**Q1.**

Use

**2** Complete the table below to show which of the five statements about disease apply to emphysema, tuberculosis, obesity, rickets and smallpox.

Fill in each box, using a tick (✔) to show that the statement applies or a cross (✘) if it does not.

| statement | emphysema | tuberculosis | obesity | rickets | smallpox |
|---|---|---|---|---|---|
| eliminated by vaccination | | | | | |
| a worldwide infectious disease | | | | | |
| a form of malnutrition | | | | | |
| a deficiency disease | | | | | |
| involves degeneration of lung tissue | | | | | |

[Total : 5]

**Q2.**

The bacterium that causes cholera, *Vibrio cholerae*, releases a toxin known as choleragen. During an immune response to cholera some B-lymphocytes produce antibodies that combine with choleragen so inactivating it. Antibodies that inactivate toxins are called antitoxins.

**(d)** Explain how the structure of an antibody, such as the antitoxin for choleragen, makes it specific to one substance.

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.....[3]

**(e)** Explain why cholera remains a significant infectious disease in some parts of the world.

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.....[3]

## Q3.

5 An estimated 300 to 500 million cases of malaria occur worldwide each year resulting in 1 to 3 million deaths. 80% of these cases are in children under the age of five.

There are four species of malarial parasite, of which *Plasmodium falciparum* is responsible for most of the deaths from this disease.

For Examiner's Use

**(a)** Describe how the malarial parasite is transmitted.

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..... [3]

**(b)** Several potential vaccines against malaria have been developed. Some of these make use of proteins from the surface membrane of *P. falciparum*.

**(i)** Explain how using such a vaccine may give long-term immunity to malaria.

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..... [4]

**(ii)** Researchers have been trying to develop a successful vaccine against malaria for about 20 years. Explain why it has proved so difficult to develop such a vaccine.

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..... [2]

**(c)** Proteins on the surface of the parasite are responsible for binding to surface receptors on the red blood cells. These are removed when the parasites enter the red blood cells.

For Examiner's Use

An enzyme has recently been discovered in *P. falciparum* that is responsible for the removal of these proteins. If the enzyme does not function then the parasites cannot enter red blood cells.

It has been suggested that a drug could be developed to inhibit this enzyme.

Describe **one** possible way in which such a drug might act on the enzyme to prevent it from functioning.

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..... [3]

[Total: 12]

## Q4.

**1** Fig. 1.1 shows the outline of a ciliated cell from the human gas exchange system.

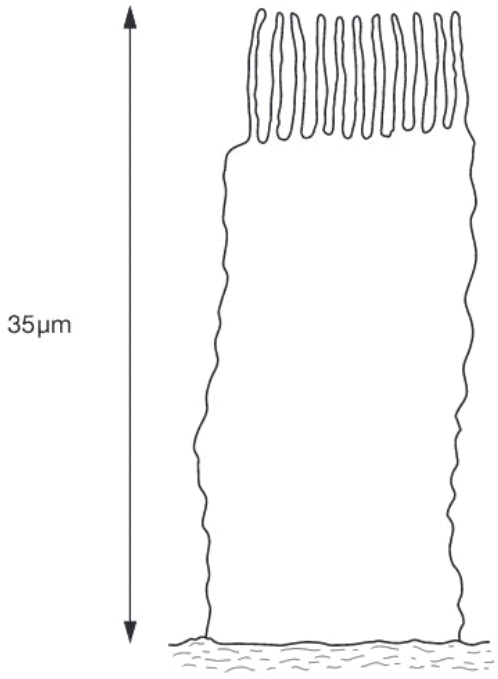


**Fig. 1.1**

**(a)** **(i)** Inside the ciliated cell in Fig. 1.1, draw the nuclear envelope and a mitochondrion as they would be seen with an electron microscope.

Label these structures. [3]

**(ii)** Calculate the magnification of the ciliated cell in Fig. 1.1.

Show your working and express your answer to the nearest whole number.

magnification = ..... [2]

Fig. 1.2 is a drawing of *Mycobacterium tuberculosis*.

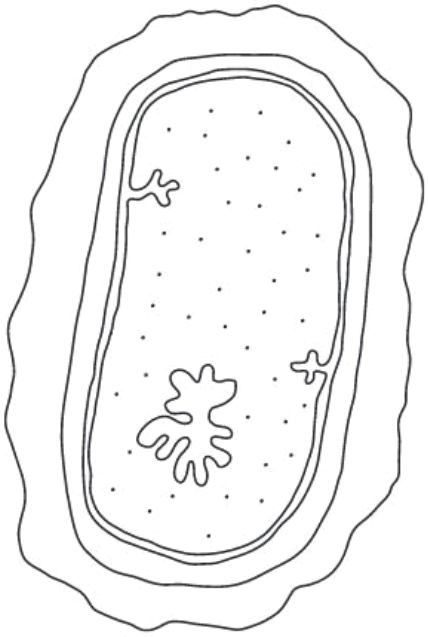

**Fig. 1.2**

**(b)** State three structural features that are found in **both** *M. tuberculosis* and animal cells, such as the ciliated cell in Fig. 1.1.

1. .....

2. .....

3. .....[3]

**(c)** Describe how *M. tuberculosis* is transmitted from an infected person to an uninfected person.

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.....[2]

Table 1.1 shows the numbers of new cases of tuberculosis (TB) and the death rates from TB in selected countries in 2005. The fatality ratio is the number of deaths as a proportion of the number of new cases.

**Table 1.1**

| country | number of new cases per 100 000 people | number of deaths per 100 000 people | fatality ratio |
|---|---|---|---|
| China | 100 | 16 | 0.16 |
| Pakistan | 181 | 37 | 0.20 |
| South Africa | 600 | 71 | 0.12 |
| Uganda | 369 | 91 | |
| United Kingdom | 14 | 1 | 0.07 |
| United States of America | 5 | 0 | 0.00 |

**(d)** **(i)** Complete Table 1.1 by calculating the fatality ratio for Uganda.

Enter your result in Table 1.1. [1]

**(ii)** Suggest why fatality ratios are higher in some of the countries shown in Table 1.1 than in others.

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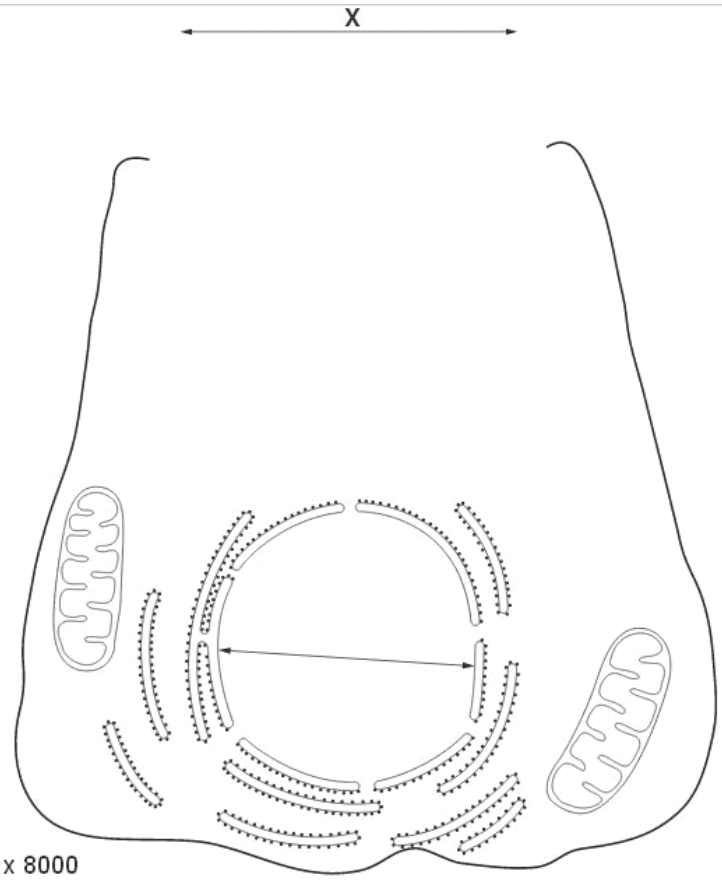
.....[4]

[Total: 15]

**Q5.**

**1** Many of the cells in the pancreas produce enzymes. Golgi bodies in the cells produce secretory vesicles full of enzymes which are released at the cell surface by exocytosis.

