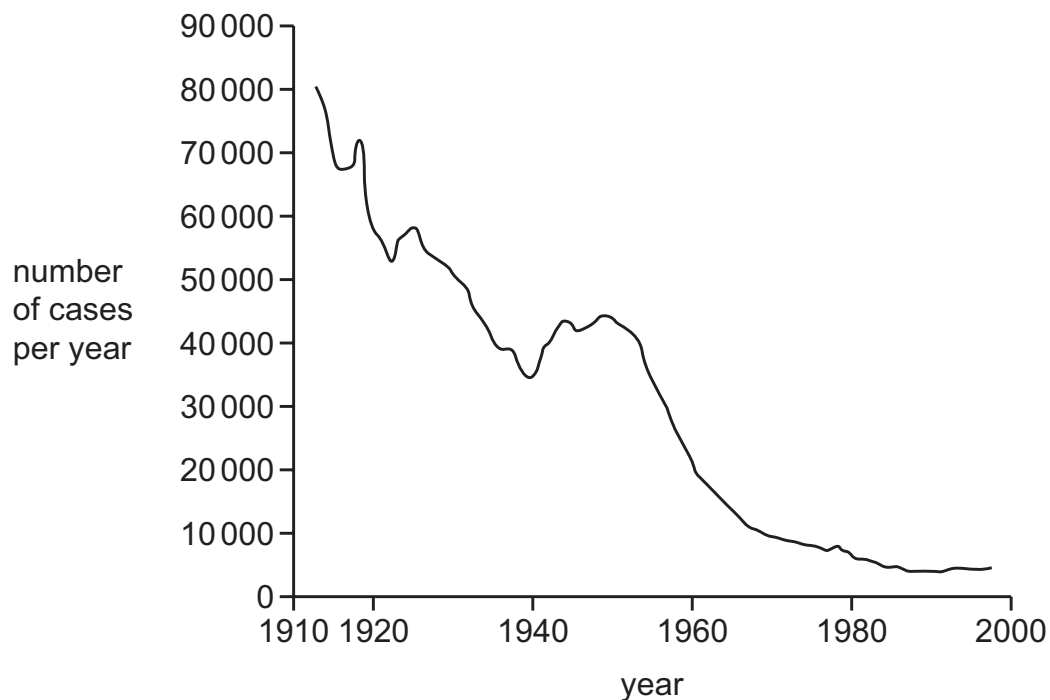


5 Which statement about viruses is correct?

- A** They are cells with a capsid made of phospholipids.
- B** They are cells with a capsid made of protein.
- C** They are particles with a capsid made of phospholipids.
- D** They are particles with a capsid made of protein.

36 The graph shows the decrease in cases of tuberculosis (TB) in a country between 1910 and 2000.



Which factors could have contributed to the fall over this period?

- 1 pasteurisation of milk
- 2 the provision of new housing to reduce overcrowding
- 3 removing large pools of stagnant water
- 4 identification of contacts of people infected with TB

A 1, 2 and 4 **B** 1 and 3 **C** 1 and 4 only **D** 2, 3 and 4

37 The pathogens for some diseases are transmitted by vectors.

Which disease is transmitted with the help of a vector that could be controlled by the removal of pools of water?

- A** cholera
- B** HIV/AIDS
- C** malaria
- D** tuberculosis

38 Which factors affect the global pattern of distribution of malaria?

- 1 the disease is mainly restricted to tropical and subtropical environments
- 2 the effective vaccine has eradicated the disease in many countries
- 3 the vector required for transmission of malaria parasites

	1	2	3
A	✓	✓	✗
B	✓	✓	✓
C	✓	✗	✓
D	✗	✓	✓

key

✓ = effect

✗ = **not** an effect

36 Which row correctly identifies the pathogens causing malaria and TB?

	malaria	TB
A	protocist	virus
B	protocist	bacterium
C	prokaryote	bacterium
D	prokaryote	virus

37 What could be used to help prevent an outbreak of cholera in a town?

- A** treatment of sewage waste
- B** spraying still water with insecticides to kill mosquito larvae
- C** increased use of antiviral medicine
- D** preventing the reuse of hypodermic needles

36 Infectious diseases may be caused by bacteria, protoctists and viruses. Different pathogens may be transmitted by airborne droplets, from faeces to mouth (faecal-oral), by sexual intercourse and by vectors.

