

The immune system

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Immunity
Sub Topic	The immune system
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed : 57 minutes

Score : / 47

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Fig. 3.1 is an electron micrograph of a type of B-lymphocyte called a plasma cell.

Plasma cells secrete antibody molecules.

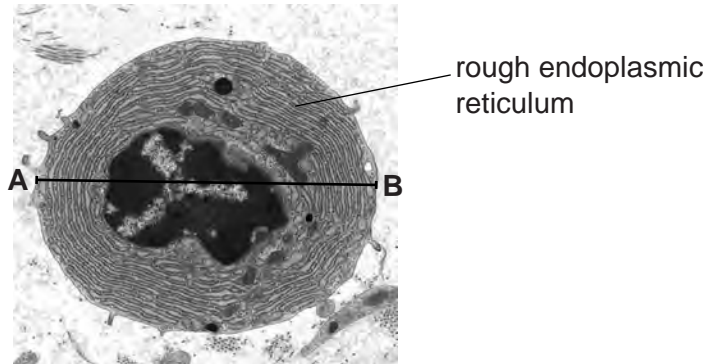


Fig. 3.1

(a) Suggest why plasma cells contain a large quantity of rough endoplasmic reticulum.

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..... [2]

(b) The diameter A – B of the plasma cell in Fig. 3.1 is 15 μm .

Calculate the magnification of Fig. 3.1.

Show your working.

magnification \times [2]

(c) Smallpox was the first disease to be eradicated by vaccination. The vaccine was effective for up to 10 years after one dose and did not require boosters within this time.

Name the causative organism (pathogen) of smallpox.

..... [1]

- (d) When a person received the smallpox vaccine, the numbers of plasma cells specific for the smallpox pathogen were measured from blood samples taken over a period of 35 days.

Fig. 3.2 shows how the numbers of smallpox-specific plasma cells changed during 35 days after vaccination.

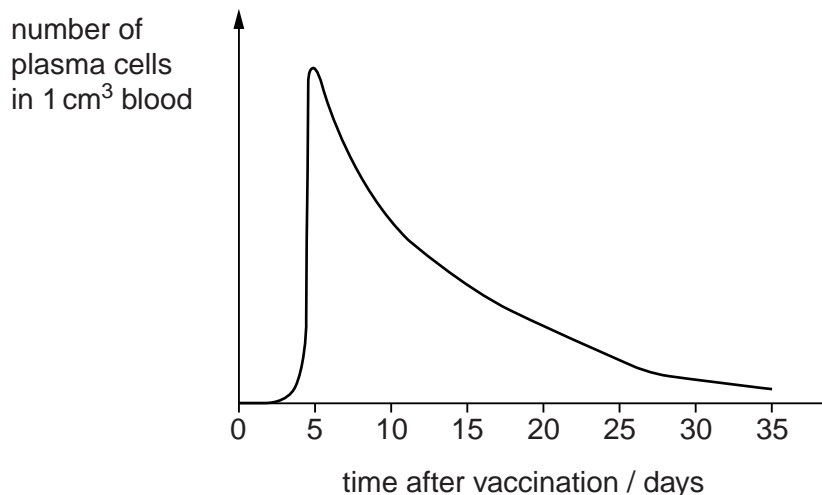


Fig. 3.2

Fig. 3.2 shows that the number of smallpox-specific plasma cells increases and then decreases within 35 days of vaccination.

Explain how a single dose of this vaccine can provide immunity for up to 10 years when the plasma cells are short-lived.

.....

 [3]

- (e) State two reasons why the vaccination programme was successful in eradicating smallpox.
 1

 2
 [2]

- (f) State the type of immunity provided by the smallpox vaccine.
 [1]