Fig. 1.1 is a diagram of an enzyme-producing cell from the pancreas. The diagram is **not** complete.




magnification = x 8000

**(a) (i)** Complete Fig. 1.1 by drawing in the following:

- a Golgi body forming secretory vesicles
- a secretory vesicle releasing its contents by exocytosis in the region labelled X

[3]

**(ii)** Calculate the actual diameter of the nucleus of the pancreatic cell. Show your working and express your answer to the nearest micrometre.

Answer = .....µm [2]

Fig. 1.2 is a drawing of the bacterium *Vibrio cholerae* the causative agent of cholera.

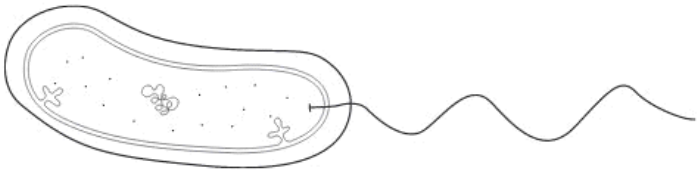


**Fig. 1.2**

**(b)** State three structural features of *V. cholerae*, that are **not** found in animal cells.

1. .....

2. .....

3. .....[3]

Table 1.1 shows the numbers of new cases of cholera and the number of deaths from cholera in selected countries in West Africa in 2005. The mortality rate is the number of deaths as a percentage of the number of cases.

**Table 1.1**

| country | total number of cases | number of deaths | mortality rate |
|---|---|---|---|
| Côte d'Ivoire | 39 | 6 | 15.38 |
| Ghana | 3166 | 51 | 1.61 |
| Guinea Bissau | 25111 | 399 | 1.59 |
| Liberia | 3823 | 18 | |
| Nigeria | 4477 | 174 | 3.89 |
| Senegal | 31719 | 458 | 1.44 |

**(c)** Calculate the mortality rate for cholera in Liberia. Write your answer in the space in the table. [1]

**(d)** Cholera tends to emerge as a risk to health following natural disasters. It is said that every death from cholera is a death that could have been prevented.

Explain how it is possible to reduce the number of deaths during a cholera epidemic in countries such as those in West Africa.

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.....[4]

**(e)** The total number of cases of cholera in the Americas and Europe during 2005 was 34. Explain why cholera is unlikely to be transmitted in developed countries.

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.....[2]

[Total: 15]

**Q6.**

4 Malaria and tuberculosis (TB) are two of the most important infectious diseases.

F
Exam
U

**(a)** Define the term *infectious disease*.

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.....[1]

**(b)** Describe how malaria is passed from an infected person to an uninfected person.

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.....[2]

Fig. 4.1 shows the worldwide distribution of malaria.


**Fig. 4.1**

**(c)** Unlike malaria, TB is found across the whole world.

Explain why malaria shows the distribution pattern shown in Fig. 4.1, but TB is found everywhere.

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.....[4]

5

**(d)** Vaccinations are used to control infectious diseases. They were used as part of the programme to eradicate smallpox and as part of the continuing programmes against diseases such as polio and measles.

Smallpox was eradicated from the world in the 1970s. Polio is likely to be the next infectious disease to be eradicated. TB and malaria continue to be important diseases.

Explain how vaccination provides immunity as an important part of programmes to control and eradicate infectious diseases.

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.....[5]

**Q7.**

**3** The HIV/AIDS pandemic has had a very large impact on life expectancy in many African countries.

Table 3.1 shows estimated data for seven African countries for

- the average life expectancy of an individual born in 2002
- the percentage of the population testing positive for HIV in 2002
- the average life expectancy of an individual born in 2002 **if there was no HIV/AIDS pandemic**.

**Table 3.1**

| country | life expectancy / years | | percentage of population testing positive for HIV |
|---|---|---|---|
| | without HIV/AIDS | with HIV/AIDS | |
| Botswana | 72.4 | 33.9 | 35.8 |
| Côte d'Ivoire | 55.6 | 42.8 | 10.8 |
| Kenya | 65.6 | 45.5 | 14.0 |
| Malawi | 56.3 | 38.5 | 16.0 |
| South Africa | 66.3 | 48.8 | 19.9 |
| Zambia | 55.4 | 35.3 | 20.0 |
| Zimbabwe | 69.0 | 40.2 | 25.1 |

**(a)** Using the 'without HIV/AIDS' and 'with HIV/AIDS' data shown in Table 3.1, calculate the percentage decrease in life expectancy for Botswana.

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

Answer = ..... % [2]

**(b)** Suggest two reasons for the differences shown in estimated life expectancy **without** HIV/AIDS between the different African countries.

1. .....

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2. .....

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.....[2]

**(c)** After studying the data in Table 3.1, a student concluded that:

**"There is a correlation between the percentage of the population testing positive for HIV and the decrease in estimated life expectancy with HIV/AIDS."**

**(i)** With reference to Table 3.1, explain why the data do **not** fully support the student's conclusion.

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.....[2]

**(ii)** List two factors in the prevention and control of HIV/AIDS that would help to improve average life expectancy in the African countries shown in Table 3.1.

1. .....

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2. .....

.....[2]

**(d)** A person who is confirmed as HIV-positive has tested positive for the presence of antibodies to HIV.

Outline the events that occur in a newly-infected person, which lead to the production of antibodies to HIV.

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.....[5]

[Total: 13]

**Q8.**

**4** The control of malaria is one of the top priorities of the World Health Organization (WHO). At present, there is no effective vaccine for the disease, so other preventative measures must be taken to control the spread of malaria.

**(a)** Describe **one** method of controlling the spread of malaria by targeting its vector and explain its effect.

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.....[2]

**(b)** Explain why it has been difficult to develop an **effective** vaccine for malaria.

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.....[3]

**(c)** Another method of preventing malaria is to take drugs, such as chloroquine, but resistance to these drugs among certain species of the malarial parasite is increasing. New drugs are being developed.

A laboratory investigation was carried out to determine the effect of a new drug on two strains of the malarial parasite *Plasmodium falciparum*. The results are shown in Fig. 4.1.

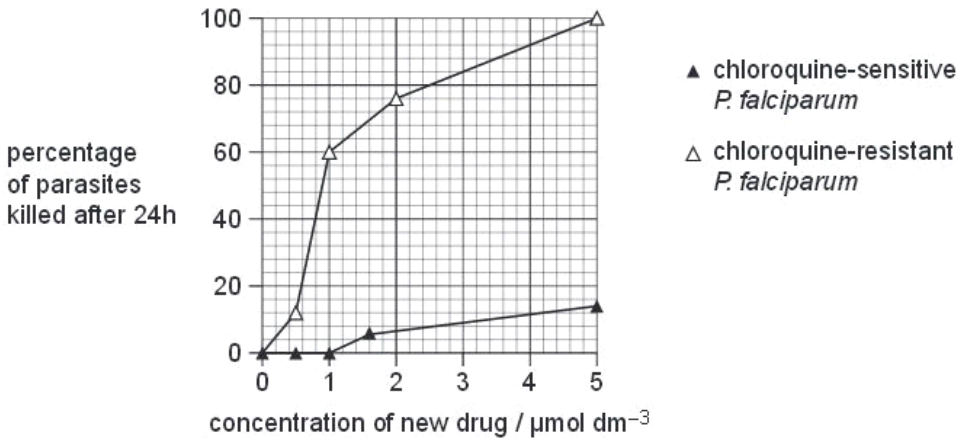


**Fig. 4.1**

With reference to Fig. 4.1, compare the effect of increasing the concentration of the drug on the chloroquine-resistant and chloroquine-sensitive strains of *P. falciparum*.

