Q1.

3 During an immune response, some B lymphocytes change into plasma cells.

Fig. 3.1 is a drawing made from an electron micrograph of a plasma cell.

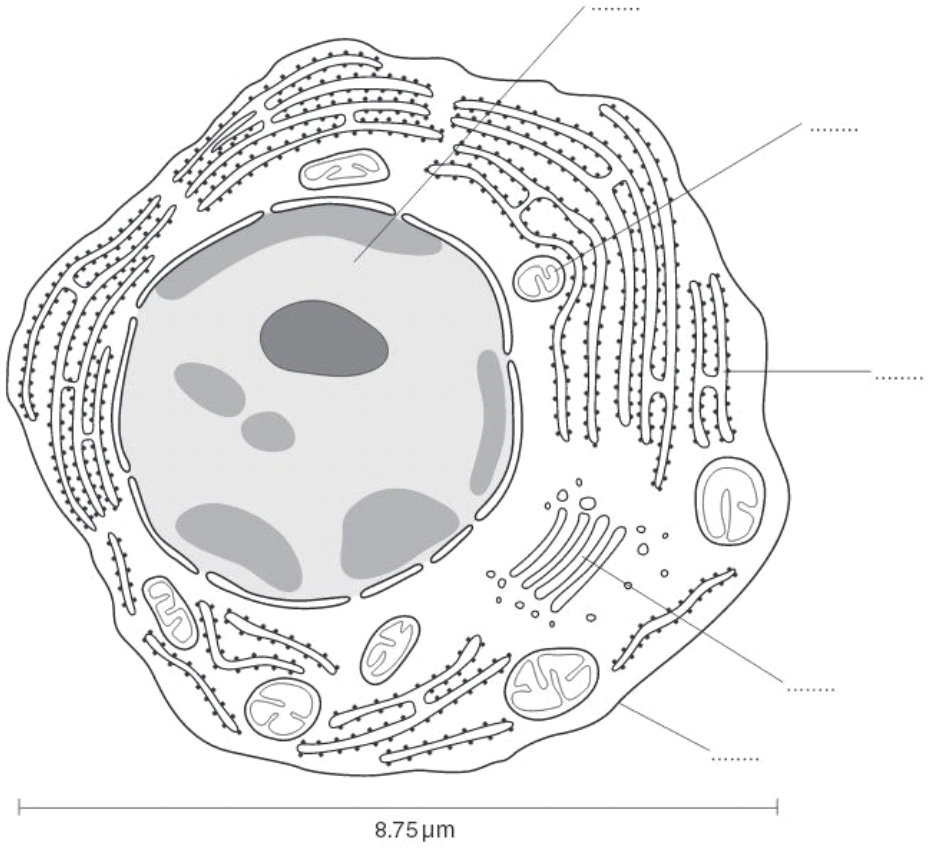


Fig. 3.1

(a) Use the label lines and the letters **A** to **E** to identify where the following processes occur.

A transcription
B polypeptide synthesis
C aerobic respiration
D formation of secretory vesicles
E active uptake of amino acids [4]

(b) State the function of plasma cells during an immune response.

.....

.....[1]

(c) State **two** ways, visible in Fig. 3.1, in which the plasma cell differs from a typical prokaryotic cell.

1. .....

.....

2. .....

.....[2]

[Total : 7]

Q2.

6 Fig. 6.1 is a diagram that shows three different T lymphocytes and the events that occur during an immune response to an antigen.

Use

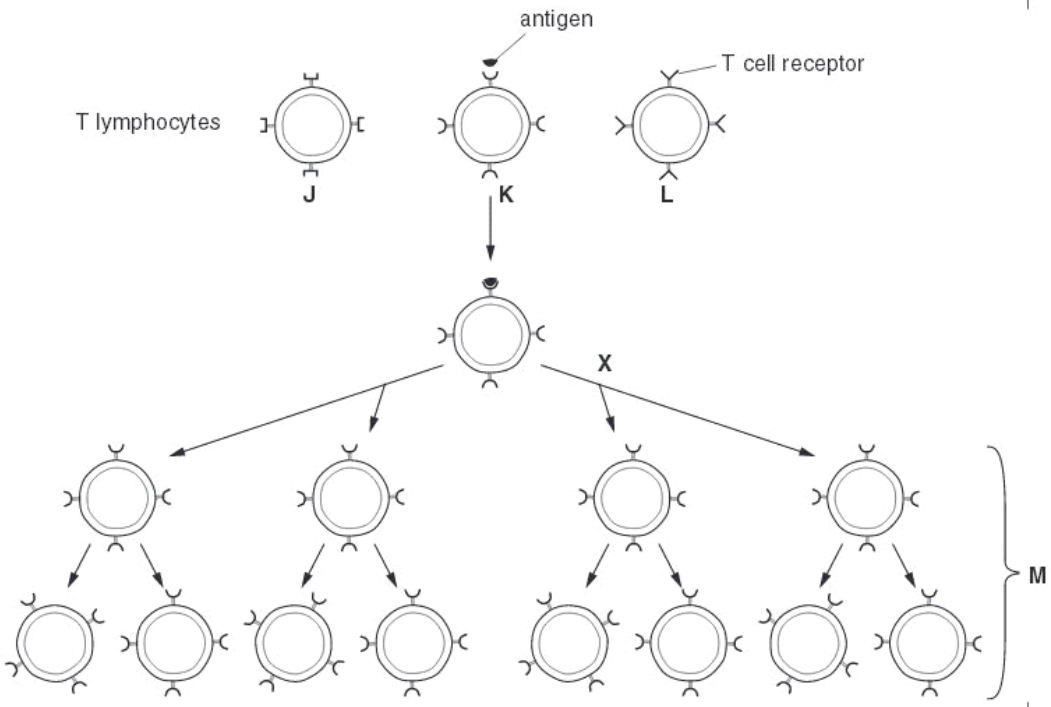


Fig. 6.1

(a) Name the type of nuclear division that occurs at **X** on Fig. 6.1.

