first time by a pathogen, on day 0. This is their 'primary response'.

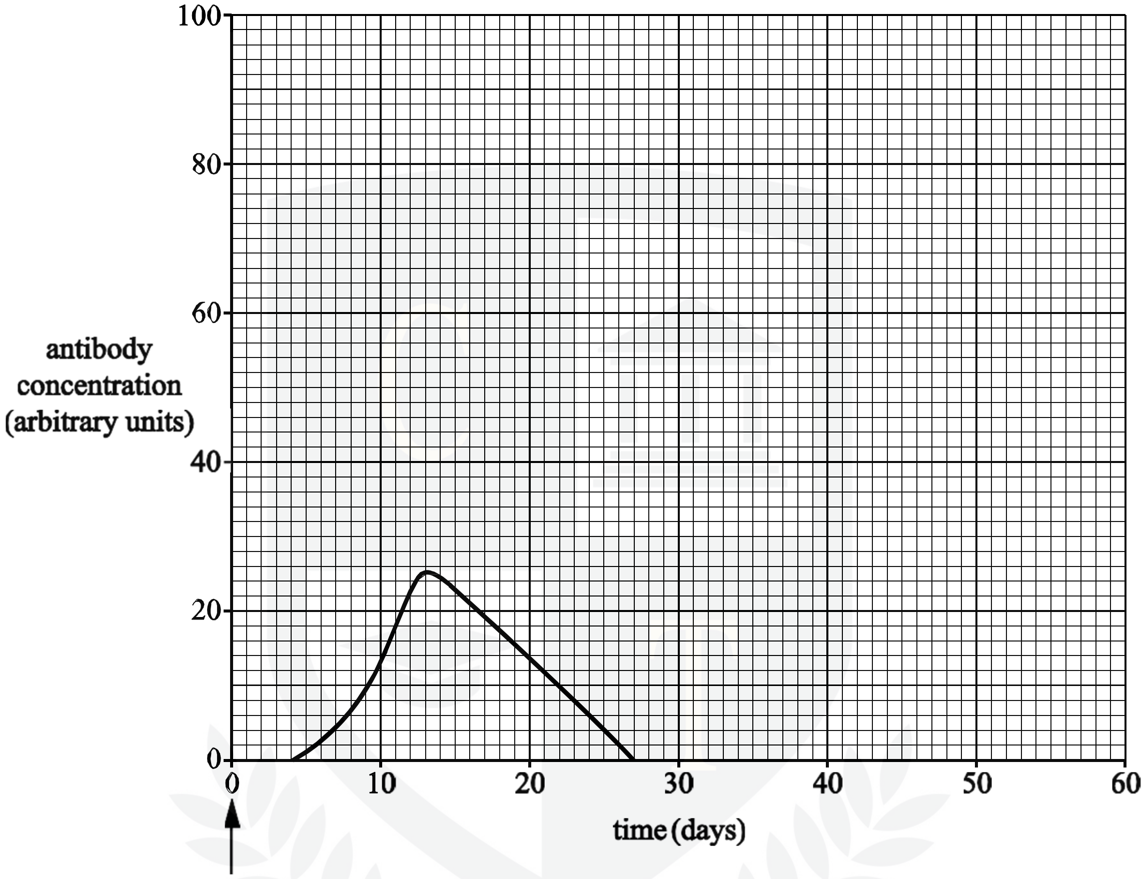


**Fig. 16.1**

**(i)** On day 30, this individual was again infected with the same pathogen. Sketch a line **on Fig. 16.1** to show the antibody concentration from day 30 onwards. **[2]**

**(ii)** Explain how memory cells caused the differences between the two lines on the graph. **[2]**

**(d)** **(i)** It takes time for an effective vaccine to be prepared in quantity for a new strain of bacterium.

List two vulnerable groups of people for whom you would advise doctors to prescribe antibiotics although they are **not** yet showing symptoms of the new disease.

**[2]**

**(ii)** Discuss the implications of the over-use of antibiotics when people do not show symptoms.

**[4]**

**[Total: 16]**