# Communicable diseases, disease prevention & the immune system

## Model Answers 3

| | |
|---|---|
| Level | A Level |
| Subject | Biology |
| Exam Board | OCR |
| Module | Biodiversity, evolution & disease |
| Topic | Communicable diseases, disease prevention & the immune system |
| Booklet | Model Answers 3 |

**Time allowed:** **51 minutes**

**Score:** **/38**

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

**Grade Boundaries:**

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

## Question 1

**(a)** Lymphocytes are important components of the immune system and can be classified into B lymphocytes and T lymphocytes.

For each of the statements in the table below, identify whether the description applies to:

- only B lymphocytes
- only T lymphocytes
- both B and T lymphocytes
- neither.

You may use each response once, more than once, or not at all. The first one has been done for you.

| statement | can be applied to ... |
|---|---|
| form part of immune response | both |
| matured in thymus | T lymphocytes |
| secrete substances which kill infected cells | T lymphocytes |
| manufacture antibodies | B lymphocytes |
| undergo clonal expansion | Both |
| activate other lymphocytes | T lymphocytes |

**[5]**

**(b)** Fig. 7.1 shows the concentration of antibodies in a patient's blood following an initial infection with a pathogen. This is known as the primary response.

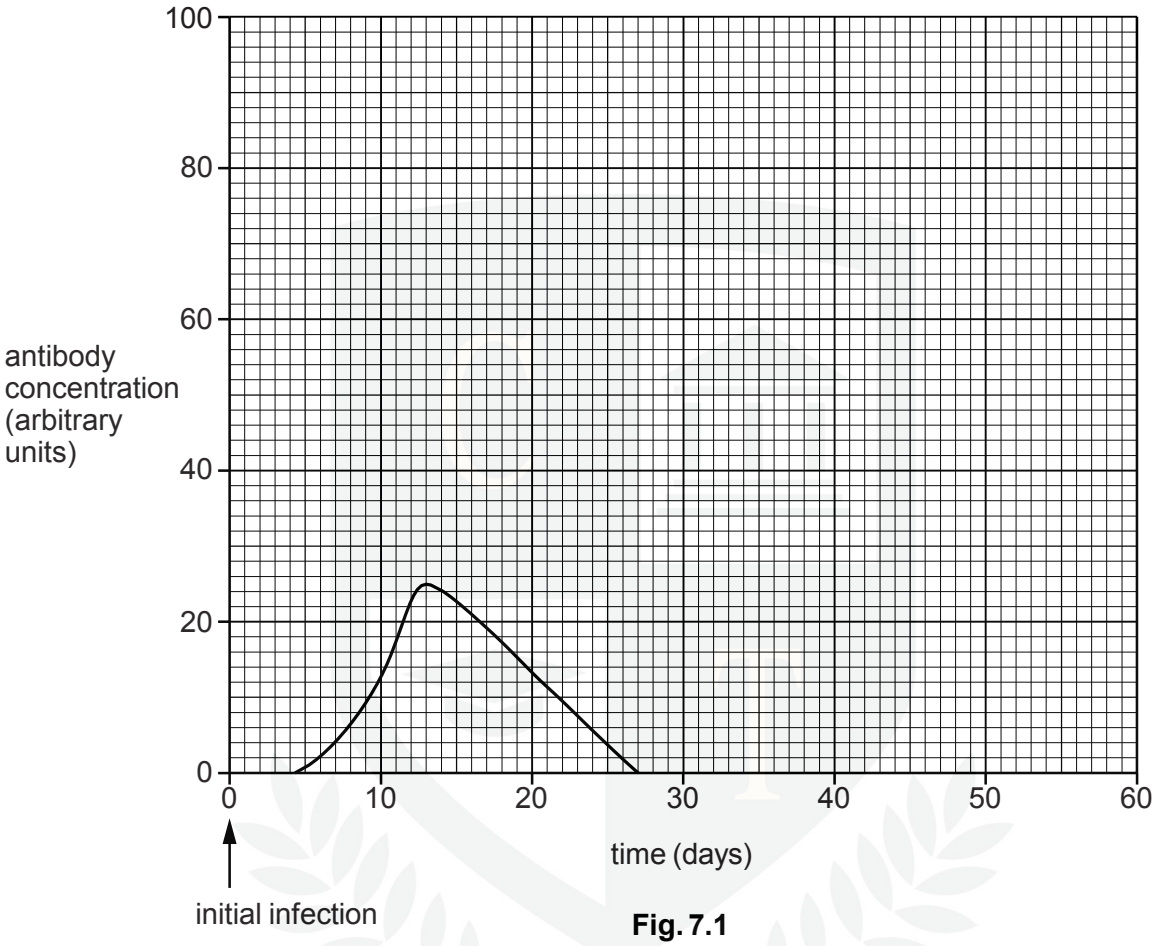



**Fig. 7.1**

**(i)** Describe the changes in antibody concentration that occur in the patient's blood during the primary response. **[3]**

- No antibodies were detected before four days or antibodies only appear at four days
- Antibody levels increase to a peak and decrease
- The peak antibody level is at 13 days when it reaches 25 arbitrary units
- The increase in antibody concentration is steeper than the decrease
- Antibody concentration returns to 0 at 27 days

**(ii)** The patient was subsequently infected with the same pathogen 30 days after the initial infection.

Draw a line **on the graph** to show the likely concentration of antibodies in the patient's blood from 30 days onwards. **[2]**

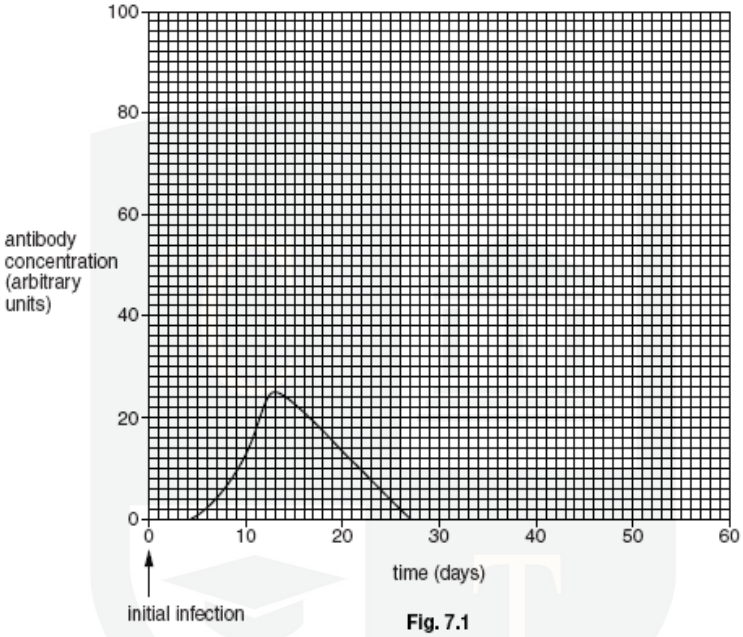



**Fig. 7.1**

- Higher peak and steeper initial increase
- Antibodies appear between 30 and 34 days, antibody concentration must be higher than primary response