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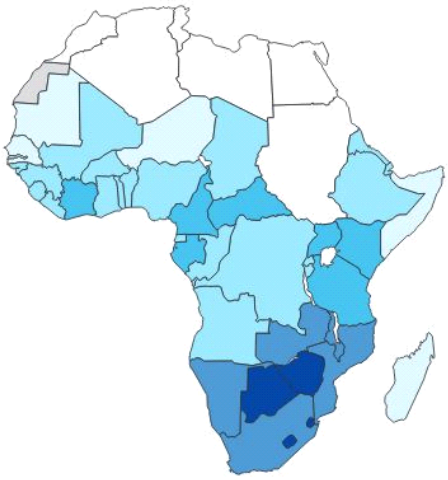
.....[3]

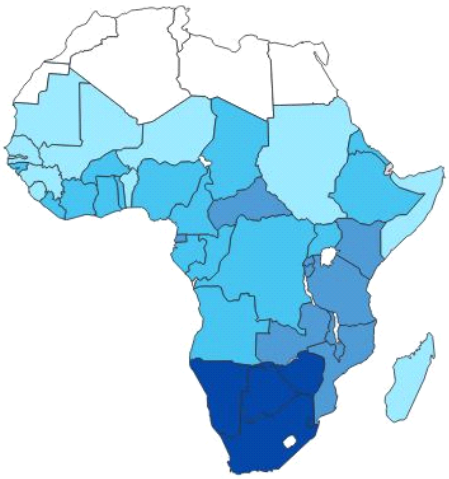
**(d)** When a person becomes infected with the Human Immunodeficiency Virus (HIV) they become more susceptible to infection by the malarial parasite.

Fig. 4.2 shows maps of Africa produced by the WHO.

- Fig. 4.2a shows the percentage population of each country testing positive for HIV
- Fig. 4.2b shows the percentage **increase** in malaria as a result of HIV infection in each country.



**HIV prevalence (%)**



**Malaria prevalence (%)**

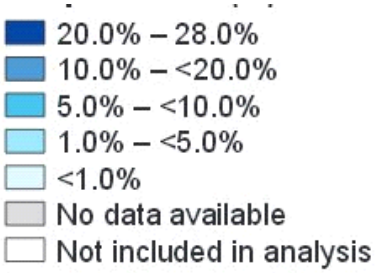



Fig. 4.2a

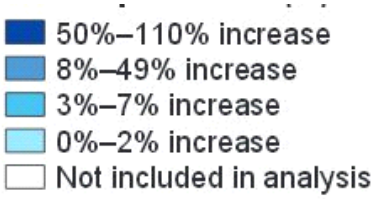



Fig. 4.2b

**(i)** Explain how the information in Fig. 4.2 supports the idea that there is a link between HIV infection and susceptibility to malaria.

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.....[2]

**(ii)** Suggest how HIV infection may have led to an increase in malarial infections in these countries.

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.....[2]

[Total: 12]

**Q9.**

6 Measles is a common viral infection. A vaccine has been available for measles since the 1960s. There are vaccination programmes for many diseases including measles. Babies are born with a passive immunity to measles so the vaccine is not given in the first few months after birth.

For Examiner's Use

**(a)** Explain how active immunity differs from passive immunity.

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.....[3]

**(b)** Explain why the vaccine for measles is not given in the first few months of a child's life.

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.....[2]

The World Health Organization (WHO) publishes data on the vaccination programmes for infectious diseases. The WHO recommends vaccination rates of over 90% of children.

Each health authority in a country reports its success in vaccinating children in their district. The WHO uses these figures to estimate the percentage of districts in each country that vaccinate 90% of children against measles.

The WHO also collects statistics on death rates of children under the age of 5 from all causes, including infectious diseases.

Fig. 6.1 shows these statistics for 24 countries for the year 2007.

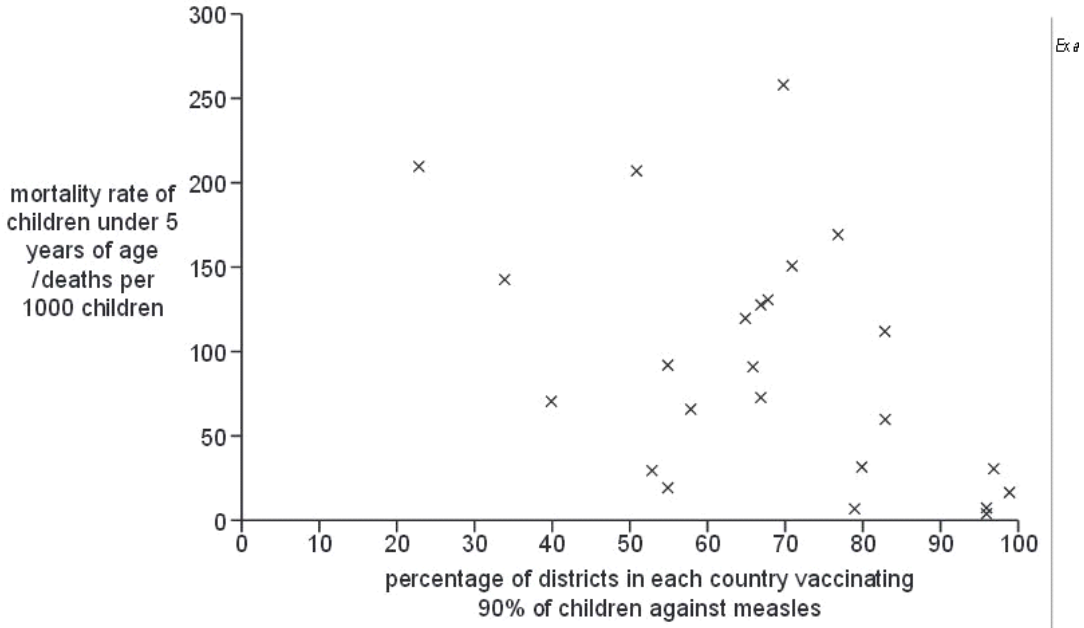


**Fig. 6.1**

**(c)** Use the information in Fig. 6.1 to explain why the WHO recommends immunisation of 90% of children.

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.....[2]

[Total: 7]

**Q10.**

**4** Tuberculosis (TB) is an infectious disease that kills about three million people worldwide each year.

**(a)** Name the pathogenic organism that causes tuberculosis.

.....[1]

Fig. 4.1 is a transmission electron micrograph of the organism that causes tuberculosis.

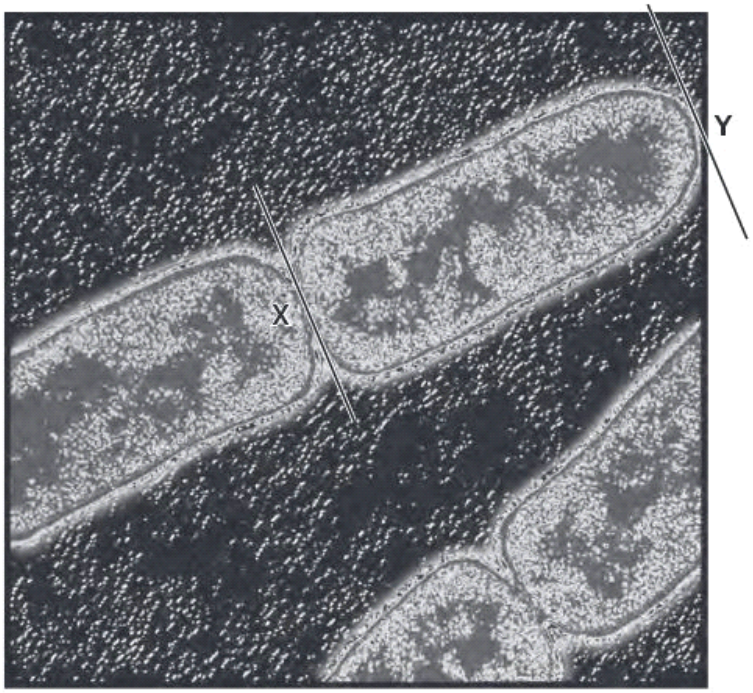


**Fig. 4.1**

**(b) (i)** The actual length of the cell between **X** and **Y** in Fig. 3.1 is 2 µm.

Calculate the magnification of the electron micrograph.

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

magnification × .....[2]

**(ii)** The organism that causes tuberculosis is a prokaryote. State three features of prokaryotes.

1. .....

2. .....

3. .....[3]

In the 1940s, the use of antibiotics led to a steady decrease in the number of new cases of tuberculosis. However, in many developed countries, the number of new cases stopped decreasing in the mid-1980s and is now increasing.

*For Examiner's Use*

**(c) (i)** State **one** factor, other than drug therapy, that contributed to the **steady decrease** in the number of new cases of tuberculosis.

.....[1]

**(ii)** Outline three reasons why, in many developed countries, the number of new cases of tuberculosis is now increasing.

1. .....

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2. .....

.....

3. .....