.....[1]

(b) State the term used to describe a group of identical cells, such as those shown at **M** on Fig. 6.1.

.....[1]

(c) Explain why T lymphocyte **K** has responded to the antigen during the immune response, but not T lymphocytes **J** and **L**.

.....

.....

.....

.....[2]

(d) Describe **one** role of T lymphocytes in fighting an infectious disease.

.....

.....

.....

.....[2]

In certain types of cancer, T cells do not mature properly, fail to develop antigen receptors on their cell membranes and do not function normally.

(e) **(i)** State the name given to agents that increase the chances of cancerous growth.

.....[1]

(ii) Suggest the likely effects on the body of T cells that do not function normally.

.....

.....

.....

.....

.....

.....[2]

Q3.

Use

5 Two people took part in a study to find out the effectiveness of two types of immunisation. Person **A** received an injection of antibodies against tetanus and person **B** received a tetanus vaccination.

Over the new few weeks, the blood from these two people was analysed for the presence of antibodies to tetanus. The results are shown in Fig. 5.1**A** and Fig. 5.1**B**.

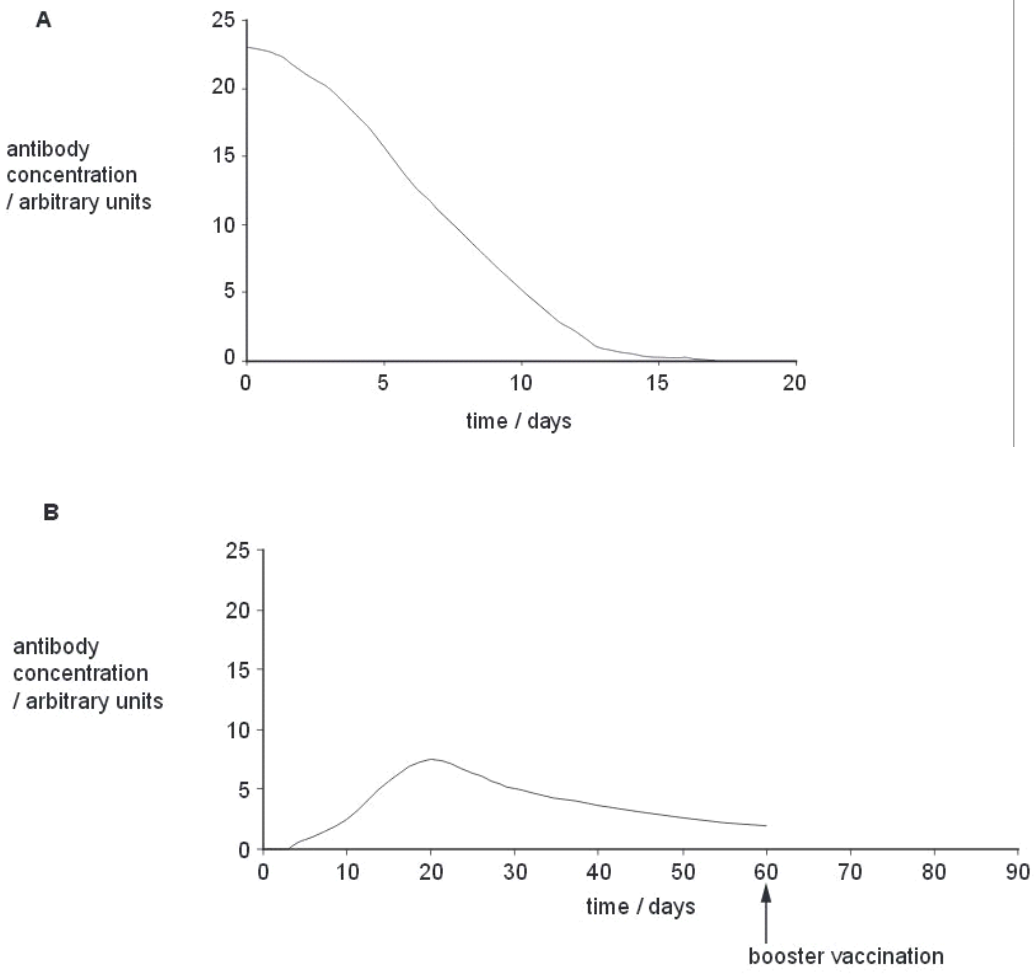


Fig. 5.1

(a) Name the types of immunity shown by Fig. 5.1 **A** and **B**.

A .....

B .....[2]

Examiner Use

(b) Explain why the antibody concentration in person **A**,

(i) decreased during the study period

.....

.....

.....

(ii) did not increase.

.....

.....

.....

.....

.....

.....[3]

(c) **Sketch on** Fig. 5.1 **B**, on page **10**, what you would expect to happen to the antibody concentration if person **B** received a booster vaccination at **day 60**.

Put your answer to this question on Fig. 5.1 **B** on page **10**.

[2]

(d) Explain why, in this investigation, the experimenters had to measure the concentration of antibodies to tetanus rather than the concentration of all antibodies in the blood of **A** and **B**.

.....

.....

.....

.....[2]

[Total: 9]

Q4.

2 Fig. 2.1 is a transmission electron micrograph of a plasma cell. Plasma cells are antibody-secreting cells that are formed from B-lymphocytes.