**(c)** Fig. 7.2 shows the structure of an antibody.

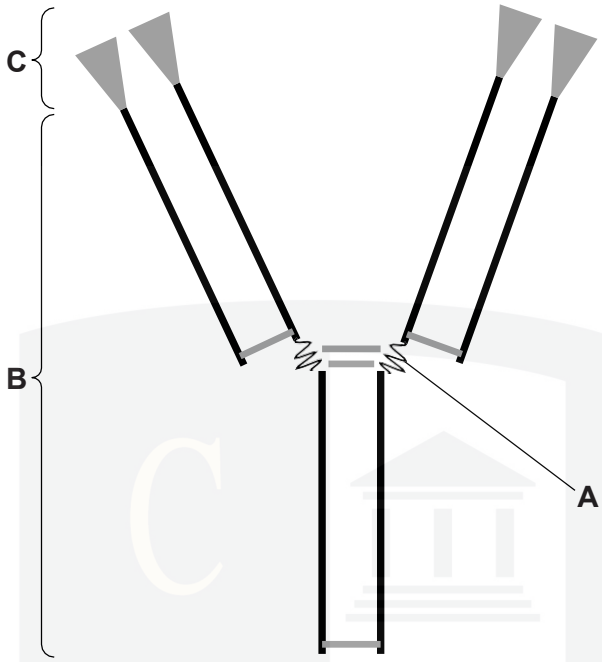
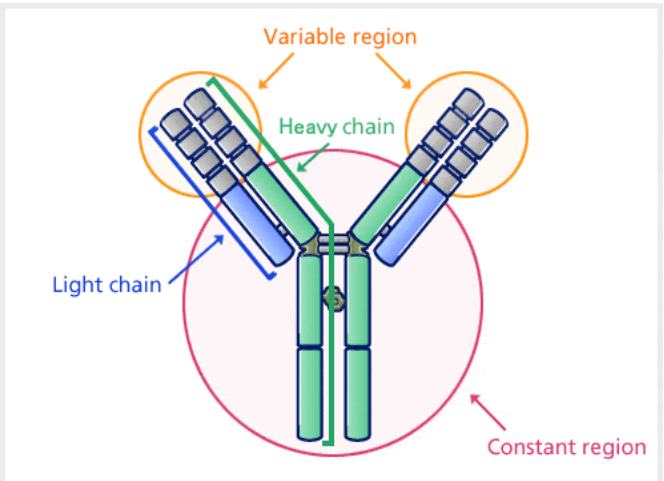



**Fig. 7.2**

Complete the table below by stating the name and function of each of the regions **A**, **B** and **C**.

| region | name | function |
|---|---|---|
| **A** | Hinge region | Flexibility, allows it to bind with more than one antigen |
| **B** | Constant region | Attachment to phagocytes |
| **C** | Variable region | Binds to antigens |

**[6]**




**[Total: 16]**

## Question 2

**(a)** Each winter, the UK government recommends that vulnerable members of the public are vaccinated against the influenza (flu) virus.

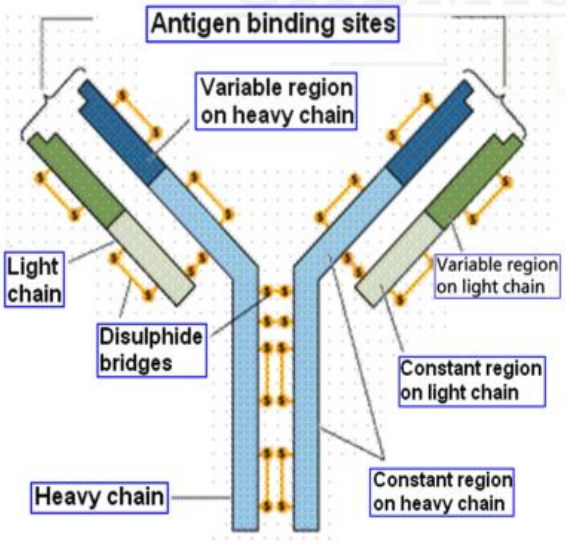
**(i)** State **two** groups of people that the government would consider as being vulnerable. **[2]**

Groups of people who would be considered as being vulnerable include:

- The elderly or older people
- Children or young people at risk
- Pregnant women
- Those with a compromised immune system is such as HIV, those on immunosuppressant drugs
- Individuals with chronic diseases
- Health workers

**(ii)** Suggest why the influenza vaccine has to be changed each year. **[2]**

- The influenza vaccine has to be changed because different strains of the virus mutate each year
- New strains have different antigens
- The antibody produced has to match the new antigen