.....[3]

**(d)** Streptomycin was the first antibiotic to be discovered that was effective against the pathogen that causes tuberculosis. Streptomycin causes the death of the pathogen by binding to ribosomes and inhibiting protein synthesis.

**(i)** Suggest two ways in which streptomycin acts at ribosomes to inhibit protein synthesis.

1. .....

.....

.....

2. .....

.....

.....[2]

**(ii)** Streptomycin does not harm mammalian cells.

Suggest an explanation for this.

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.....[1]

[Total: 13]

**Q11.**

**(d)** Antibiotic resistance is a serious worldwide problem.

Suggest how antibiotics can be used effectively to avoid the development of widespread resistance in bacteria.

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.....[2]

[Total: 11]

**Q12.**

5 **(a)** State the name of the organism that causes cholera.

..... [1]

**(b)** NQR is an important respiratory enzyme located in the cell surface membrane of the bacterium that causes cholera.

A student suggested that an inhibitor of the enzyme NQR could be used as a drug in the prevention and control of cholera.

Suggest and explain how this inhibitor would function.

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..... [3]

**(c)** Table 5.1 shows the statistics for cholera reported to the World Health Organization (WHO) in four regions of the world in 2008.

**Table 5.1**

| region | number of cases | number of deaths | fatality rate / % |
|---|---|---|---|
| Africa | 179 323 | 5 074 | 2.83 |
| Asia | 10 778 | 69 | 0.64 |
| Europe | 22 | 0 | 0.00 |
| North America | 7 | 0 | 0.00 |
| Total | 190 130 | 5 143 | |

**(i)** Calculate the total cholera fatality rate for 2008.

Show your working.

answer ..... % [2]

**(ii)** Apart from differences in total population size in each of the regions, suggest explanations for the differences shown in Table 5.1.

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.....[4]

[Total: 10]

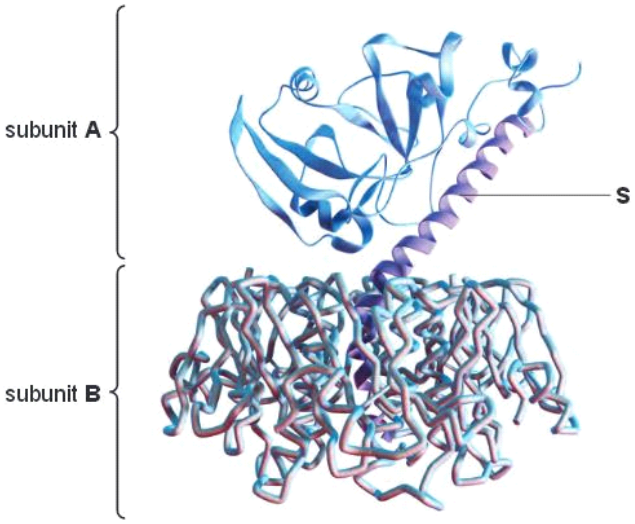
**Q13.**

3 Cholera is a disease caused by the bacterium *Vibrio cholerae*. The disease symptoms are caused by a toxin, produced by the bacterium, interacting with proteins in the cell surface membranes of epithelial cells in the human intestine.

For Examiner's Use

The cholera toxin is a protein and is composed of two subunits, **A** and **B**. Subunit **A** is made from one polypeptide and subunit **B** is made from five identical polypeptides.

Fig. 3.1 shows the structure of the cholera toxin.



**(a)** Name:

**(i)** the level of structure that is only shown by a protein that has more than one polypeptide chain

.....[1]

**(ii)** the part labelled **S**.

.....[1]

The cholera toxin interacts with ion channels in the epithelial membranes, resulting in watery diarrhoea.

*For Examiner's Use*

These channels open, allowing ions to move from the epithelial cells into the lumen of the intestine.

**(b)** **(i)** Name the process by which the ions move in this case.

.....[1]

**(ii)** Due to the movement of ions into the lumen, water moves from the epithelial cells into the lumen.

Name the process by which water moves and explain why it moves into the lumen.

*name* .....

*explanation* .....

.....

.....

.....[3]

Large outbreaks of cholera are often associated with natural disasters. For example, following an earthquake in Pakistan in 2005, an estimated 20 000 cholera cases were reported in the vicinity, compared to approximately 1000 cases in the rest of the country.

**(c) (i)** Describe the mode of transmission of cholera.

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.....[2]

**(ii)** Explain how natural disasters can sometimes result in transmission to more individuals.

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.....[2]

[Total: 10]

**Q14.**

5 Malaria is a disease caused by the parasite, *Plasmodium*. The parasite has a complex life-cycle, part of which involves development within the gut of the female mosquito which is responsible for the transmission of the disease.

For Examiner's Use

Fig. 5.1 shows part of the life-cycle of the malarial parasite.

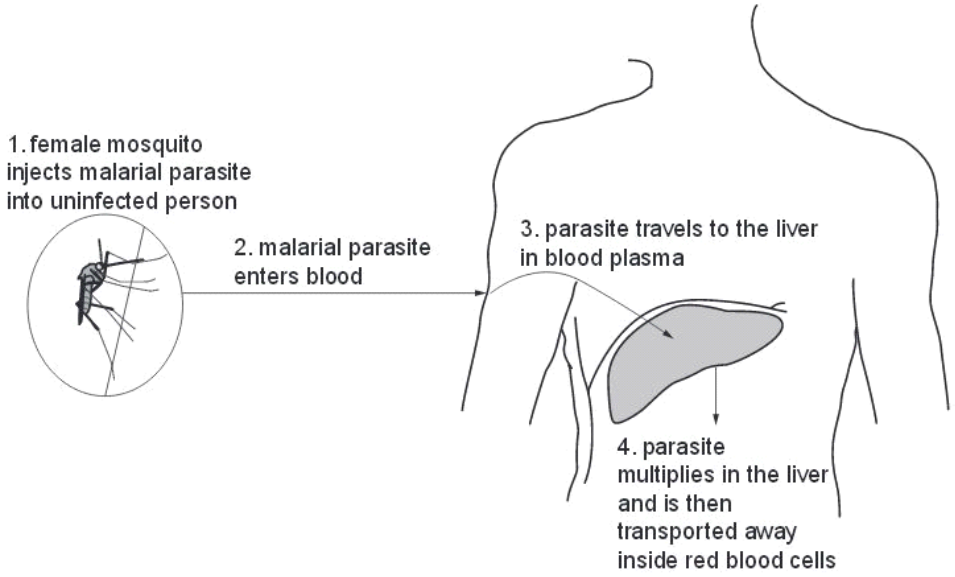


**Fig. 5.1**

Research has been directed towards the development of a malarial vaccine. Much of this research relies on the fact that *Plasmodium* has different forms in its life cycle.

During trials of a malarial vaccine, the parasites were killed using radioactivity and then injected into volunteers. This method provided some protection against malaria.

**(a)** Explain why the parasites were killed using radioactivity and not by using high temperatures.

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.....[3]

**(b)** With reference to Fig. 5.1, explain why the researchers decided to use the form of the parasite which is injected by mosquitoes and not the form which leaves the liver.

*For Examiner's Use*

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.....[3]

**(c)** The volunteers who were injected with the killed parasites produced antibodies, which provided some protection against the disease.

Outline the events that occur following injection of the parasites, which lead to the production of antibodies.

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.....[5]

[Total: 11]

**Q15.**

HIV enters T-lymphocytes by a form of endocytosis. Two of the enzymes in HIV are:

- reverse transcriptase, which uses viral RNA as a template to make DNA to incorporate into the chromosomes of the host's cells
- protease, which is used to break a polypeptide into smaller molecules. These molecules are used to make the protein coat of new viral particles, which will infect other cells.

Various drugs have been developed to treat HIV infections. Table 4.1 gives information about some of these drugs.

**Table 4.1**

| drug | enzyme inhibited | mode of action |
|---|---|---|
| zidovudine | reverse transcriptase | occupies active site |
| tenofovir | reverse transcriptase | occupies active site |
| efavirenz | reverse transcriptase | occupies sites other than the active site |
| atazanavir | protease | occupies active site |

**(b)** Explain the difference between the mode of action of zidovudine and efavirenz.

For Examiner Use

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..... [4]

**(c)** People who receive drug treatment for HIV take a mixture of drugs that act in different ways.

Suggest the advantage of taking a mix of the drugs shown in Table 4.1.