2 B-lymphocytes respond to the presence of a non-self antigen by dividing as shown in Fig. 4.1.

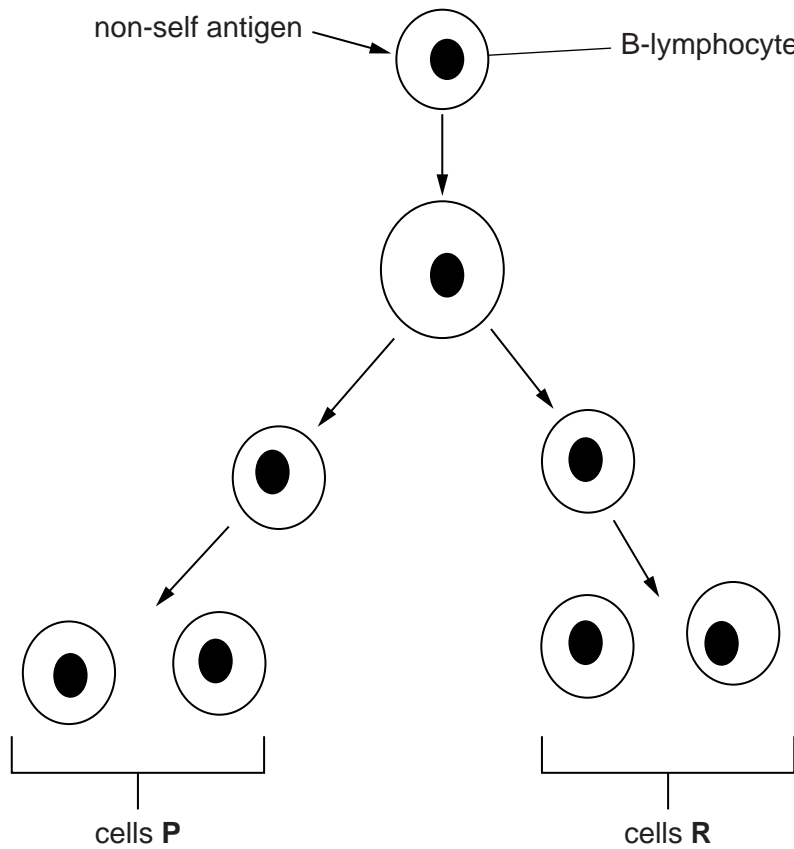


Fig. 4.1

(a) (i) Explain what is meant by the term *non-self antigen*.

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..... [2]

(ii) Outline how B-lymphocytes recognise non-self antigens.

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..... [2]

The cells labelled **P** on Fig. 4.1 continue to divide to give rise to many cells that differentiate into short-lived plasma cells. The plasma cells release antibody molecules.

(b) (i) Outline how plasma cells produce antibody molecules.

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..... [4]

(ii) Describe how antibody molecules are released from the plasma cell.

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..... [2]

(c) The cells labelled **R** on Fig. 4.1 divide to give more cells that do not differentiate into plasma cells. These cells have an important role in the immune system.

Explain the role of these cells.

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..... [3]

The mass of DNA in the cells shown in Fig. 4.1 was determined. The results are shown in Fig. 4.2.

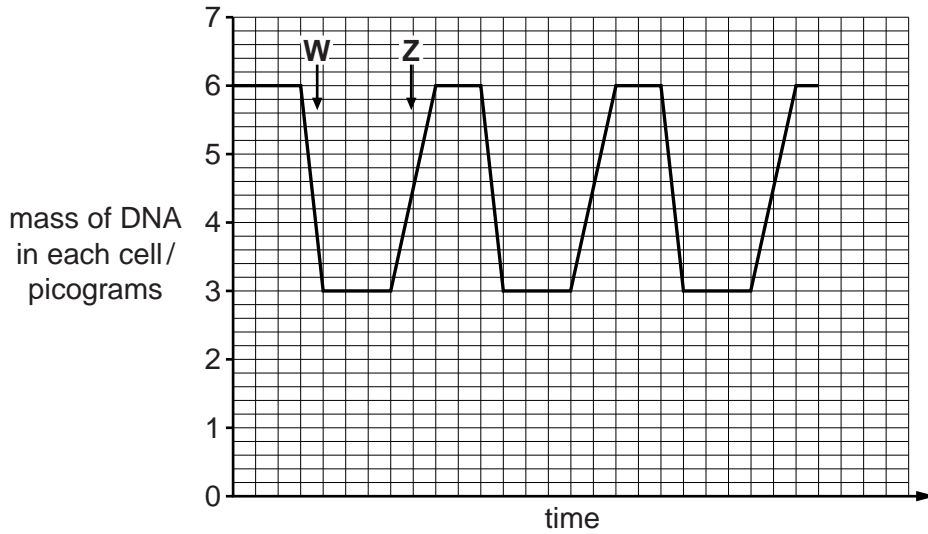


Fig. 4.2

(d) State what happens at **W** and **Z** to change the mass of DNA in each cell.

