

Infectious Diseases

(Past Year Topical Questions 2010-2015)

May/June 2010 (21)

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

(a) Define the term *infectious disease*.

.....
..... [1]

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

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

May/June 2010 (22)

- 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.

.....

.....

2.

.....

..... [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.

.....

.....

.....

.....

.....

..... [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.

.....

2.

..... [2]

May/June 2010 (23)

- 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.

.....

.....

..... [2]

(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.

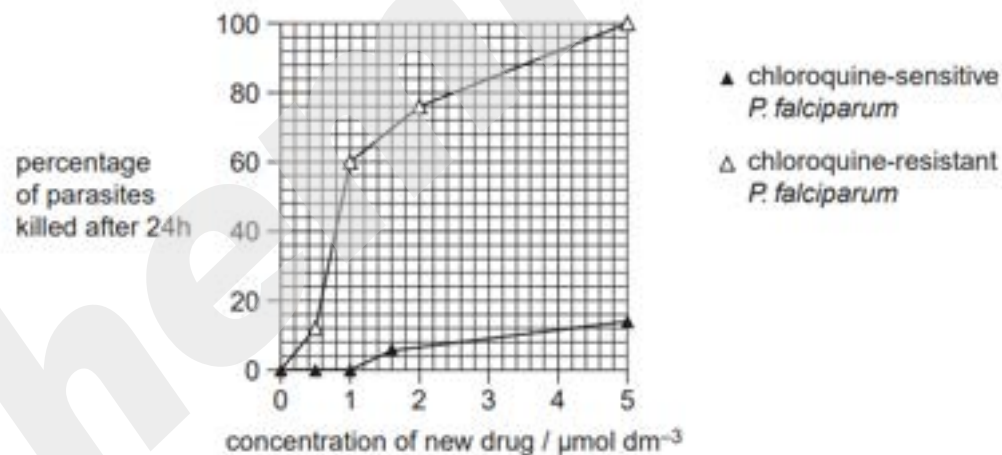
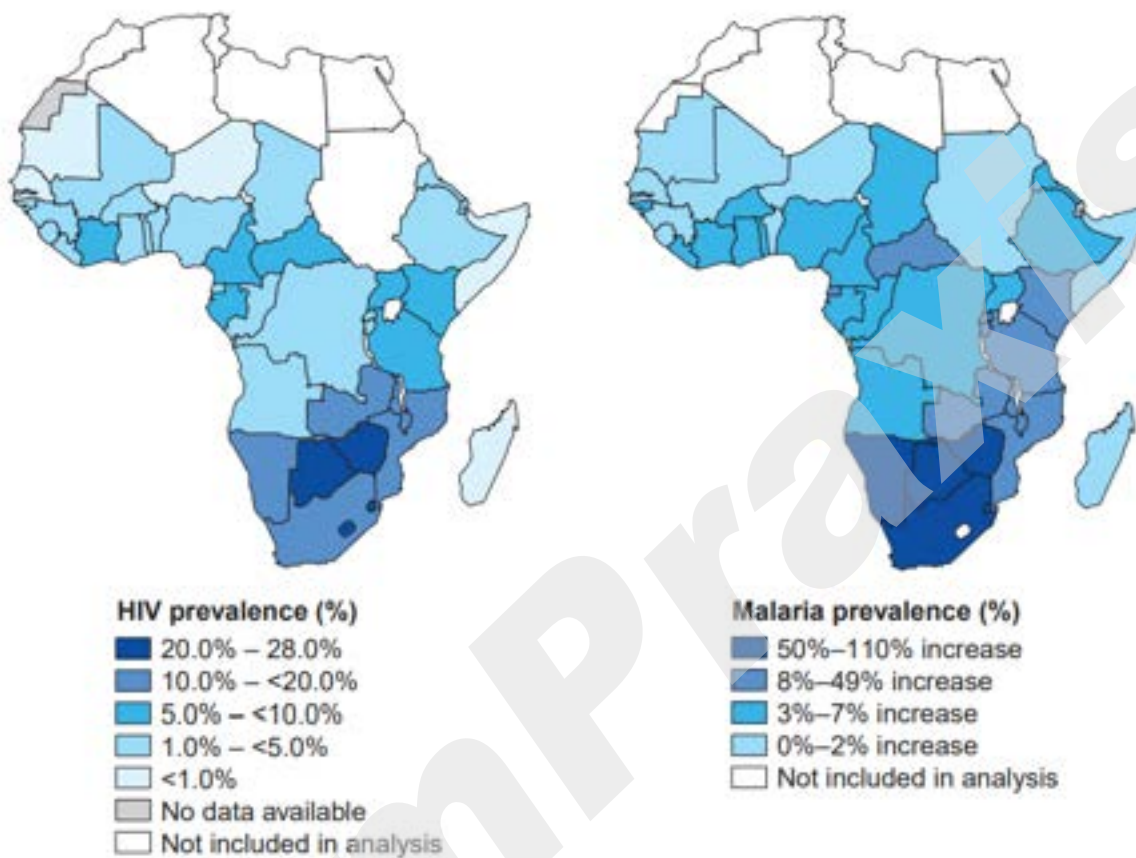


Fig. 4.1


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.