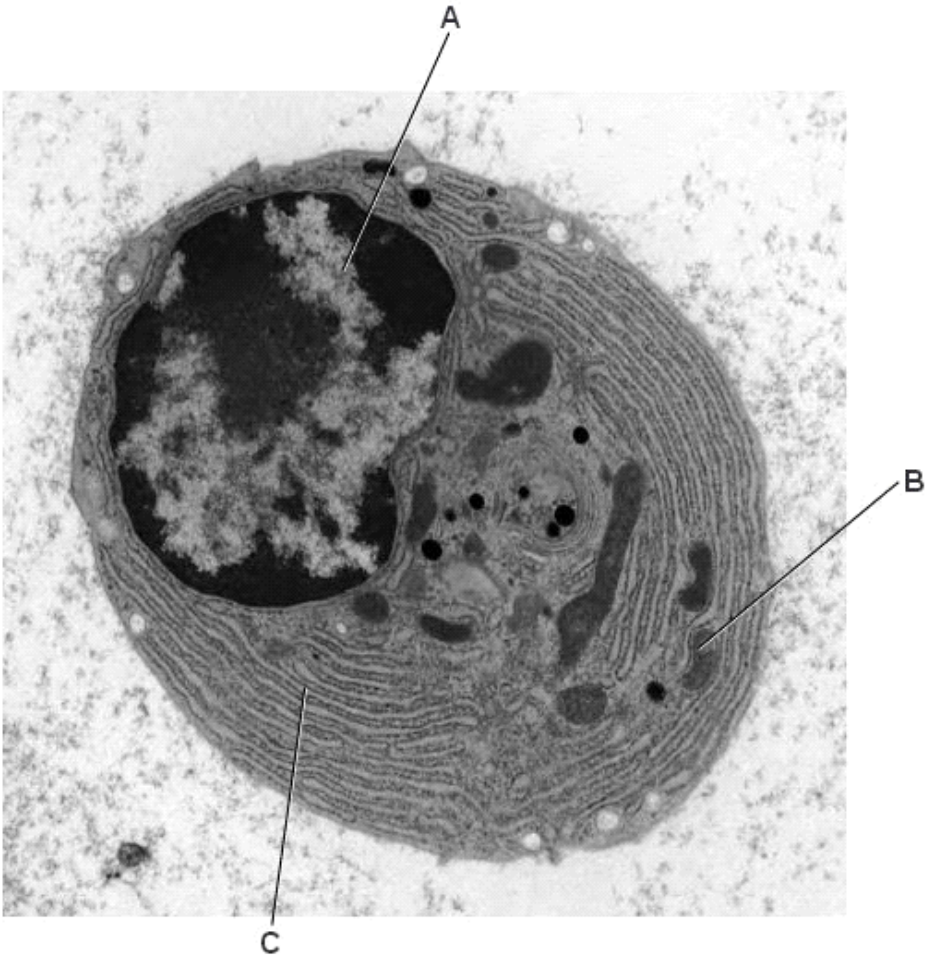


Fig. 2.1

(a) Complete Table 2.1 to:

- name in full, structures **A**, **B** and **C**
- outline how each structure functions to contribute to the **specific role of the plasma cell**.

Table 2.1

structure	name of structure	function of structure within plasma cell
A		
B		
C		

[6]

(b) An activated B-lymphocyte divides repeatedly by mitosis to produce many identical plasma cells.

(i) Explain why it is important that many identical plasma cells are produced.

.....

.....

.....

.....

.....

..... [3]

(ii) B-lymphocytes have centrioles and a spindle that can be observed during mitosis.

Describe and explain how the behaviour of the centrioles and spindle of a cell dividing by mitosis is associated with the behaviour of the chromosomes.

You may use the space below for labelled diagrams.

.....

.....

.....

.....

.....

..... [4]

[Total: 13]

Q5.

2 (a) Explain how the virus that causes measles is transmitted.

.....

.....

.....

..... **[2]**

(b) Antibodies against measles are produced by plasma cells during an immune response.

Fig. 2.1 shows a diagram of an antibody molecule.

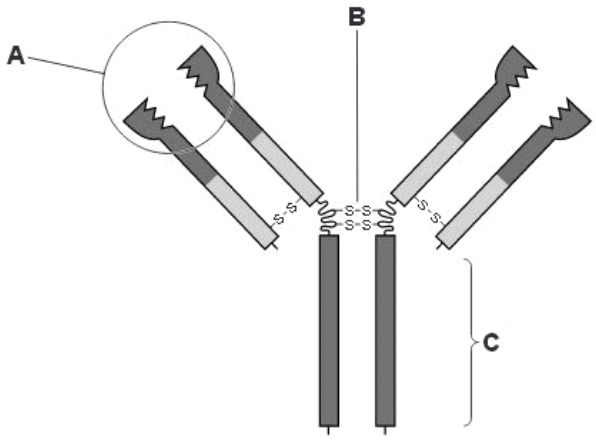


Fig. 2.1

Explain the functions of the parts labelled **A**, **B** and **C**.

(i) **A** .....

.....

.....

.....

..... [2]

(ii) **B** .....

.....

..... [1]

(iii) **C** .....

.....

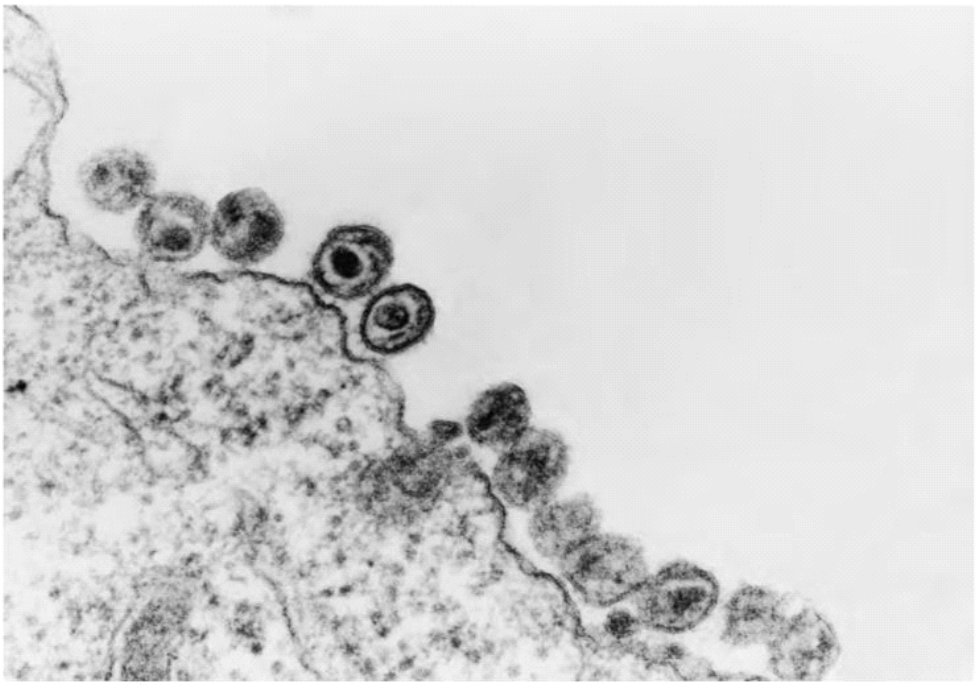
..... [1]

[Total: 6]

Q6.