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..... [2]

**(d)** Antibiotics are prescribed to people who have HIV/AIDS for the treatment of secondary infections, but not to treat the HIV infection.

Explain why this is so.

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..... [2]

## Q16.

**3** **(a)** Explain why tuberculosis (TB) is known as an **infectious** disease.

For Examiner Use

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..... [3]

**(b)** Outline the role of antibiotics in the treatment of infectious diseases, such as TB.

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..... **[4]**

Tobacco smoking is a risk factor for a number of diseases. This means that it increases the risk of developing disease. In 2009, the World Health Organization (WHO) published a factsheet stating that tobacco smoking:

- may be responsible for more than 20% of the new cases of TB globally
- increases the risk of becoming infected and having active TB
- increases the risk of dying from TB
- is a risk factor for TB in all socioeconomic groups.

Projects have been set up in a number of different countries to tackle this health problem. One project involves health workers encouraging TB patients to give up smoking.

**(c)** Suggest what epidemiological evidence would lead to the conclusion that tobacco smoking is a risk factor for TB.

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

**(d)** Suggest **and** explain how the effects of smoking can increase the risk of becoming infected with TB.

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..... [3]

**(e)** Many smokers know that tobacco smoking is a risk factor for coronary heart disease, but continue to smoke. Some of these smokers have stated that they expect medical practitioners to cure them if they develop coronary heart disease.

List two treatments used by medical practitioners to treat coronary heart disease.

1. .....

2. ..... [2]

[Total: 14]

## Q17.

**6** Measles is an infectious disease, while lung cancer is not.

**(a)** Explain why lung cancer is sometimes referred to as a 'lifestyle disease'.

.....

.....

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..... [2]

**(b)** State the type of pathogen that causes measles and state its mode of transmission.

*pathogen* .....

*transmission* .....

.....

[2]

**(c)** Between January and April 2011, 118 measles cases were reported in the USA, where measles was previously thought to be virtually eradicated.

Suggest a reason for this rise in measles cases.

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..... [1]

[Total: 5]

## Q18.

**5** **(a)** Describe how the malarial parasite is normally transmitted from an infected person to an uninfected person.

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.....

.....[2]

Fig. 5.1 is drawn from an electron micrograph of a red blood cell taken from a person suffering from malaria.

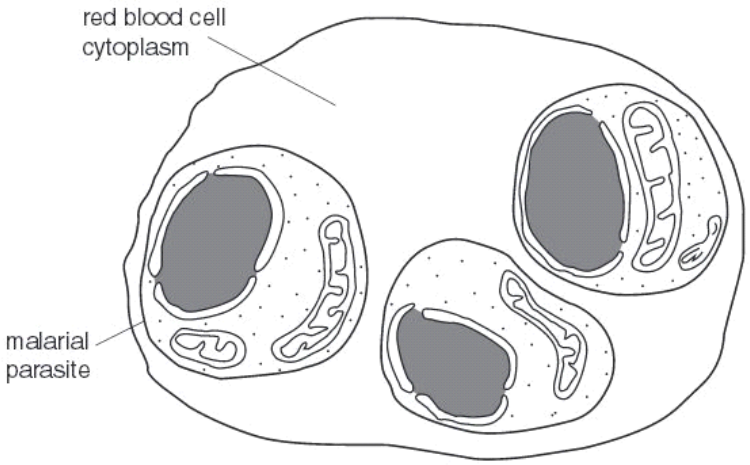


**Fig. 5.1**

**(b)** State two features, **visible in Fig. 5.1**, that indicate that the malarial parasite is eukaryotic.

1. .....

2. .....[2]

**(c)** Outline the likely effects on the body of the presence of malarial parasites in red blood cells.

.....

.....

.....

.....[3]

[Total : 7]

**Q19.**

**3** Complete the following passage on cholera.

Cholera is an acute intestinal infection caused by the bacterium ..... . It has a short incubation period, from less than one day to five days, and produces a toxin that causes symptoms, such as ..... that can quickly lead to severe dehydration and death if not treated promptly. Cholera bacteria are transmitted by contaminated ..... . In highly endemic areas, it is mainly a disease of young children, although breastfeeding infants are rarely affected. Limited stocks of two oral cholera vaccines that provide high-level protection for several months against one strain of cholera have recently become available in a few countries. The vaccine stimulates an ..... ..... , involving the lymphocytes in the lining of the gut. The B lymphocytes produce ..... that act against the cholera bacteria, which tend to remain in the intestines during an infection.

[Total: 5]

**Q20.**

Use

**4** Fig. 4.1 is a diagram of a bacterium.

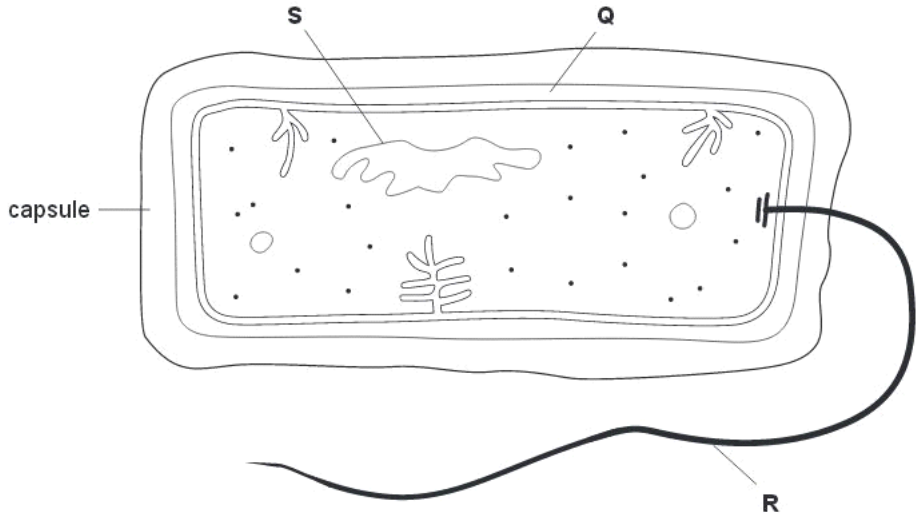


**Fig. 4.1**

**(a)** Name structures **P** to **S**.

**Q** .....

**R** .....

**S** .....[3]

**(b)** State the names of three structures that are present in a phagocyte from a mammal that are **not** present in bacteria.

1 .....

2 .....

3 .....[3]

Tuberculosis (TB) is an infectious disease caused by a bacterium.

**(c) (i)** Name the bacterium that causes TB.

.....[1]

**(ii)** Describe how TB is transmitted from infected to uninfected people.

.....

.....

.....

.....[2]

Antibiotics are used in the treatment of people with TB. The usual procedure is for people with TB to take a mixture of three or four antibiotics for up to a year.

**(d)** Explain why it is necessary to give people with TB this type of treatment.

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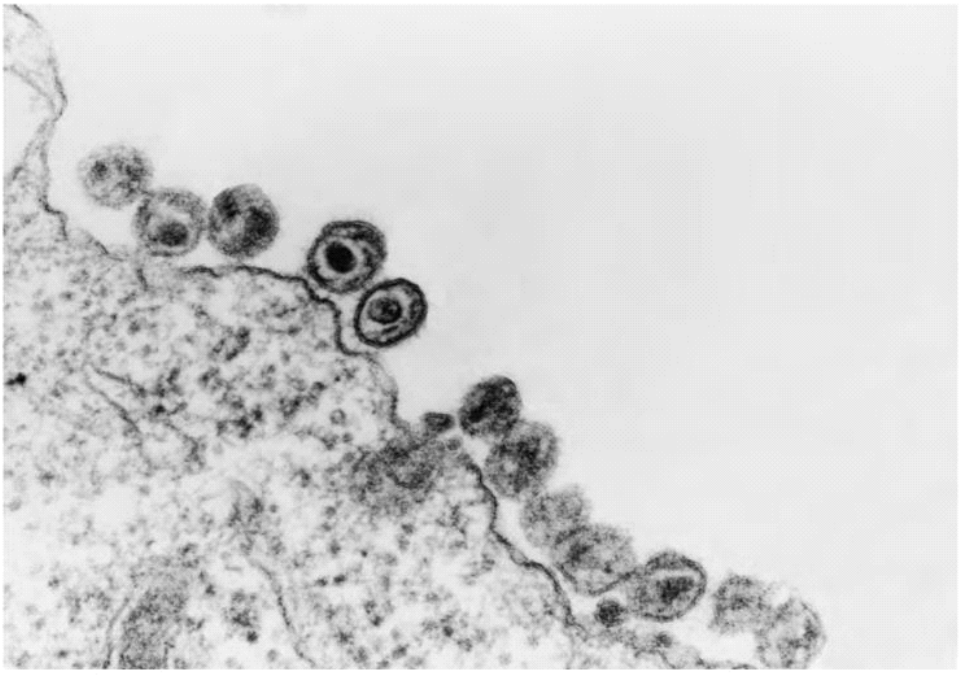
.....[3]

[Total : 12]

**Q21.**

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]

**(c)** State three ways in which HIV is transmitted.

1. .....