Four examples of infectious diseases are listed.

- 1 cholera
- 2 HIV/AIDS
- 3 malaria
- 4 tuberculosis

Which table classifies the four diseases correctly to show the type of pathogen that causes the disease and the mode of transmission?

A

	bacterium	protoctist	virus
droplet			2
faecal-oral	1		
sexual		3	
vector			4

B

	bacterium	protoctist	virus
droplet		2	
faecal-oral	1		
sexual			3
vector		4	

C

	bacterium	protoctist	virus
droplet	4		
faecal-oral	1		
sexual			2
vector		3	

D

	bacterium	protoctist	virus
droplet	3		
faecal-oral		2	
sexual	1		
vector			4

2 Cholera is an infectious intestinal disease caused by a bacterial pathogen.

(a) Name the species of bacterium that causes cholera.

..... [1]

(b) The World Health Organization (WHO) recommends a number of different approaches for the prevention and control of cholera. Two of these are:

- Authorities should provide access to safe drinking water.
- Individuals and communities should practise preventive personal hygiene.

Suggest **and** explain how these two approaches help in the prevention and control of cholera.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Mass vaccination using an oral cholera vaccine (OCV) can be carried out in situations where there is a high risk of people developing the disease.

Passive immunisation involves transferring antibodies into a person for the prevention or treatment of an infectious disease. Some of the infectious diseases for which passive immunisation is available use monoclonal antibody. Passive immunisation for cholera using monoclonal antibody could be available in the future.

(i) Complete Table 2.1 to compare an OCV and passive immunisation for cholera:

- fill in the empty box in **row 1**
- circle the correct answers from the choices given in **rows 3, 4 and 5**.

Table 2.1

row	feature	oral cholera vaccine	passive immunisation for cholera
1	component causing the desired response		antibody
2	type of immunity gained	artificial active	artificial passive
3	stimulates production of memory lymphocytes	yes / no	yes / no
4	length of time needed to have an effect	shorter same longer	longer same shorter
5	duration of immunity	shorter same longer	longer same shorter

[4]

(ii) The production of monoclonal antibodies for treatment involves the formation of hybridoma cells from two different cell types.

Name the **two** types of cell that fuse to form a hybridoma cell **and** explain why this fusion is necessary.

[3]

2 Cholera, malaria and tuberculosis (TB) are infectious diseases caused by unicellular organisms.

(a) For each of the diseases listed, state whether the disease is caused by a eukaryotic or prokaryotic organism.

cholera

malaria

TB

[1]

(b) State the term given to an organism that causes diseases such as cholera, malaria and TB.

..... [1]

(c) Malaria is caused by species from the genus *Plasmodium*.

Ring cells are one stage in the complex life cycle of *Plasmodium* that are found within red blood cells. Fig. 2.1 is a scanning electron micrograph showing two ring cells, surrounded by the membrane of a red blood cell, which has just lysed (burst).