Use

3 Fig. 3.1 is an electron micrograph of HIV particles leaving a T lymphocyte.



Magnification × 100 000

Fig. 3.1

HIV instructs the cell to reproduce more viruses. During this process the cell makes viral DNA and viral proteins that assemble to make new viral particles. These particles bud away from the cell membrane to infect other T lymphocytes. This process of viral budding kills T lymphocytes. A decrease in the number of T lymphocytes in the blood results in the destruction of a person's immune system and leads to the onset of AIDS.

(a) (i) Calculate the actual size of a viral particle shown in Fig. 3.1. Show your working and express your answer to the nearest nanometer.

Answer ..... nm [2]

(ii) State the property of the electron microscope that makes it possible to view clearly very small objects, such as viral particles.

.....[1]

(b) Suggest why an infected T lymphocyte that is producing HIV particles has a higher demand for amino acids than an uninfected cell.

.....

.....[1]

Q7.

(c) Fig. 4.1 shows the origin and development of a B lymphocyte and its subsequent role in an immune response following an infection with the measles virus.

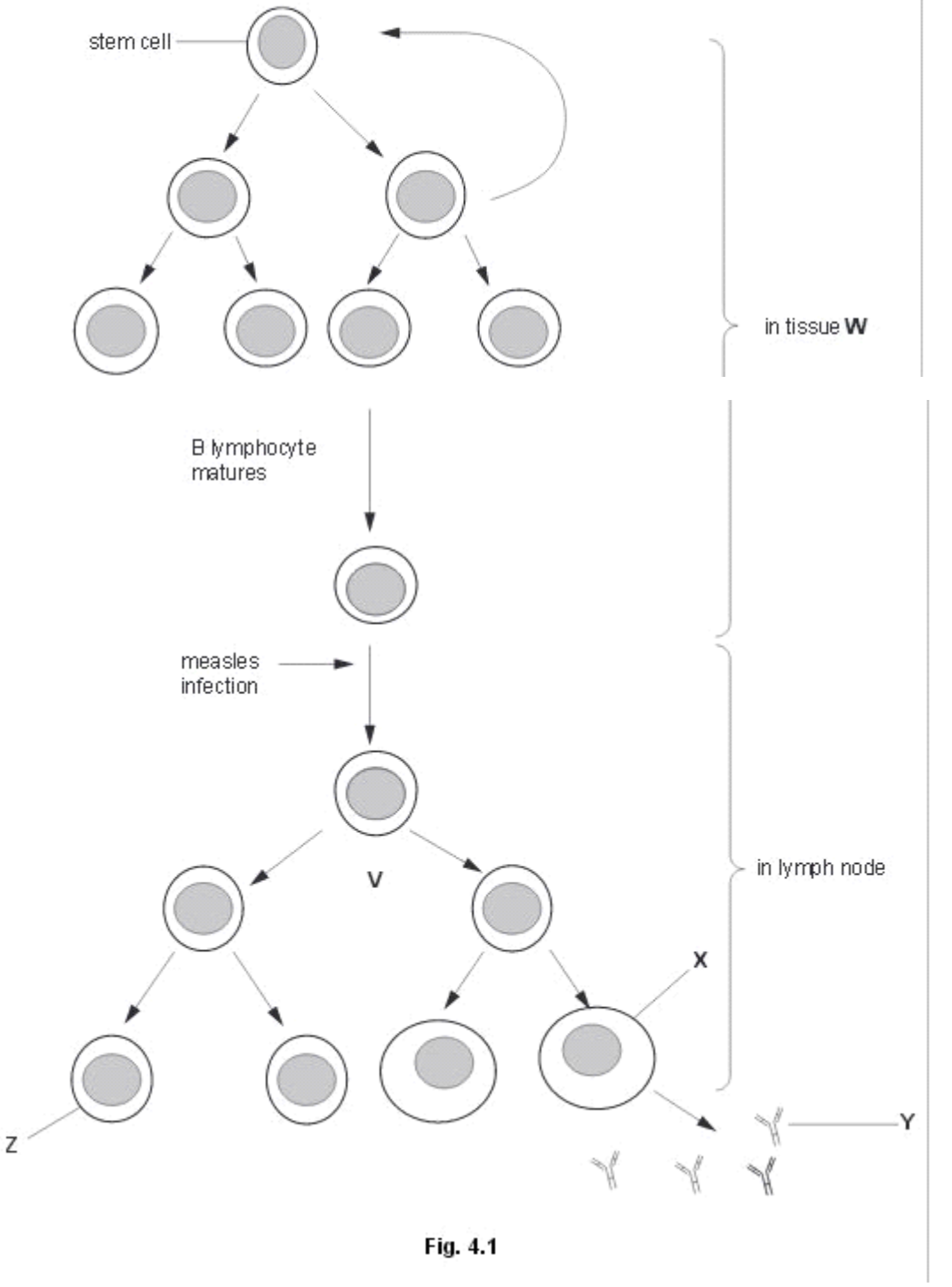


Fig. 4.1

(i) Name the type of nuclear division that occurs at **V**.

.....[1]

(ii) Name the tissue **W**.

.....[1]

(iii) State the term given to foreign molecules, such as those on the surface of the measles virus, that stimulate an immune response.

.....[1]

(iv) Name cell **X** and molecule **Y**.

X .....

Y .....[2]

(v) Cell **Z** is responsible for long-term immunity to measles.

Name cell **Z** and outline its role.

name .....

role .....

.....

