

AICE Biology: Infectious Disease and Immunity Problem Set

Answer the following AICE practice questions in complete sentences. This problem set is worth 30 points and is due the day of the test, Friday, April 6.

1. Which row correctly matches a function with B-lymphocytes and T-lymphocytes?

	function	B-lymphocytes	T-lymphocytes	
A	may become plasma cells	X	X	key
B	may secrete antibodies	X	✓	✓ true
C	provides a cell-mediated response	✓	✓	X false
D	provides a humoral response	✓	X	

2. What happens when people are injected with dead bacteria?

- A** B-lymphocytes produce antibodies.
- B** B-lymphocytes produce antigens.
- C** T-lymphocytes produce antibodies.
- D** T-lymphocytes produce antigens.

3. Some children are born with Severe Combined Immune Deficiency (SCID). These children do not normally have any T-lymphocytes and suffer from many diseases.

How may these children be cured?

- A** bone marrow transplantation
- B** continual use of antibiotics
- C** transfusion of antibodies
- D** vaccination against all diseases

4. Which of the following increase the risk of contracting TB?

- 1 drinking unpasteurised milk
- 2 eating shellfish which have fed on raw sewage
- 3 living in overcrowded conditions

- A** 2 only
- B** 1 and 2
- C** 1 and 3
- D** 2 and 3

5. The following are all methods of transmission of infectious diseases.

- 1 droplet
- 2 food
- 3 contact
- 4 vector

Which row shows the correct organism and method of transmission of each disease?

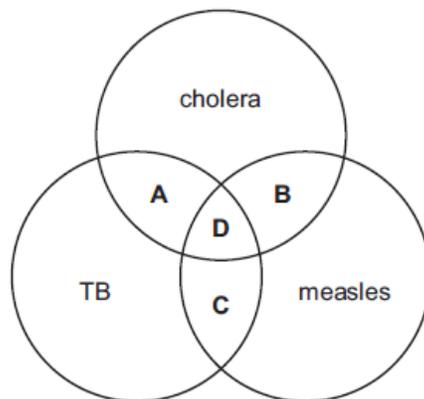
	malaria	TB	HIV
A	bacterium 4	virus 1 and 2	virus 3 and 4
B	protoctist 4	bacterium 1 and 2	virus 3
C	protoctist 3	virus 1	bacterium 3
D	bacterium 3	protoctist 1	bacterium 1 and 3

6. 40% of the world's population live in an area where malaria is a threat to health. In recent years there have been many more cases of malaria in Africa.

What is the **social** factor that is letting the spread of malaria get out of control?

- A** an increase in drug resistant forms of malaria
- B** climate change
- C** difficulty in producing a vaccine
- D** migration of people because of wars

7. Which diseases are treated with antibiotics?



8. Which are specific immune responses?

- 1 phagocytosis
- 2 production of antibodies
- 3 effect of histamine

- A** 1 only
- B** 2 only
- C** 1 and 3 only
- D** 2 and 3 only

9. Why has vaccination failed to eradicate cholera?
- A The pathogen exists in many strains which mutate.
 - B The pathogen is present in the lumen of the gut.
 - C The pathogen is waterborne.
 - D There is a stage of the life cycle in other mammals.

10. A person's blood group is determined by antigens present on the red blood cells. Most people have antibodies in their blood plasma even if they have never received a blood transfusion. It is these antibodies in the plasma of the person who receives the blood which makes some blood transfusions unsafe.

The table shows the antigens and antibodies in the blood of people with different blood groups.

blood group	antigens on red blood cells	antibodies in plasma
A	A	antibodies to B
B	B	antibodies to A
AB	A and B	no antibodies to A and B
O	neither A nor B	antibodies to A and B

Which are the blood groups of people who can safely receive blood from a person who has blood group A?

- A A and AB
 - B A and O
 - C B and O
 - D AB only
11. A country has fewer than 2.5 deaths per 100 000 people from TB in one year and the next year this rose to 25 deaths per 100 000.