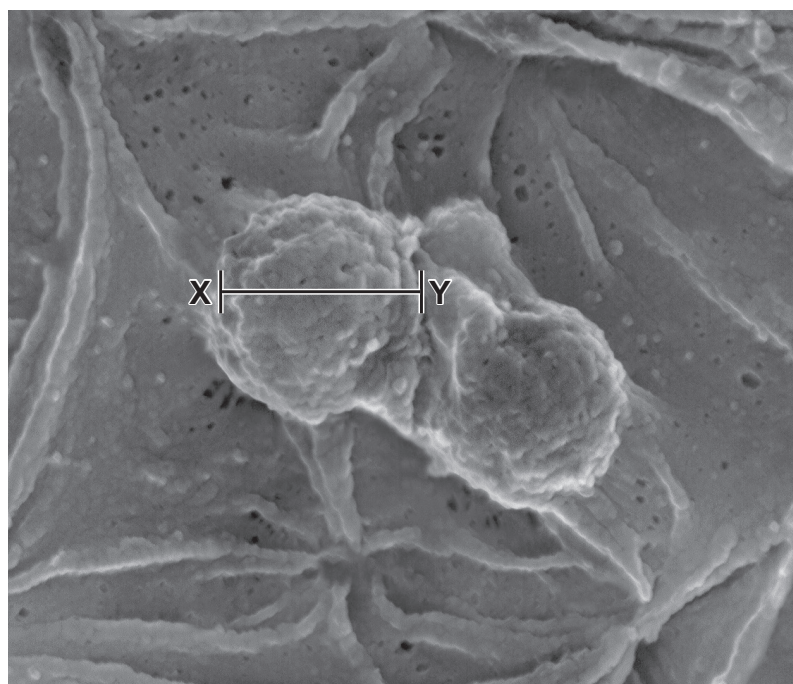


Fig. 2.1

(i) The actual diameter of the ring cell along the length **X–Y** is $2\mu\text{m}$.

Calculate the magnification of the image shown in Fig. 2.1.

Give your answer to 3 significant figures.

magnification = $\times$ [2]

(ii) Describe how *Plasmodium* is transmitted from a person with malaria into the blood stream of an uninfected person.

[3]

(d) In a person with malaria, phagocytes destroy infected red blood cells. The phagocytes respond to the presence of particular molecules in the outer phospholipid bilayer of the cell surface membrane.

The cell surface membrane of a healthy, uninfected red blood cell shows an uneven distribution of types of phospholipid making up the bilayer (membrane asymmetry). For example, most of the phospholipid phosphatidylserine (PS) is located in the inner layer, facing the cytoplasm.

(i) After a red blood cell is infected, a much higher proportion of PS is found in the outer layer of the cell surface membrane, facing blood plasma.

Suggest how the presence of PS in the outer layer can cause a response in a phagocytic cell.

[2]

(ii) Suggest why some **uninfected** red blood cells in a person with malaria can also be destroyed by phagocytic cells.

[1]

(e) Research has shown that *Plasmodium* uses cholesterol from the cell surface membrane of the red blood cell it has infected.

(i) Suggest why cholesterol is needed by *Plasmodium*.

.....

.....

..... [1]

(ii) The use of cholesterol by *Plasmodium* causes a decrease in the quantity of cholesterol in the cell surface membrane of the red blood cell.

Outline how a decrease in cholesterol could affect the cell surface membrane of the red blood cell.

.....

.....

.....

.....

..... [2]

(f) To achieve membrane asymmetry, which is an essential feature of a healthy cell, the red blood cell needs a supply of ATP and must maintain a very low concentration of calcium ions (Ca²⁺) within the cytoplasm.

Table 2.1 shows details of three membrane enzymes that are involved in the movement of phospholipids between the inner and outer layers.

Table 2.1

key

PS = phosphatidylserine

PE = phosphatidylethanolamine

PC = phosphatidylcholine

} type of phospholipid

enzyme	enzyme action
flippase	hydrolyses ATP and moves PS and PE from the outer to the inner layer
floppase	hydrolyses ATP and moves PC from the inner to the outer layer
scramblase	after binding Ca ²⁺ , randomly moves PS, PE and PC between layers

A healthy red blood cell has most PS and PE located in the inner layer and most PC located in the outer layer.

- (i) Phospholipids can occasionally move between layers without the action of an enzyme, so the continued activity of flippase and floppase is needed.

With reference to Table 2.1, explain why the action of the enzymes flippase and floppase involves the hydrolysis of ATP.

[1]

- (ii) Blood plasma has a higher concentration of Ca^{2+} than the cytoplasm of red blood cells.

Suggest **one** way in which a red blood cell can have a very low concentration of Ca^{2+} when blood plasma has a higher concentration of Ca^{2+} .

[1]

- (iii) The concentration of Ca^{2+} within the red blood cell increases when the cell is infected with the malarial parasite. This leads to the loss of membrane asymmetry.

With reference to Table 2.1, suggest **and** explain how membrane asymmetry is lost when the concentration of Ca^{2+} within the red blood cell increases.

[3]

[Total: 18]