.....

.....[3]

Q8.

(b) **State the roles of phagocytes and T helper lymphocytes during an immune response to a bacterial infection.**

phagocytes

.....

.....

T helper lymphocytes

.....

.....**[2]**

(c) Antibiotics are used to treat people with bacterial infections.

Explain the danger of the widespread use of antibiotics to treat disease.

.....

.....

.....

.....[2]

Q9.

1 **(a)** Phagocytes and lymphocytes are both involved in defence against infectious diseases. Active B lymphocytes are known as plasma cells.

Fig. 1.1 shows drawings made from electron micrographs of a phagocyte, **A**, and a plasma cell, **B**.

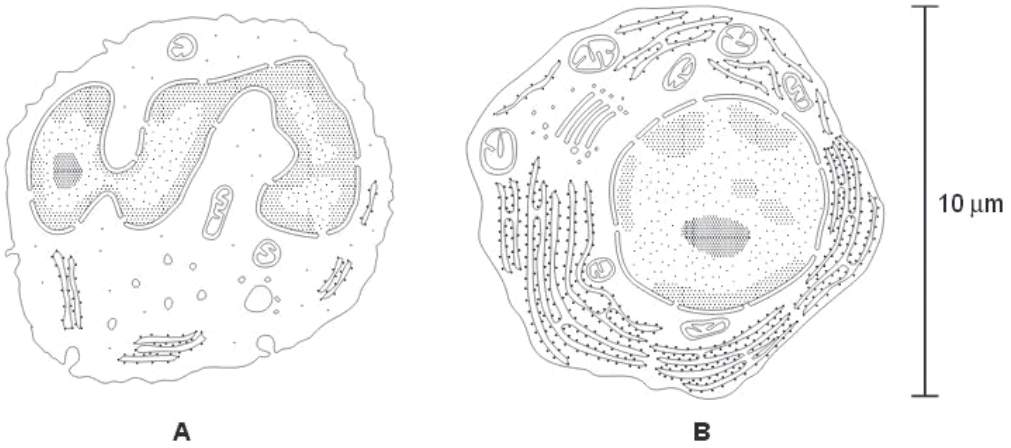


Fig. 1.1

Complete the table to show three **visible structural** differences between the cells **A** and **B**.

feature	cell **A**	cell **B**

[3]

(b) Calculate the magnification of the cells in Fig. 1.1.

Show your working and give your answer to the **nearest whole number**.

..... [2]

(c) With reference to Fig. 1.1, describe the modes of action of the two cells in defence against infectious diseases.

For Examiner Use

phagocyte .....

.....

.....

.....

.....

..... [3]

plasma cell .....

.....

.....

.....

.....

..... [3]

(d) The bacteria that cause tuberculosis (TB) infect cells in the lungs, including some phagocytic cells. TB is treated with a combination of several antibiotics that are taken over a period of about nine months.

Explain why the antibiotics used to treat TB are taken in combination over a long period of time.

.....

.....

.....

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.....

.....

.....

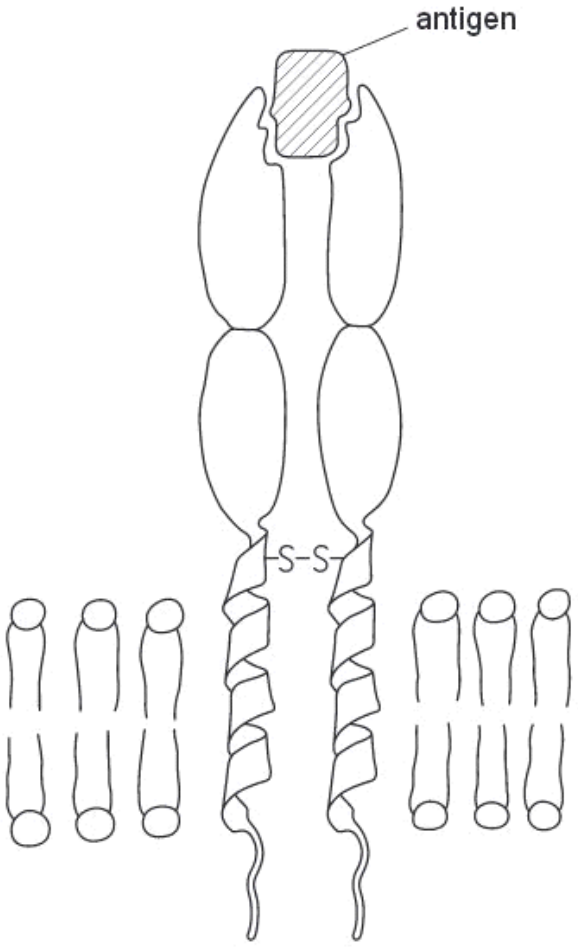
..... [4]

[Total: 15]

Q10.

1 Receptor proteins are part of the fluid mosaic structure of cell surface (plasma) membranes of T-lymphocytes. Each type of receptor protein is specific to a particular antigen.

Fig. 1.1 shows a receptor protein and the surrounding phospholipids of a cell surface membrane of a T-lymphocyte.



(iii) Describe how the **structure** of the receptor shown in Fig. 1.1 is similar to the structure of an antibody molecule.

.....

.....

.....

.....

..... [2]

(b) Describe the roles of T-lymphocytes in a primary immune response.

.....

.....

.....

.....

.....

.....

.....

..... [4]

Q11.

1 During an immune response, plasma cells secrete antibody molecules. Fig.1.1 is a diagram of an antibody molecule. The diagram is **not** complete.

Fig. 1.1

(a) (i) Draw a circle around a variable region. [1]

(ii) Draw in and label the position of the disulfide bonds in the molecule. [1]

(iii) Explain the importance of disulfide bonds in protein molecules, such as antibodies.

.....

.....

.....

.....

.....

.....[3]

(b) Describe how antibodies provide protection against pathogens.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(c) Other proteins are found in cell surface membranes.

Describe three roles of the proteins in cell surface membranes.

1 .....

.....

2 .....

.....