What may have contributed to this change?

- 1 decrease in contact tracing
- 2 increase in refugee camps
- 3 water supply contaminated by sewage

- A 1 and 2
- B 1 and 3
- C 2 and 3
- D 1, 2 and 3

12. Scientists are concerned that avian (bird) flu caused by the H5N1 virus, could infect humans and cause a pandemic.

If this occurs, which factors could help prevent humans spreading the disease?

- 1 killing all poultry
- 2 reducing all air flights
- 3 taking a course of antibiotics

- A 1 only
- B 2 only
- C 3 only
- D 1, 2 and 3

13. What are produced by B-lymphocytes?

	killer lymphocyte clones	memory cells	plasma cell clones
A	✓	✓	x
B	✓	x	✓
C	✓	✓	✓
D	x	✓	✓

14. After an immune response, memory cells remain in the blood for a long time.

What is the function of memory cells?

- A** They can ingest invading bacteria.
- B** They contain lots of antibodies.
- C** They divide to make plasma cells.
- D** They kill cells infected with virus.

15. Which is correct for TB, measles and malaria?

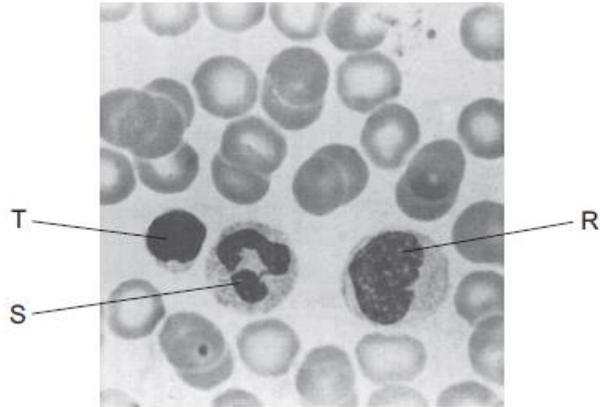
	TB		measles		malaria	
	causative agent	transmission	causative agent	transmission	causative agent	transmission
A	bacteria	air-borne	virus	air-borne	protoctist	insect vector
B	bacteria	water-borne	protoctist	air-borne	virus	insect vector
C	virus	air-borne	bacteria	water-borne	protoctist	insect vector
D	virus	insect vector	protoctist	insect vector	bacteria	water-borne

16. What do the causative agents of HIV/AIDS, malaria and TB have in common?

	they have a cell surface membrane	they have genes	they have ribosomes	they respire
A	✓	✓	✓	✓
B	✓	x	x	✓
C	x	✓	x	✓
D	x	✓	x	x

key
 ✓ present in each causative agent
 x not present in each causative agent

17. The photomicrograph shows human blood, with three types of white cell labelled.



Which row correctly identifies these white cells?

	cell R	cell S	cell T
A	lymphocyte	lymphocyte	lymphocyte
B	lymphocyte	phagocyte	phagocyte
C	phagocyte	lymphocyte	phagocyte
D	phagocyte	phagocyte	lymphocyte

18. What are the function(s) of T-lymphocytes during an immune response?

- 1 destroy infected body cells
- 2 differentiate into memory cells
- 3 secrete antibodies

A 1 only B 3 only C 1 and 2 only D 2 and 3 only

19. A student wrote down three statements about antibodies.

- 1 Their structure depends on peptide, hydrogen and disulfide bonds.
- 2 They are protein molecules with both tertiary and quaternary structure.
- 3 Four polypeptides provide four antigen binding sites.

Which statements are true?

- A 1, 2 and 3
B 1 and 2 only
C 1 and 3 only
D 2 and 3 only

20. The data shows how the number of human deaths caused by the bacterium *Staphylococcus aureus* has changed from 1997 to 2005.