W

Z

[2]

(e) Acute lymphoblastic leukaemia (ALL) is a cancer of B-lymphocytes. It is very rare in adults, but more common in children. A study in 2009 found that exposure to tobacco smoke in the home may put children at risk of developing ALL.

Suggest how smoking by adults in the home may put their children at risk of cancers, such as ALL.

.....

[3]

[Total: 18]

- 3 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.

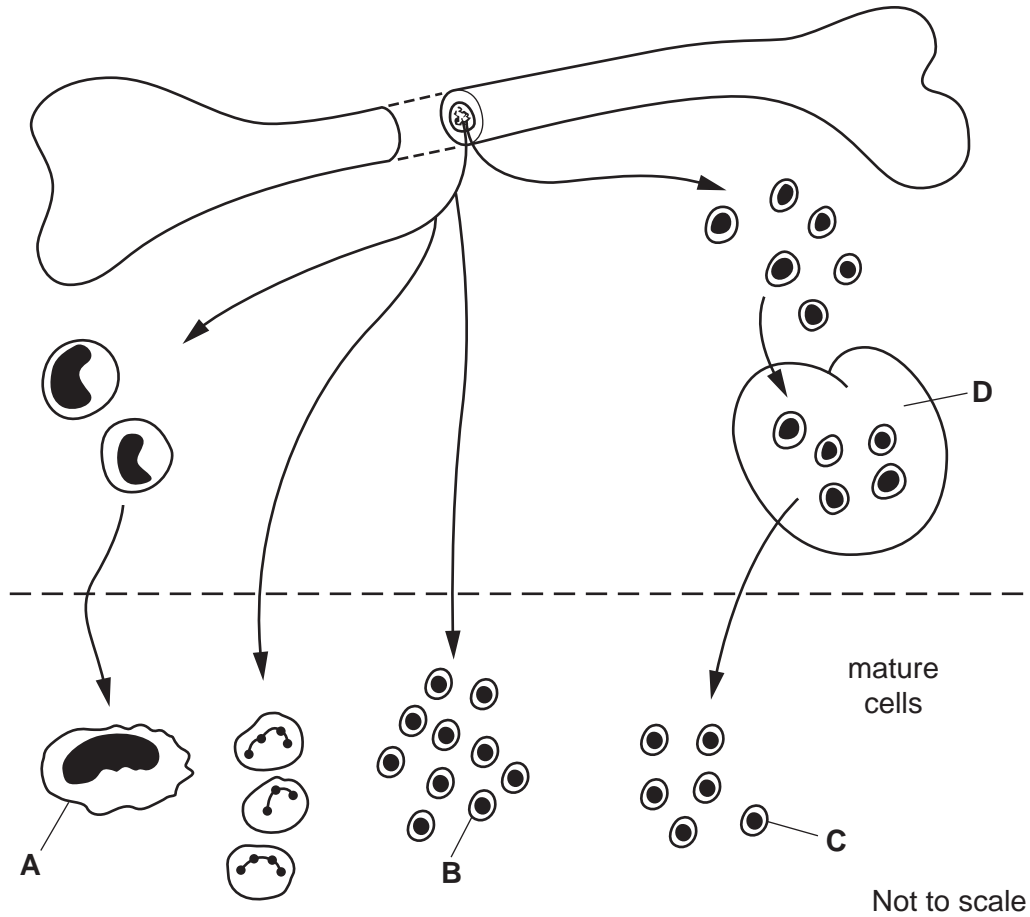


Fig. 6.1

- (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]

4 Table 5.1 shows blood cell counts for three different people.

Table 5.1

	number of cells per mm ³ of blood		
	healthy person at sea level	healthy person acclimatised to high altitude	person with a bacterial infection
red blood cells	5 400 000	6 100 000	5 300 000
T helper lymphocytes	1 000	1 050	850
phagocytes	5 400	5 600	8 750

- (a) (i) Calculate the percentage increase in the number of red blood cells in the person acclimatised to high altitude compared with the person at sea level. Show your working and express your answer to the nearest whole number.

Answer = [2]

- (ii) Explain the advantage of this increase in red blood cells to people who live at high altitude.

.....

 [2]

- (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.

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..... [2]

[Total: 8]