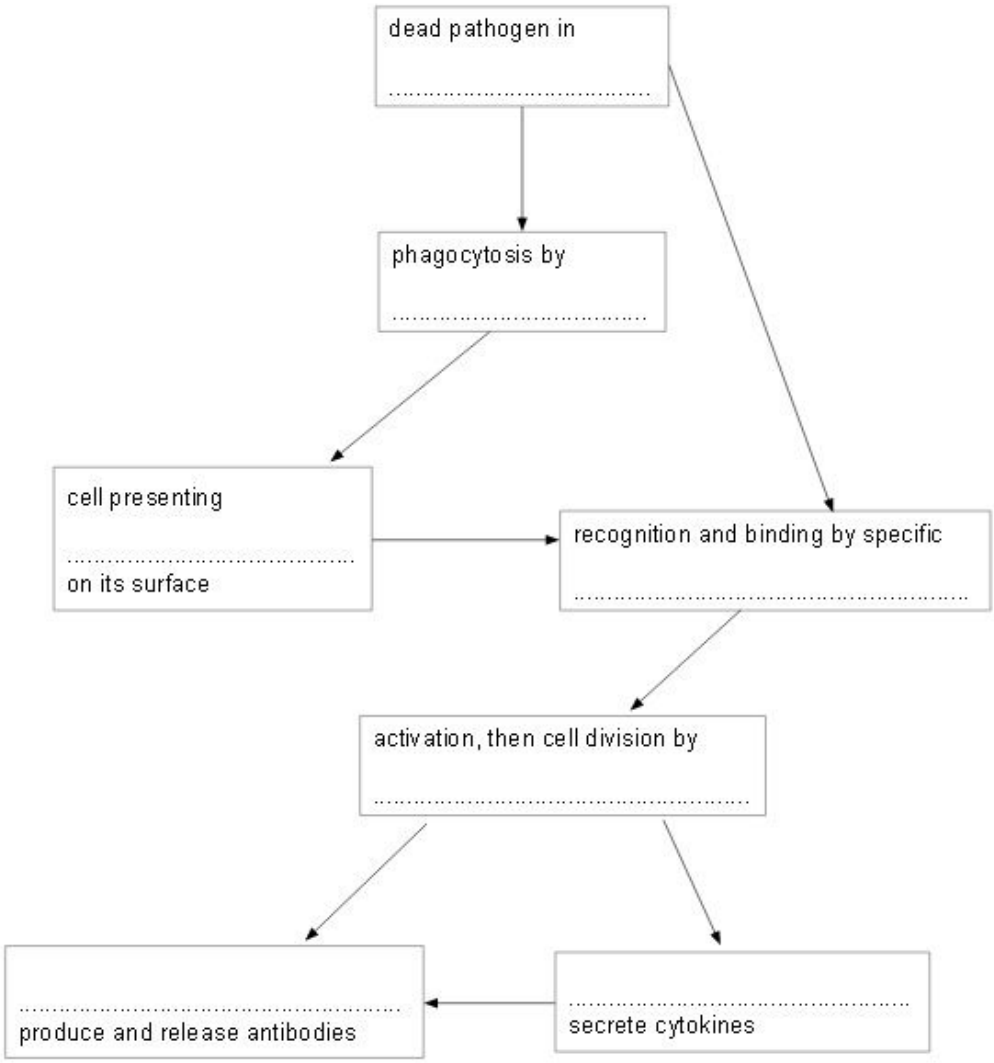
3 .....

.....[3]

[Total: 12]

Q12.

4 Fig. 4.1 is an incomplete flow chart showing some of the events of the primary immune response that occur after a person has been given a vaccine.



(a) Choose the correct term from the list below to complete Fig. 4.1.

lymphocytes	**antigens**	**mitosis**	**vaccine**
T_h-lymphocytes	**plasma cells**	**macrophages**	

[3]

(b) Explain why the person is unlikely to become ill if they are infected by the same pathogen some months later.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

(c) Some parents decide that their children should not take part in a vaccination schedule.

Suggest how a country-wide vaccination schedule can give protection against infection to **unvaccinated** children.

.....

.....

.....

..... [2]

[Total: 8]

Q13.

4 (a) Outline the roles of the T-lymphocytes and B-lymphocytes in a primary immune response. 6

T-lymphocytes .....

.....

.....

.....

B-lymphocytes .....

.....

.....

.....[4]

Fig. 4.1 shows how the concentration of antibody in blood plasma changes during the response to an antigen which is injected at day 0.

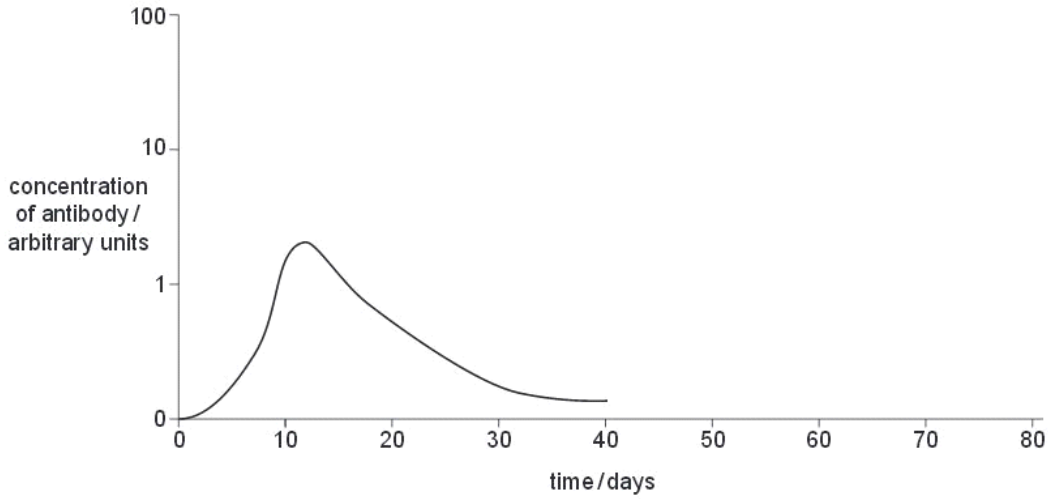


Fig. 4.1

(b) Explain why the concentration of antibody falls as shown in Fig. 4.1.