Methicillin is an antibiotic used to treat a disease caused by *S. aureus*.
MRSA is methicillin-resistant *S. aureus*.

year	total number of death certificates with <i>S. aureus</i>	total number of death certificates with MRSA
1997	369	355
1999	452	431
2001	456	681
2003	420	890
2005	428	1512

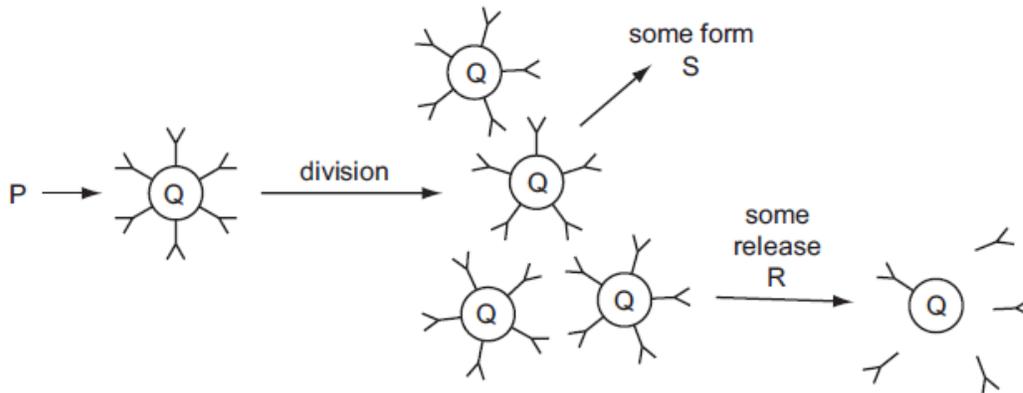
Which statement is **not** supported by this data?

- A More people have MRSA so the disease spreads.
 B MRSA is more likely to lead to death as there is no treatment.
 C Resistant strains of MRSA are becoming more common.
 D *S. aureus* will always cause humans to die.
21. An enzyme hydrolyses the two heavy polypeptide chains of an antibody molecule. The hydrolysis occurs at the hinge region and breaks the antibody into three fragments.

How many of these fragments are able to bind to antigens?

- A 0 B 1 C 2 D 3

22. The diagram shows the response to a pathogen by the immune system.



Which row correctly identifies P, Q, R and S?

	P	Q	R	S
A	antibody	T-lymphocyte	antigen	plasma cell
B	antigen	B-lymphocyte	antibody	memory cell
C	antigen	T-lymphocyte	antitoxin	B-lymphocyte
D	bacteria	B-lymphocyte	antibody	T-lymphocyte

23. Some antibiotics are used in animal feed to reduce disease.

What explains why these antibiotics should not be used in the treatment of human diseases?

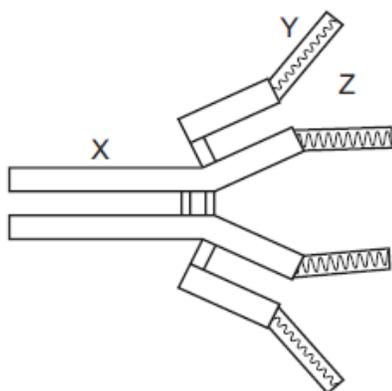
- A Humans may be allergic to these antibiotics.
- B Human cells may stop responding to these antibiotics.
- C Pathogenic bacteria may develop resistance to these antibiotics.
- D Useful gut bacteria may be killed by these antibiotics.

24. Some children are born with Severe Combined Immune Deficiency (SCID). These children do not normally have any T-lymphocytes and suffer from many diseases.

How can these children be cured?

- A bone marrow transplantation
- B continual use of antibiotics
- C transfusion of antibodies
- D vaccination against all diseases

25. The diagram represents the structure of a molecule of antibody.



Which arrangement of labels X, Y and Z correctly identifies its different parts?

	X	Y	Z
A	antigen binding site	constant region	variable region
B	constant region	antigen binding site	variable region
C	constant region	variable region	antigen binding site
D	variable region	antigen binding site	constant region

26.

(a) Define the term *disease*.

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..... [1]

Fig. 2.1 is a flow chart that shows the four different ways that a person can become immune to an infectious disease.