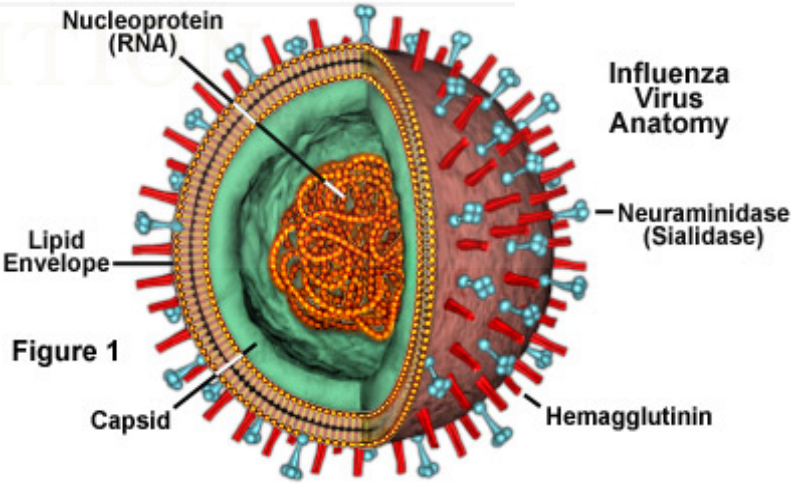




Figure 1

Fig. 4.1 shows the concentration of antibodies in a patient's bloodstream following an influenza vaccination and then infection with the influenza virus.

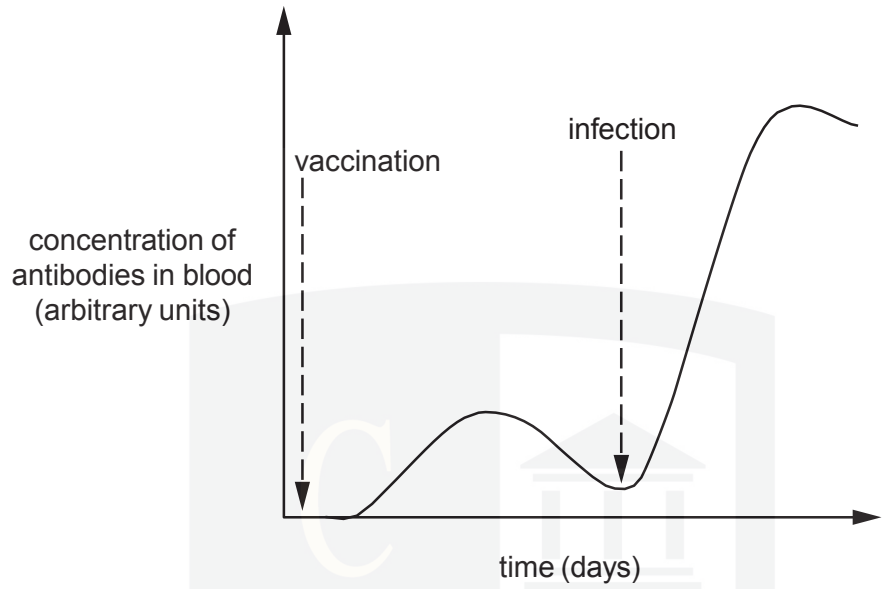
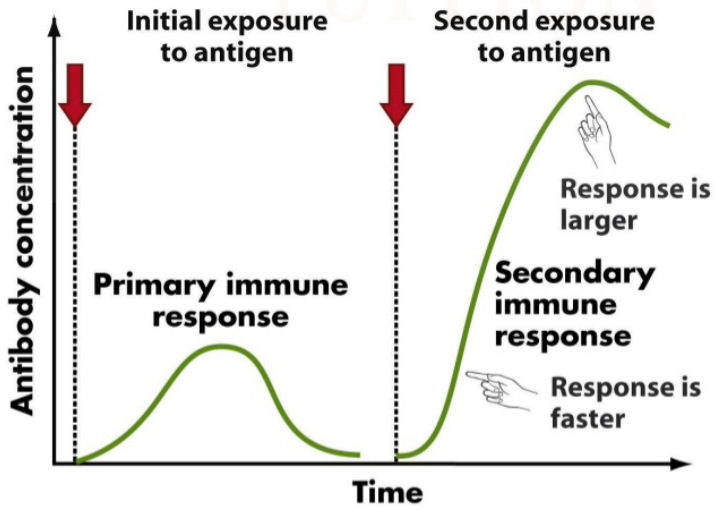