.....

2. .....

.....

3. .....

.....[3]

**(d)** Outline the problems involved in controlling the spread of HIV.

.....

.....

.....

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.....

.....[3]

[Total: 10]

**Q22.**

5 **(a)** **(i)** Name the organism that causes tuberculosis (TB).

.....[1]

**(ii)** Explain how TB is transmitted from an infected person to an uninfected person.

.....

.....

.....

.....[2]

The World Health Organisation (WHO) collects data on TB from its six different regions as shown in Table 5.1. In 2003, it used these figures to estimate

- the total number of people with the disease in each region
- the number of deaths from TB.

Many of those who died from TB were also infected with HIV.

**Table 5.1**

| WHO region | number of cases per 100 000 population | number of deaths from TB (including TB deaths in people infected with HIV) per 100 000 population |
|---|---|---|
| Africa | 345 | 78 |
| The Americas | 43 | 6 |
| Eastern Mediterranean | 122 | 28 |
| Europe | 50 | 8 |
| South-East Asia | 190 | 38 |
| Western Pacific | 112 | 19 |

**(b)** Explain the advantage of expressing the number of cases and the number of deaths as 'per 100 000 population'.

.....

.....

.....

.....[2]

**(c)** Using the information in Table 5.1, outline the reasons why TB has a greater impact on the health of people in some regions rather than others.

.....

.....

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.....

.....

.....[3]

**(d)** The number of cases of TB decreased considerably in many countries during the 20th century. Over the past 20 years, the number of cases worldwide has increased very steeply. A vaccine against TB has existed since 1921.

Explain why TB has not been eradicated even though a vaccine has existed since 1921.

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.....[3]

[Total: 11]

**Q23.**

5 *Plasmodium falciparum* is the causative agent of the most severe form of malaria.

It is distributed throughout the tropics.

**(a)** Explain why malaria is restricted to the tropics.

.....

.....

.....

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..... [2]

The haploid number of *P. falciparum* is 14.

Fig. 5.1 shows the life cycle of *P. falciparum*.

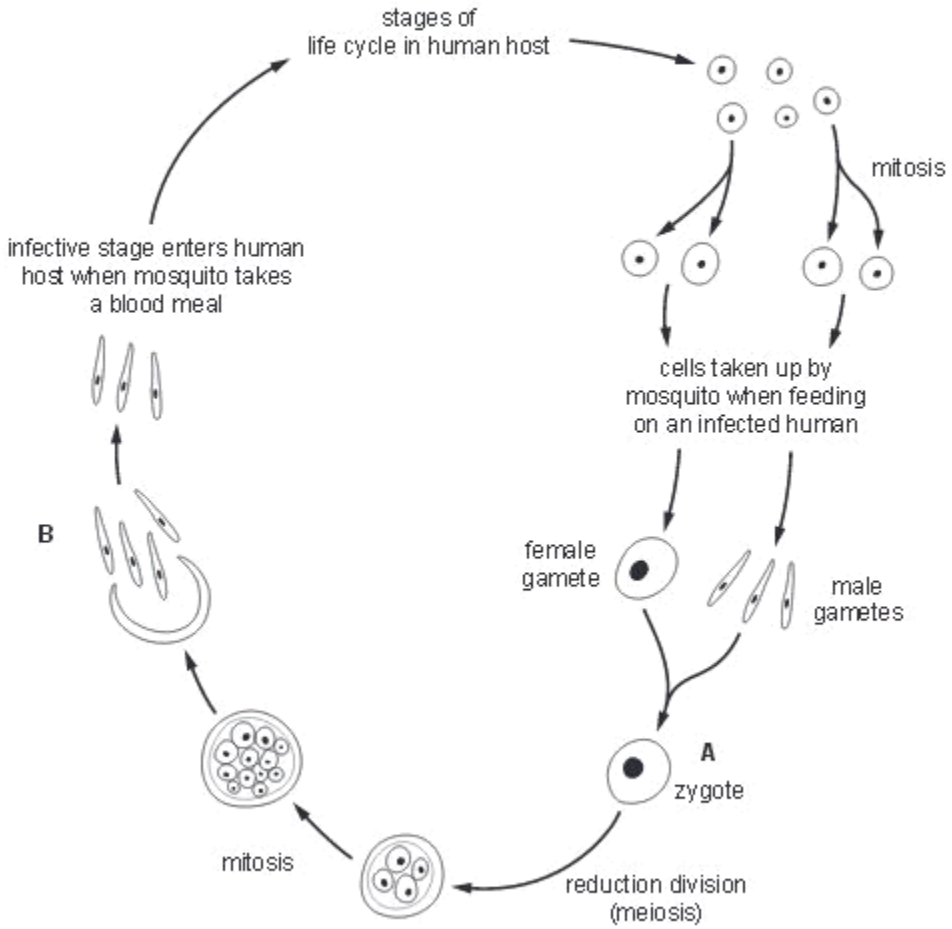


**Fig. 5.1**

**(b) (i)** State the number of chromosomes present at stages **A** and **B**.

**A** .....

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

**(ii)** Explain why a reduction division (meiosis) occurs during the life cycles of organisms, such as *Plasmodium*, that reproduce sexually.

For Examiner's Use

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..... [2]

**(c)** Explain why it has proved difficult to develop a vaccine for malaria.

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..... [4]

**Q24.**

**5** *Pneumocystis jirovecii* is a yeast-like fungus that lives in human lungs. It is the causative agent of one of the opportunistic pneumonia-like infections that may develop during AIDS.

Ex

*P. jirovecii* is eukaryotic. Its life cycle is difficult to observe as it has never been cultured in the laboratory. Fig. 5.1 shows its possible life cycle. The numbers on the diagram represent the number of chromosomes in each stage.