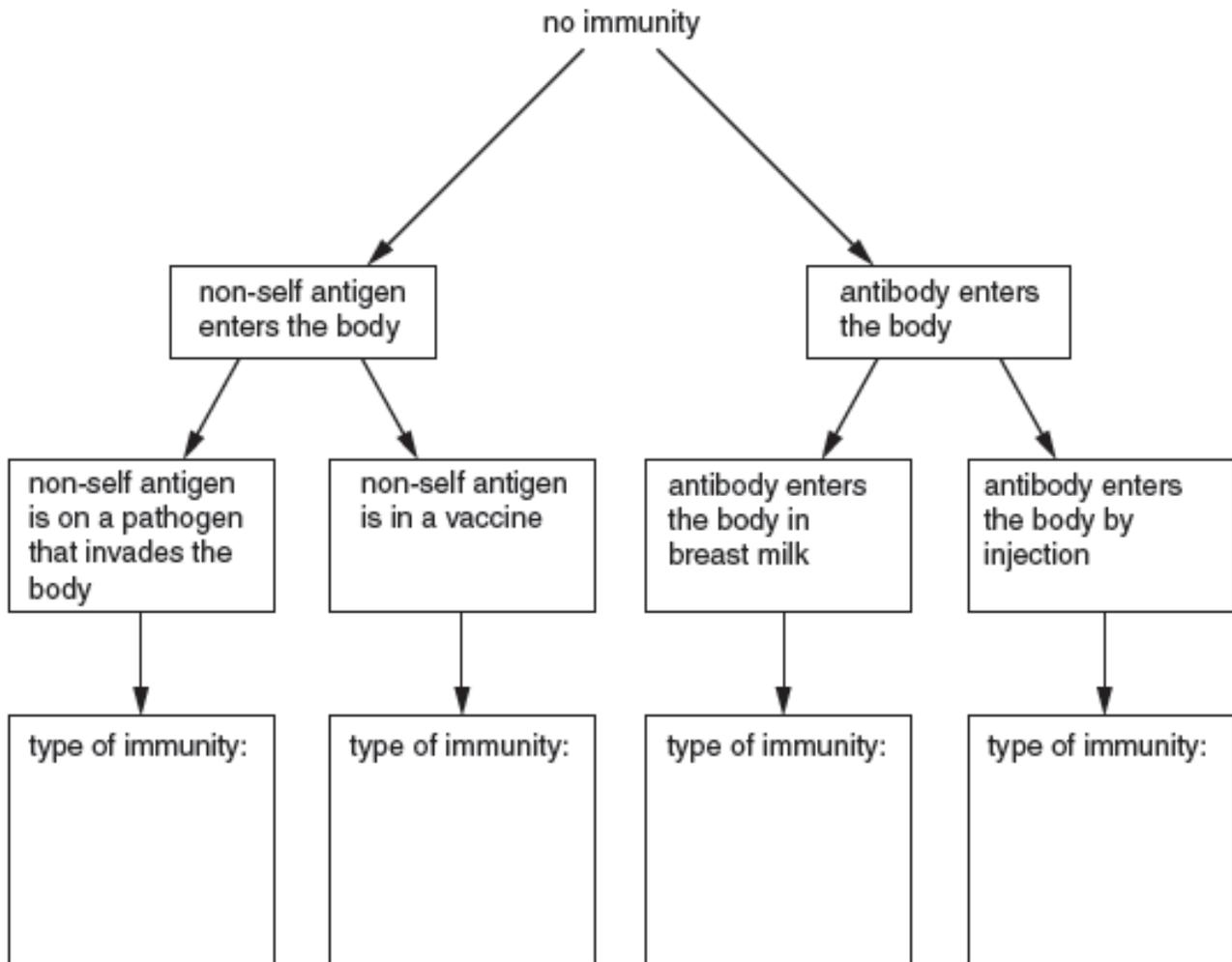


Fig. 2.1

(b) Complete Fig. 2.1 by writing in the boxes provided the four types of immunity described. [4]

(b) With reference to Fig. 3.1, explain:

(i) how alveoli are adapted for gaseous exchange

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..... [3]

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

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..... [4]

(c) Phagocytes release enzymes that digest proteins. In smokers, this may lead to the large-scale destruction of alveolar walls.