**Fig. 4.1**

**(iii)** Using the information from Fig. 4.1, state **two differences** between the primary and secondary immune responses. **[2]**

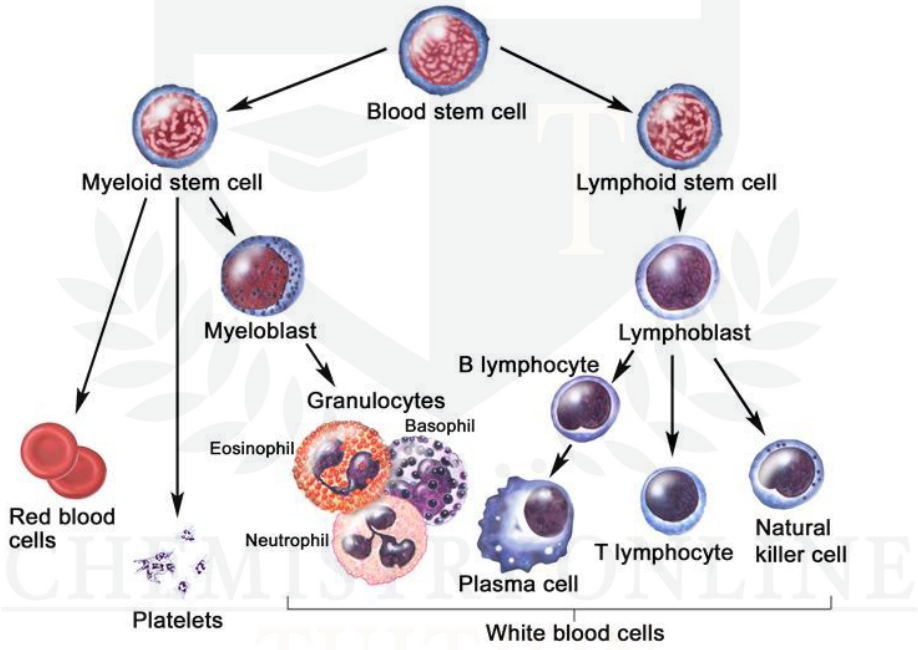
- The secondary response has a shorter delay than the primary response
- The secondary response is more rapid than the primary response
- The secondary response produces more antibodies or the secondary response lasts longer



**(iv)** Memory cells are produced when a patient is vaccinated against influenza.

Describe the role of these memory cells when the influenza virus enters the body. **[3]**

- Memory cells recognise the antigens on the virus when it enters the body
- The memory cells divide to produce a clone
- The memory cells can then differentiate to form a plasma cells
- Plasma cells make antibodies against the virus
- Memory cells are responsible for the secondary response
- Memory cells can develop into T helper or T killer cells




**(b)** Tamiflu® is an antiviral drug that can be used to treat influenza patients.

**(i)** State why a doctor would **not** prescribe antibiotics to treat influenza. **[1]**

- A doctor would not prescribe antibiotics to treat influenza because it is a virus and antibiotics are only effective against bacteria