.....

.....

.....

.....

[2]

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

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

Oct/Nov 2010 (21)

- 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, 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.

.....
..... [1]

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

.....
.....
.....
..... [3]

(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]

- (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.

.....
.....
.....
..... [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.

.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [5]

May/June 2011 (22)

- 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]

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.

(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.

.....

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.

(ii) Streptomycin does not harm mammalian cells.

Suggest an explanation for this.

.....

..... [1]

Oct/Nov 2011 (22)/Q2

- (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]

Oct/Nov 2011 (23)

- 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.

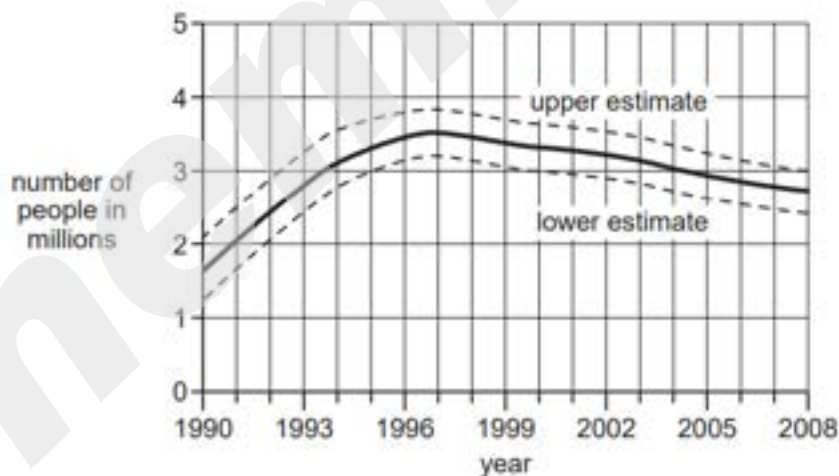


Fig. 4.1

- (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.

.....

.....

.....

.....

.....

.....

..... [3]

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

.....

.....

..... [1]

May/June 2012 (21)/Q4

(d) Antibiotic resistance is a serious worldwide problem.

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

.....

.....

.....

..... [2]

May/June 2012 (22)

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

..... [1]

(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	179323	5074	2.83
Asia	10778	69	0.64
Europe	22	0	0.00
North America	7	0	0.00
Total	190130	5143	

May/June 2012 (23)/Q3

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.

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

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

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

May/June 2012 (23)

- 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.

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

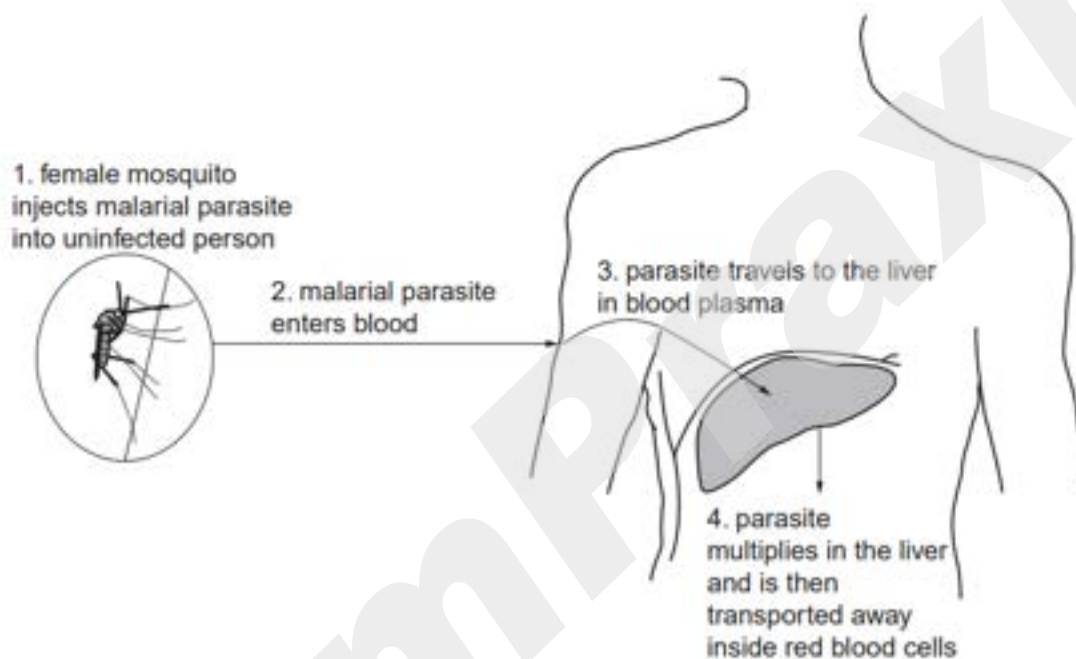


Fig. 5.1

Oct/Nov 2012 (22)

4 Diseases are either infectious or non-infectious.

(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	<i>Vibrio cholerae</i>
HIV/AIDS	virus	
malaria		
tuberculosis (TB)		<i>Mycobacterium tuberculosis</i>

[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) Suggest the effect which penicillin will have on bacterial cells.