Outline the effects of this destruction on a person's health.

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..... [3]

[Total: 12]

28.

Cholera bacteria release the enzyme neuraminidase which alters some of the surface proteins on the membranes of epithelial cells in the small intestine.

These surface molecules become receptors for the toxin, cholera toxin, released by cholera bacteria. The toxin stimulates the cells to secrete large quantities of chloride ions into the lumen of the small intestine. Sodium ions and water follow the loss of chloride ions.

(a) (i) Name the pathogen that causes cholera.

.....[1]

(ii) Suggest how chloride ions are moved from the epithelial cells into the lumen of the small intestine.

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.....[1]

(iii) Explain how cholera bacteria are transmitted from one person to another.

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

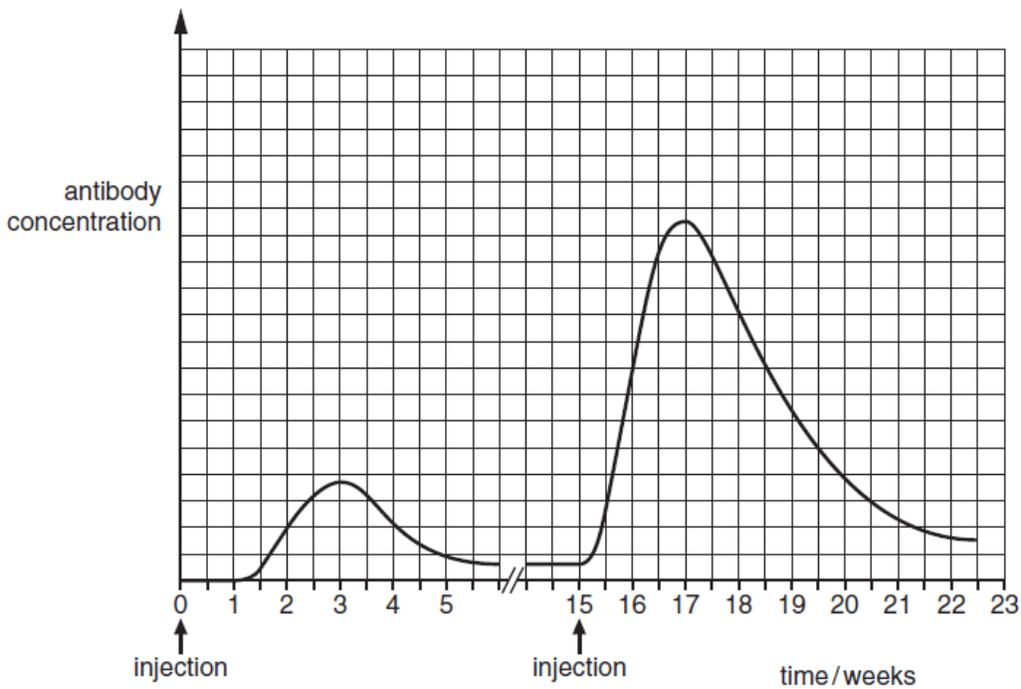


Fig. 4.1

29.

Bone marrow contains stem cells that divide by mitosis to form blood cells. Each time a stem cell divides it forms a replacement stem cell and a cell that develops into a blood cell.

Fig. 3.1 shows changes in the mass of DNA in a human stem cell from the bone marrow during three cell cycles.