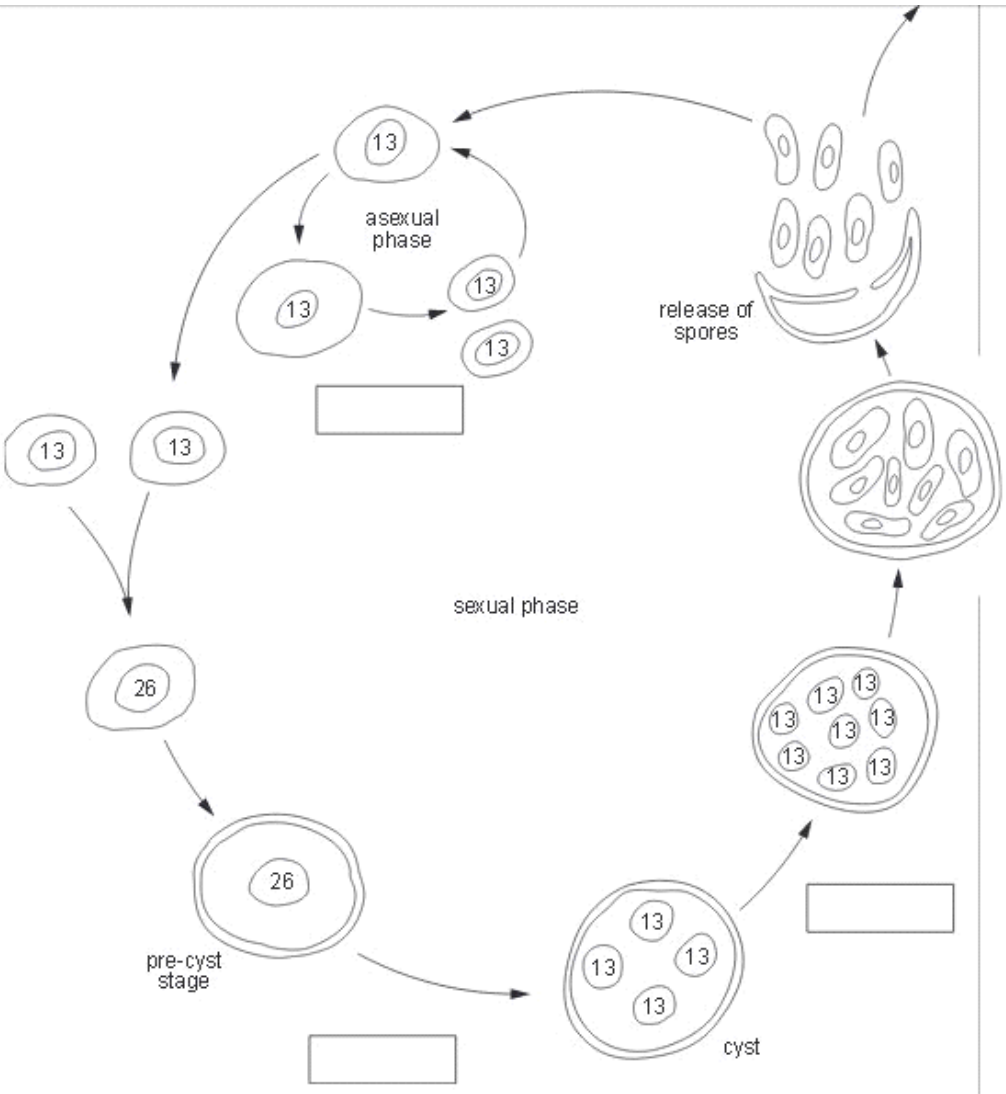


**Fig. 5.1**

**(a)** *P. jirovecii* has a haploid number of 13 chromosomes.

Complete the life cycle by writing either mitosis or meiosis in the boxes in Fig. 5.1. [2]

For Examiner Use

**(b)** State two structural features that you would expect to find in the cytoplasm of *P. jirovecii* that indicate it is a eukaryote and not a prokaryote.

1 .....

2 .....[2]

**(c)** Suggest how *P. jirovecii* is transmitted from one person to another.

.....

.....

.....

.....[2]

**(d)** Discuss the problems in attempting to control the spread of HIV/AIDS.

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.....[4]

[Total: 10]

**Q25.**

**4** 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, choleragen, 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.

.....

.....[1]

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

.....

.....

.....

.....

.....[3]

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.

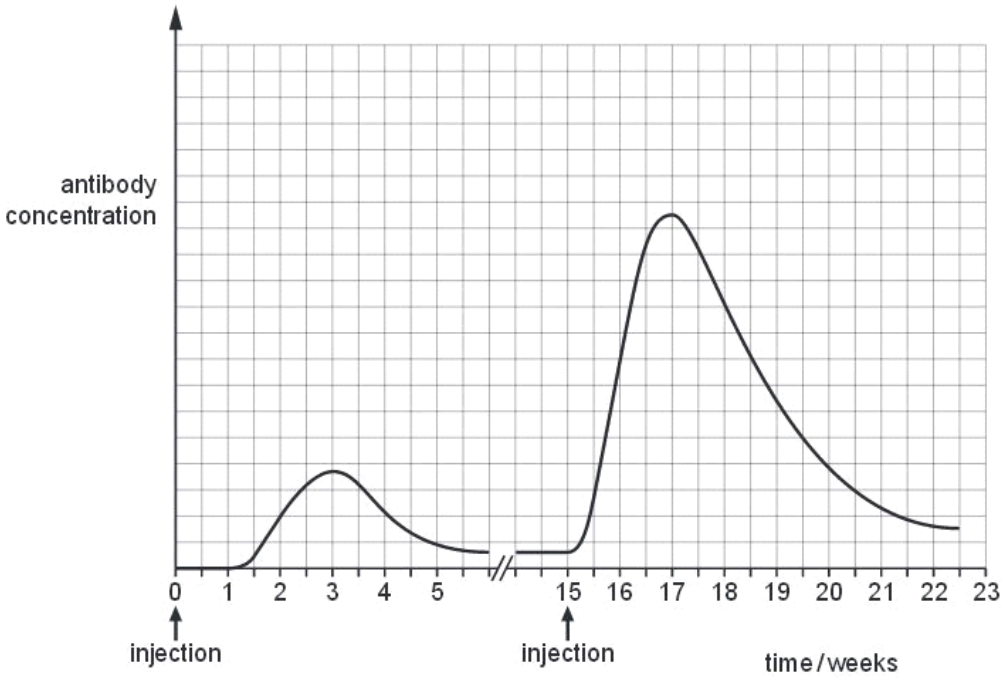


**Fig. 4.1**

**(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]

(c) Discuss the problems involved in preventing the spread of cholera.

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.....[4]

[Total: 13]

**Q26.**

2 Malaria is an infectious disease that is considered by the World Health Organization to be a disease of worldwide importance.

**(a)** Explain what is meant by the term *infectious*.

.....

.....

.....

..... [2]

**(b)** Name **one** species of organism that causes malaria.

..... [1]

**(c)** Explain the significance of the following statements in the control of malaria.

**(i)** The female *Anopheles* mosquito has been more closely studied with regard to malaria than the male *Anopheles* mosquito.

.....

..... [1]

**(ii)** The infective stages of the malarial organism are present in anti-coagulant produced by the mosquito.

.....

..... [1]

**(iii)** After circulating in the blood for a short time, the pathogen enters liver cells of the newly infected person and then enters red blood cells.

.....

.....

.....

..... [2]

**(d)** Discuss the factors that determine the distribution of malaria worldwide.

.....

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.....

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..... **[4]**

**[Total: 11]**

**Q27.**

**2** Fig. 2.1 shows a world map shaded by country according to the incidence of tuberculosis (TB).

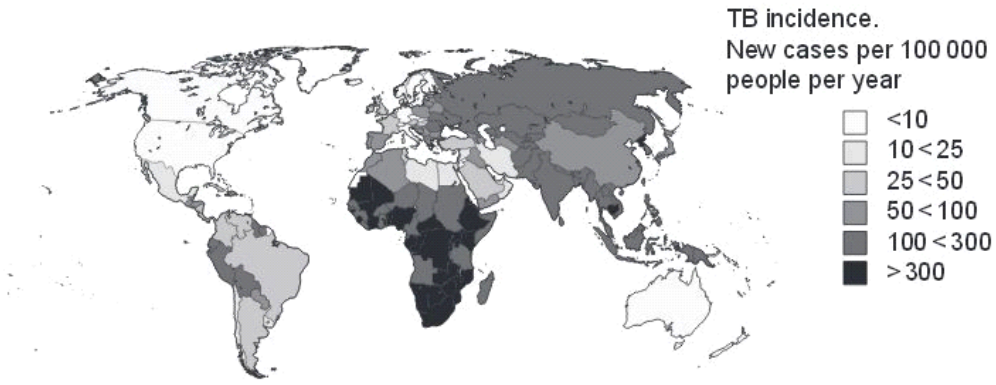


**Fig. 2.1**

**(a)** State the name of the pathogenic organism which causes TB and describe its mode of transmission from infected to uninfected people.

*name of organism* .....

*mode of transmission* .....

.....

.....[3]

**(b)** People suffering from TB are treated using antibiotics. Recently, multi-drug resistant TB (MDR-TB) has developed, making the disease more difficult to treat.
Suggest how this drug resistance may have arisen.

.....

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.....

.....

.....[2]

**(c)** The World Health Organization (WHO) aims to eradicate TB worldwide by 2050. With reference to Fig. 2.1, discuss the problems to be faced in the eradication of TB.

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.....[5]

[Total: 10]

**Q28.**

**(b)** In 1980, it was announced that the highly infectious viral disease, smallpox, had been eradicated. This was mainly due to a worldwide vaccination programme planned by the World Health Organization (WHO).

Attempts have been made to control other diseases, such as measles, sickle cell anaemia and cholera, without the same success as smallpox.

**(i)** Define the term *disease*.

.....

.....

.....

.....

.....[2]

**(ii)** Describe two features of the vaccine that contributed to the success of the smallpox eradication programme.

1. .....

.....

.....

2. .....

.....

.....[2]

**(iii)** Discuss the reasons why vaccination has **not** eradicated cholera **and** sickle cell anaemia.

*cholera* .....