.....

.....

.....

.....

.....[3]

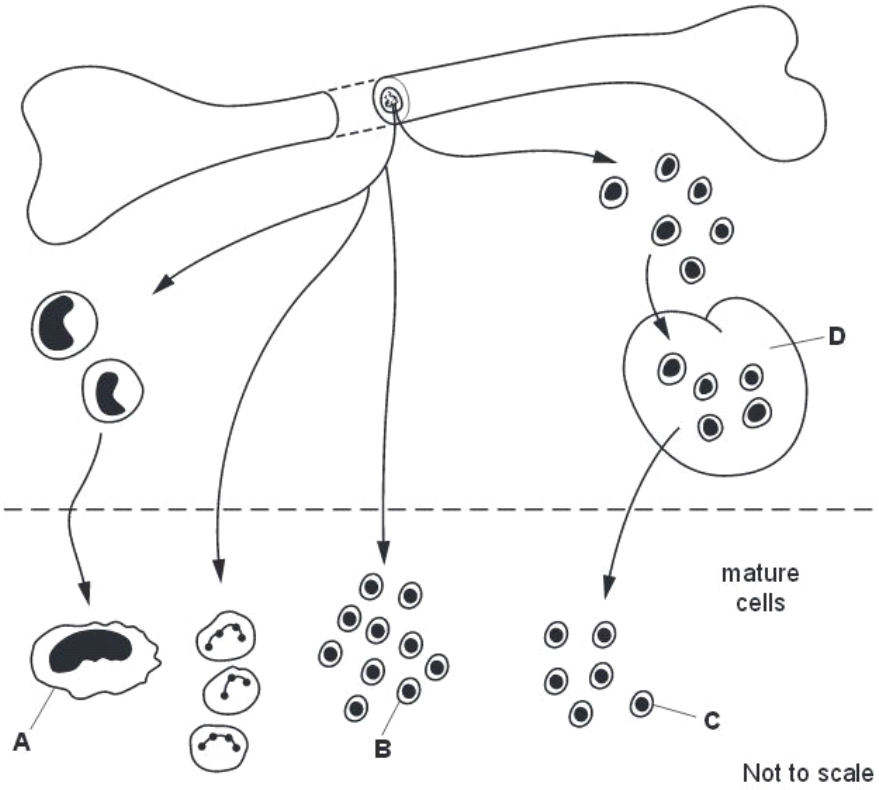
(c) Draw on Fig. 4.1 how the antibody concentration would change if the **same** antigen entered the blood plasma on day 40. [3]

[Total: 10]

Q14.

6 Phagocytes and lymphocytes are part of the body's cellular response to infection by pathogens.

Fig. 6.1 shows the origin and maturation of phagocytes and lymphocytes.



(a) Name the site of origin of phagocytes and lymphocytes.

.....[1]

(b) Name:

(i) cells **A**, **B** and **C**

A .....

B .....

C .....[3]

(ii) organ **D**.

.....[1]

(c) Explain the roles of the cells, **A**, **B** and **C** in an immune response.

In your answer use the terms *antigen* and *non-self*.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

Q15.

2 **(a)** White blood cells play an important role in defence.

For Examiner Use

State precisely the type of white blood cell that fits each of the descriptions given in **(i)** to **(iv)**.

(i) It is formed in the bone marrow and matures from a monocyte. It contains many lysosomes with hydrolytic enzymes.

.....[1]

(ii) It is formed, and matures in, the bone marrow. It contains a lobed nucleus and has the ability to ingest microorganisms by endocytosis.

.....[1]

(iii) When activated, it differentiates into a cell that secretes a chemical, which causes other cells to lyse (burst). It contains a large, spherical nucleus.

.....[1]

(iv) It is formed as a result of a primary immune response and remains in the body. On activation, it has the potential to produce antibodies during a secondary immune response.

.....[1]

Q16.

Stem cells in bone marrow give rise to phagocytes, B-lymphocytes and T-lymphocytes.

Exa

(b) Describe how a red blood cell develops from a stem cell.

.....

.....

.....

.....

.....

.....[3]

(c) During an immune response, cells divide by mitosis.

Describe how mitosis is involved in an immune response.

.....

.....

.....

.....

.....

.....[3]

(d) Describe the modes of action of T-lymphocytes during an immune response.

.....

.....

.....

.....

.....

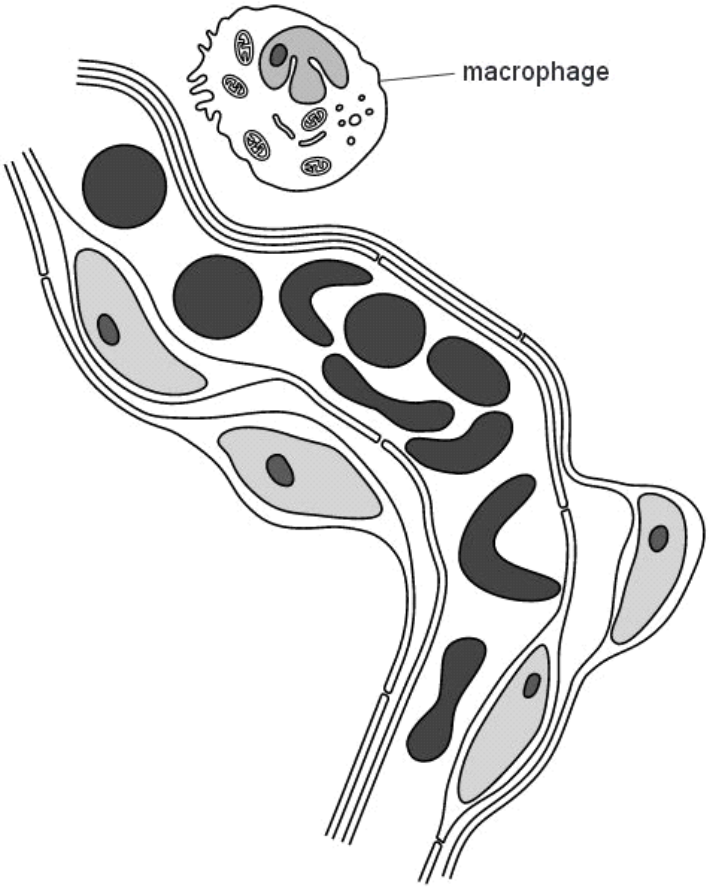
.....[3]

[Total: 13]

Q17.