.....
.....
.....
.....
..... [3]

May/June 2013 (21)/Q4

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

- (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.

.....

.....

.....

.....

..... [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.

.....

.....

.....

.....

..... [2]

May/June 2013 (22)

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

.....
.....
.....
.....
.....
.....
..... [3]

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

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [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.

.....

.....

.....

.....

.....

..... [2]

May/June 2014 (21)/Q1

- (d) Describe how *V. cholerae* is transmitted from an infected person to an uninfected person.

.....

.....

.....

.....

..... [2]

- (e) It is important to know how pathogens are transmitted in order to develop effective control methods.

Explain how this knowledge is used to control the spread of *V. cholerae* in the human population.

.....

.....

.....

.....

.....

May/June 2014 (22)

- 4 Table 4.1 shows some information about five infectious diseases.

Table 4.1

infectious disease	name of causative organism(s)	type of causative organism	main mode of transmission
HIV/AIDS	human immunodeficiency virus (HIV)	virus	sexual contact
cholera	<i>Vibrio cholerae</i>		ingestion of contaminated water and food
tuberculosis	<i>Mycobacterium tuberculosis</i>	bacterium	
measles		virus	aerosol / droplet infection
	<i>Plasmodium vivax</i> or <i>P. malariae</i> or <i>P. falciparum</i> or <i>P. ovale</i>		

(a) Complete Table 4.1.

[3]

- (d) Suggest why TB is more likely to be fatal in people who have HIV/AIDS than in those who do not have HIV/AIDS.

.....

.....

.....

..... [2]

Oct/Nov 2014 (21)

- 2 (a) Define the term *disease*.

.....

.....

..... [1]

Oct/Nov 2014 (22)

- 4 Cholera is an infectious disease that can affect children and adults. Symptoms of the disease can occur very quickly, from a few hours to a few days.

Table 4.1 shows:

- ∞ the economic status of each of five countries
- ∞ the number of cases of cholera reported to the World Health Organization (WHO) over a five year period for each country
- ∞ the population in 2006 and in 2010 of each country.

Table 4.1

country	economic status	number of cholera cases reported			population / millions	
		2006	2008	2010	2006	2010
Zimbabwe	low	789	60055	951	12.5297	12.5715
Uganda	low	5194	3726	2341	29.3703	33.4247
Angola	middle	67257	10511	1484	17.0104	19.0819
Cameroon	middle	922	0	10759	17.9484	19.5989
Canada	high	2	1	2	32.6490	34.1088

- (a) (i) Table 4.1 shows that there are differences in the number of cholera cases reported between the high economic status country and the low economic status countries.

Suggest three reasons to explain these differences.

1.

.....

.....

2.

.....

.....

3.

.....

..... [3]

- (ii) With reference to Table 4.1, suggest reasons for the differences in the number of cases of cholera reported over the five year period for Angola and Cameroon.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

May/June 2015 (22)

- 2 Fig. 2.1 is a scanning electron micrograph of an area of the trachea showing the presence of *Bordetella pertussis* bacteria.

B. pertussis is the causative organism of a respiratory disease in humans known as whooping cough. The disease is transmitted from person to person in a similar way to tuberculosis (TB).

A symptom that is common to TB and to whooping cough is the production of an excess of mucus.

- (c) Suggest how whooping cough is transmitted.

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

Oct/Nov 2015 (22)

- 5 Diseases can be infectious or non-infectious.

- (a) Explain the difference between an infectious and a non-infectious disease.

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

Malaria is an infectious disease caused by *Plasmodium*. *Plasmodium* requires two hosts to complete its complex life cycle. One of the hosts is the *Anopheles* mosquito, which acts as a vector of malaria.

Transmission of malaria occurs when females of some species of *Anopheles* take blood meals from humans infected with *Plasmodium*, and then feed on uninfected individuals.

Both male and female *Anopheles* mosquitos have piercing and sucking mouthparts. The female mosquito is shown in Fig. 5.1.



Fig. 5.1

- (b) The blood meals are a good source of protein for *Anopheles* for the production of eggs.

Explain why blood is a good source of protein.

.....

.....

.....

..... [2]