.....

.....

.....

.....

.....

.....

*sickle cell anaemia* .....

.....

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.....[5]

[Total: 13]

**Q29.**

**4** Fig. 4.1 shows a graph of the number of people, worldwide, estimated to be newly infected with the human immunodeficiency virus (HIV) in the years 1990 to 2008.

*For Examiner's Use*

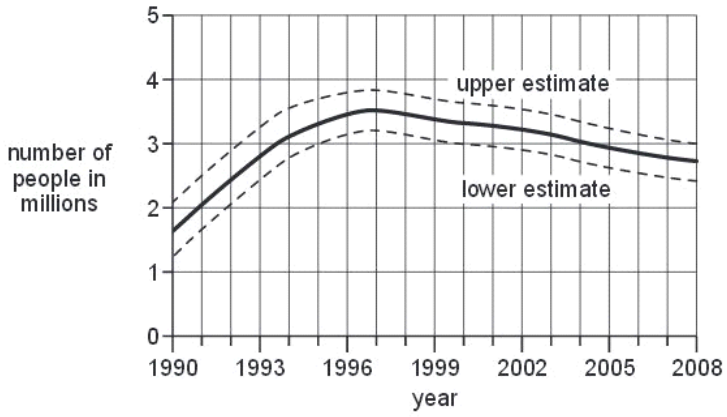


**Fig. 4.1**

**(a) (i)** Use the information in Fig. 4.1 to describe the changes in the number of people newly infected with HIV.

.....

.....

.....

.....

.....

..... [3]

**(ii)** Suggest possible explanations for the decrease in the number of people newly infected with HIV.

.....

.....

.....

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.....

..... [3]

**(b)** Explain why it was necessary to include the upper and lower estimates on the graph in Fig. 4.1.

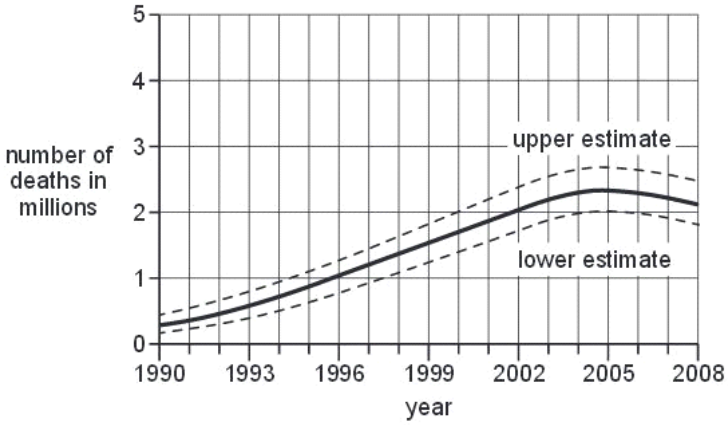
For Examiner Use

.....

.....

..... [1]

Fig. 4.2 shows a graph of the total number of estimated deaths due to HIV/AIDS over the same time period as the graph in Fig. 4.1.




**(c)** Use the information given in Fig. 4.1 **and** Fig. 4.2 to explain the relationship between new HIV infections and deaths due to HIV/AIDS.

.....

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.....

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.....

.....

..... [4]

[Total: 11]

**Q30.**

4 Diseases are either infectious or non-infectious.

For Examiner's Use

**(a)** Complete Table 4.1 to produce a summary of four important infectious diseases.

**Table 4.1**

| name of disease | type of causative organism | name of causative organism |
|---|---|---|
| cholera | bacterium | *Vibrio cholerae* |
| HIV/AIDS | virus | |
| malaria | | |
| tuberculosis (TB) | | *Mycobacterium tuberculosis* |

[4]

**(b)** Typhoid is an example of an infectious disease.

Some features of typhoid include:

- caused by a bacterium that can only infect humans
- caused by the ingestion of contaminated food and water
- can be treated with drugs
- can be prevented by a vaccine.

**(i)** State which of the diseases named in Table 4.1 is transmitted in the same way as typhoid.

..... [1]

**(ii)** State which type of drug can be used in the treatment of typhoid. Give a reason for your answer.

.....

.....

..... [1]

**(iii)** Child vaccination programmes against typhoid in some countries have had considerable success. The numbers contracting the disease have decreased, not only in the vaccinated children, but also in other age groups that were not part of the programme.

For Examiner's Use

Suggest explanations for this observation.

.....

.....

.....

..... [2]

**(c)** After infection, the ingested typhoid bacteria are engulfed by phagocytes.

**(i)** Explain why the phagocytes act only against the bacteria and not against human cells.

.....

.....

.....

.....

.....

..... [3]

**(ii)** Unlike other bacteria, the typhoid bacteria are able to survive and multiply within the phagocytes.

Suggest an explanation for this observation.

.....

.....

..... [1]

**(iii)** Explain why people with HIV/AIDS are more susceptible to infections, such as typhoid.

.....

.....

.....

..... [2]

[Total: 14]

**Q31.**

**2** Antibiotics are drugs which are very important in the treatment and cure of some diseases.

**(a)** Underline the disease or diseases in the list below which are treatable with antibiotics.

**cholera**

**malaria**

**HIV/AIDS**

**tuberculosis (TB)**

[1]

**(b)** When patients are prescribed a course of antibiotics, they must not stop taking the antibiotics as soon as they start to feel better, or when they feel that the disease symptoms have gone.

Explain the importance of taking a complete course of antibiotics.

.....

.....

.....

.....

.....

.....[3]

**(c)** Some antibiotics act as competitive inhibitors of enzymes in pathogens.

**(i)** Describe what is meant by the term competitive inhibitor.

.....

.....

.....

.....

.....

.....[3]

Penicillin acts as a competitive inhibitor of one of the enzymes involved in bacterial cell wall synthesis.

**(ii)** State why penicillin, which is an enzyme inhibitor, can be taken by humans.

.....

.....

.....[1]

**(iii)** Suggest the effect which penicillin will have on bacterial cells.

.....

.....

.....

.....

.....[3]

[Total: 11]

**Q32.**

3 **(a)** Tuberculosis (TB) and chronic obstructive pulmonary disease (COPD) are diseases that affect the lungs.

With reference to TB and COPD, explain how infectious diseases differ from non-infectious diseases.

.....

.....

.....

.....

.....[2]

**Q33.**

4 *Staphylococcus aureus* is a bacterium that is the cause of many different infectious diseases.

**(a)** Fig. 4.1 is a diagram of *S. aureus*.

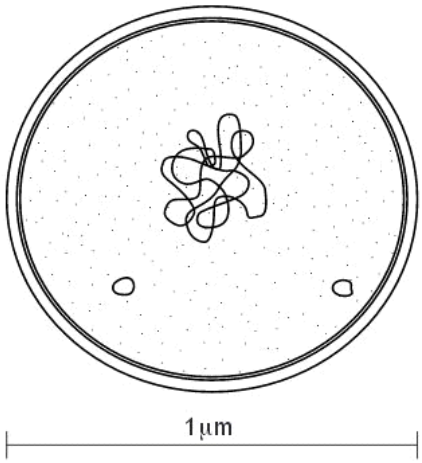


**Fig. 4.1**

**(i)** Cell structures, such as mitochondria, endoplasmic reticula (ER), Golgi apparatus, lysosomes and chloroplasts are found only in eukaryotic cells. These are not present in Fig. 4.1.

With reference to Fig. 4.1, describe **other features** that support the fact that *S. aureus* is a prokaryote.

.....

.....

.....

.....

.....

.....[3]

**(ii)** State the main difference in the composition of the plant cell wall compared to the bacterial cell wall.

*plant cell wall* .....

*bacterial cell wall* .....[2]

**(b)** Bacterial cells behave in a similar way to plant cells when immersed in solutions of different water potential.

Suggest **and** explain what would happen to bacteria placed in a solution with a water potential more negative than their cell contents.

.....

.....

.....

.....

.....

.....[3]

**(c)** Some strains of *S. aureus* have become resistant to one or more of the antibiotics used to treat infections.

The mechanisms of antibiotic resistance involve proteins, for example:

- enzymes to breakdown antibiotics
- membrane proteins that inactivate antibiotics
- membrane proteins that pump out antibiotics.

Explain why antibiotic resistance arises as a result of mutation.

.....

.....

.....

.....[2]

[Total: 10]