Macrophages are large phagocytic cells that are found in many tissues including alveolar tissue in the lungs. They provide the main means of defence against pathogens in this tissue.

Fig. 3.1 is a drawing made from an electron micrograph showing part of a capillary and two alveoli, with a macrophage.



(ii) how macrophages function to protect the lungs from becoming infected.

.....

.....

.....

.....

.....

.....

.....

.....[4]

Q18.

6 **(a)** Nicotine, in cigarette smoke, is highly addictive. A nicotine vaccine has been developed to try and reduce the effects of addiction. The vaccine stimulates an immune response to produce antibodies that bind to the nicotine molecule. Fig. 6.1 is a diagram of an antibody molecule.

On Fig. 6.1:

- label **three** structural features that enable an antibody molecule to carry out its function.
- next to each label, state the function of the feature.

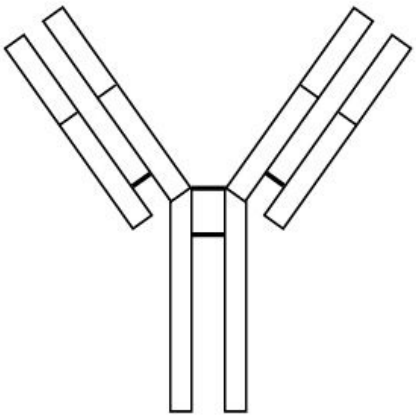


Fig. 6.1

[3]

Q19.

1 Fig. 1.1 is a diagram of an antibody molecule.

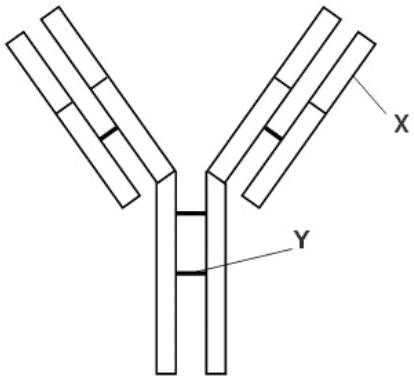


Fig. 1.1

(a) (i) Name the part labelled **X**.

..... [1]

(ii) Name the bond labelled **Y**.

..... [1]

(iii) The antibody molecule in Fig. 1.1 has quaternary structure.

Explain the meaning of the term *quaternary structure* as applied to proteins.

.....

.....

..... [1]

(b) When a pathogen enters the body, a primary immune response occurs. This response includes the production of antibodies.

Describe the stages in the immune response that lead to antibody being produced against a specific antigen.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Vaccination was used in the eradication of smallpox.

Explain, in terms of antigens, why it has not been possible to do the same for malaria.

.....

.....

.....

.....

.....

..... [2]

[Total: 9]

Q20.

A potential vaccine for choleragen was trialled on volunteers. Fig. 4.1 shows the concentration of antibodies against choleragen in the blood of a volunteer who received a first injection at week 0, followed by a booster injection at week 15.

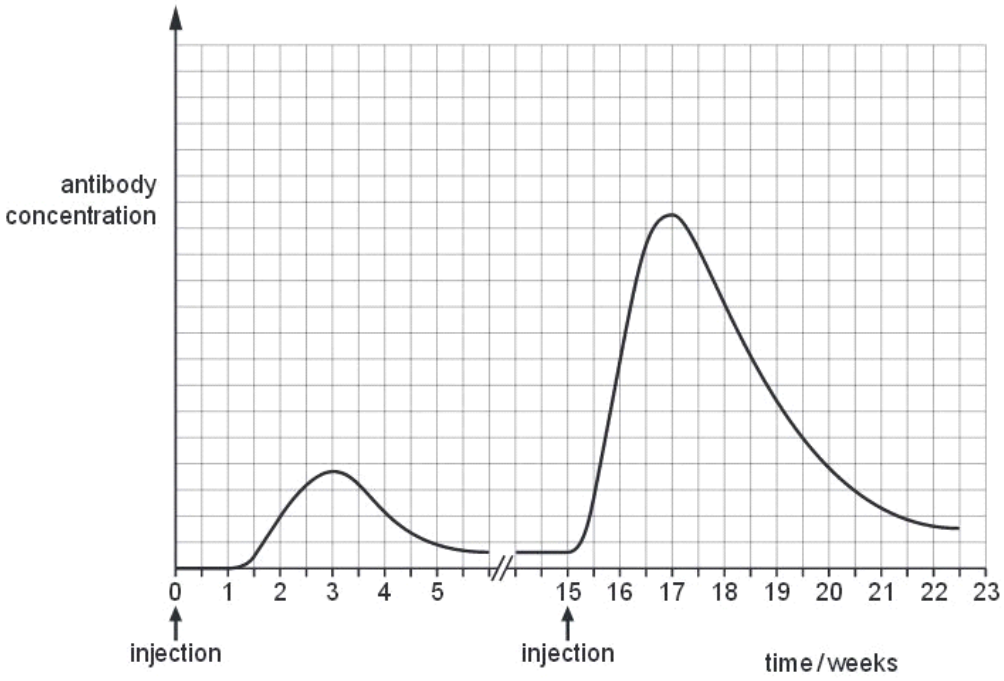


Fig. 4.1

(b) Using the information in Fig. 4.1, explain the differences between the responses to the first injection and the booster injection.

.....

.....

.....

.....

.....

.....

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.....

.....

.....[4]