**(ii)** Neuraminidase is an enzyme which is present on the protein coat of the influenza virus.

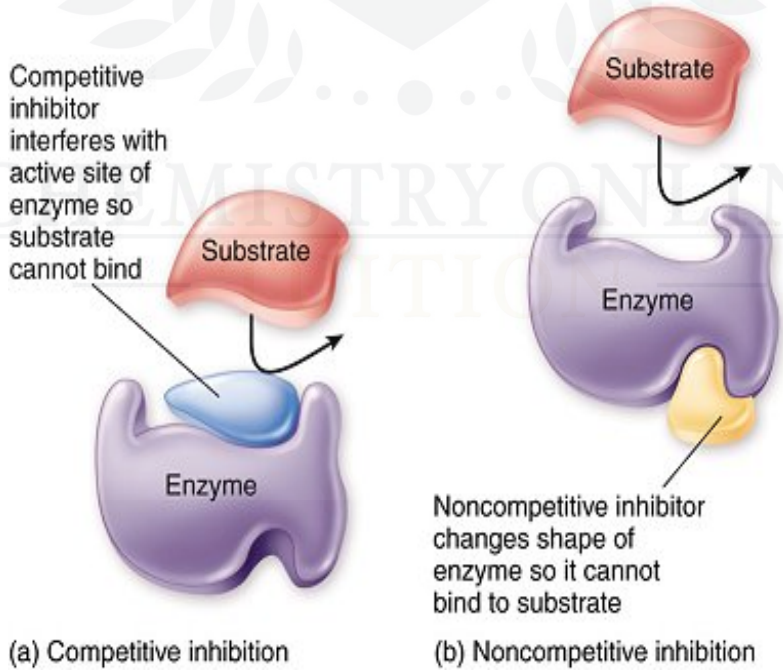
This enzyme is used to break down the host cell membrane and allow the influenza viruses to leave the infected cell. Tamiflu® is a neuraminidase inhibitor.

Suggest how Tamiflu® could inhibit neuraminidase. **[2]**

- Tamiflu is a competitive inhibitor of the enzyme neuroaminidase
- It binds with the active site of the enzyme because it has a complementary shape
- When it binds with the active site it prevents the substrate binding and preventing the formation of an enzyme substrate complex

or

- Tamiflu is a non-competitive inhibitor
- It binds with the allosteric site changing the shape of the active site
- The substrate is unable to bind to the active site and cannot form and enzyme substrate complex



**(iii)** Suggest how Tamiflu® could help to reduce the spread of influenza. **[2]**

- Tamiflu could help to reduce the spread of influenza because fewer viruses are produced
- Fewer viruses are released when sneezing and coughing occurs
- This is a result of viruses being unable to leave the cell
- The viruses cannot infect and spread to other cells

**(c)** In an effort to find new drugs to combat a possible new influenza pandemic, researchers have investigated plants used in traditional medicine in Nepal. Two plants, an onion, *Allium oreoprasum*, and an asparagus, *Asparagus filicinus*, have been found to show antiviral properties.

Suggest why researchers in Nepal concentrated their research on plants that had been used in traditional medicine. **[2]**

- Because they had already been identified as likely to have medicinal effects
- This will reduce the time and effort spent in finding plants with active chemicals
- This could possibly reduce the cost of research



**[Total: 16]**

## Question 3

Complete the following passage by selecting the most suitable term from the list below.

Each term may be used once, more than once or not at all.

| | |
|---|---|
| **antibiotics** | **natural** |
| **antibodies** | **non-specific** |
| **antibody** | **specific** |
| **antigen** | **vaccination** |
| **artificial** | **vaccines** |

The body can acquire immunity in a number of different ways.

In passive immunity, .....antibodies.....are introduced directly into the body. This may occur via breast milk or the placenta, in which case it is described as .....natural..... immunity. This immunity provides the growing child with valuable protection until its immune system has developed fully. It is sometimes important to provide immediate protection, such as when a person has a wound that could be contaminated with tetanus bacteria. In this case, suitable blood serum from another individual is injected into the bloodstream to provide .....artificial..... immunity.

Edward Jenner pioneered the technique of stimulating the immune system into action so that the body develops immunity without developing the symptoms of the disease. Jenner's technique mimics the way in which the body would develop .....natural..... immunity from direct contact with the pathogen and the stimulation of the primary response. Nowadays, a harmless form of the .....antigen..... is injected so that the body develops antibodies and memory cells for future defence. This technique is known as .....vaccination.....

**[6]**

**[Total: 6]**