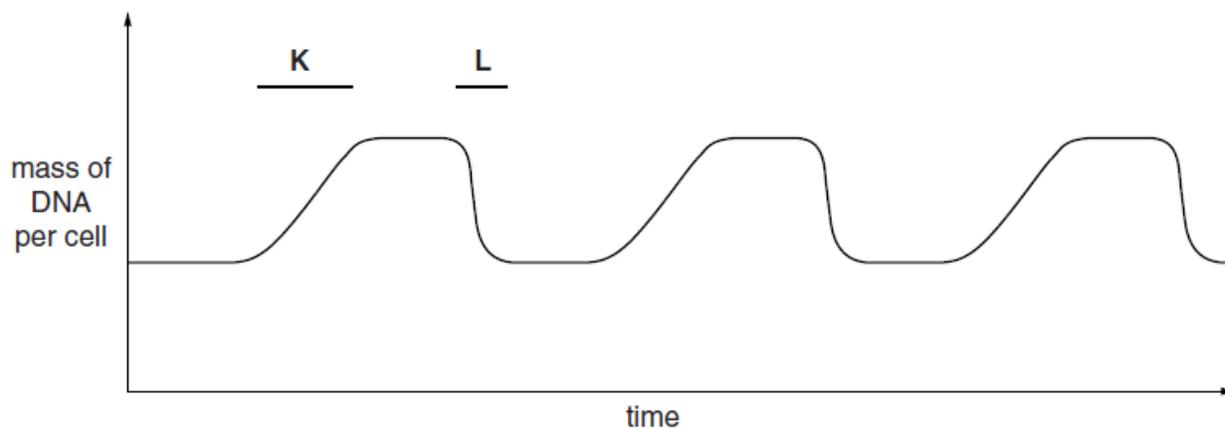


Fig. 3.1

(a) With reference to Fig. 3.1, state:

(i) what happens to bring about the changes in the mass of DNA per cell at K and at L

K

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L

.....[2]

(ii) how many blood cells are formed from the stem cell in the time shown

.....[1]

(iii) what happens to the number of chromosomes in the stem cell.

.....[1]

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

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

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.....[3]

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

Describe how mitosis is involved in an immune response.

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

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..... [3]

[Total: 13]

30.

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.

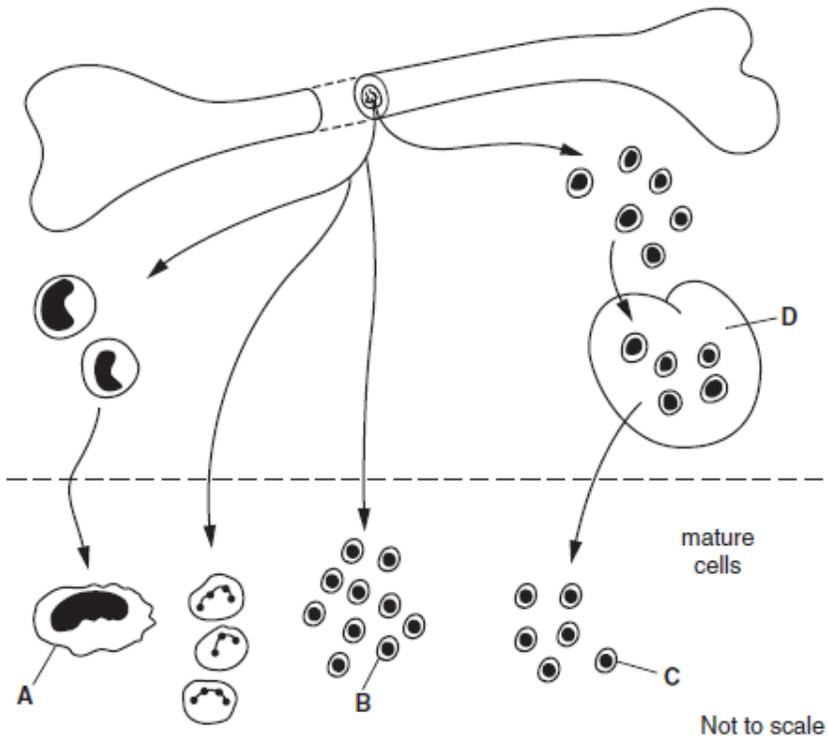


Fig. 6.1

