CAMBRIDGE INTERNATIONAL AS & A LEVEL BIOLOGY · 9700

BIOLOGY



EXAM QUESTION PACK

10 INFECTIOUS DISEASES

SCORE	PERCENTAGE
/	%

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Chapter 10

Infectious disease

10.1 Infectious diseases

1404. 9700_m20_qp_12 Q: 35

A disease is an abnormal disruption to the functioning of an organism or part of an organism.

Which disruption to function is an example of an infectious disease?

A Airflow to one lung is disrupted by uncontrolled cell division forming a mass of cells.

B Airways become inflamed due to exposure to smoke.

C Oxygen transport is disrupted due to changes in protein shape in red blood cells.

D Lung tissue is disrupted by the multiplication of prokaryotic cells.

1405. 9700_m20_qp_12 Q: 36

The number of people at risk of contracting malaria has increased due to an increase in the distribution of *Anopheles* mosquitoes.

What could be the cause of this increase in the distribution of *Anopheles* mosquitoes?

A antibiotic resistance

B drug resistance in *Plasmodium*

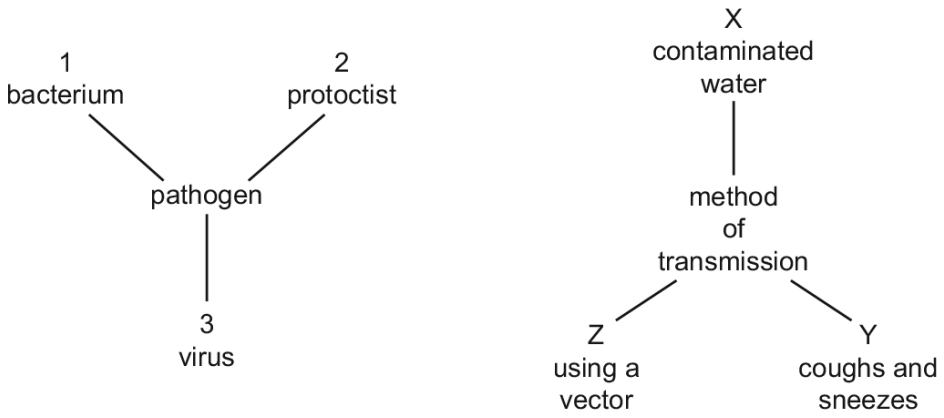
C no effective vaccine

D global warming

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1406. 9700_s20_qp_11 Q: 36

The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



Which row matches the correct number for the pathogen with the correct letter for their mode of transmission for cholera and measles?

	cholera	measles
A	1 and X	3 and Y
B	1 and Y	3 and Y
C	2 and X	2 and Z
D	3 and Z	1 and X

1407. 9700_s20_qp_11 Q: 37

Which factors would increase the global distribution of malaria?

1 a fall in annual rainfall

2 an increase in the use of antibiotics

3 a rise in global air temperatures

4 increasing irrigation of land for farming

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

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1408. 9700_s20_qp_12 Q: 35

Which of these causative agents of disease can be transmitted by droplet infection?

1 *Vibrio*

2 *Mycobacterium*

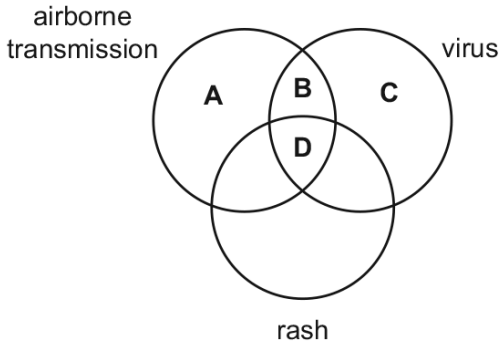
3 *Morbillivirus*

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

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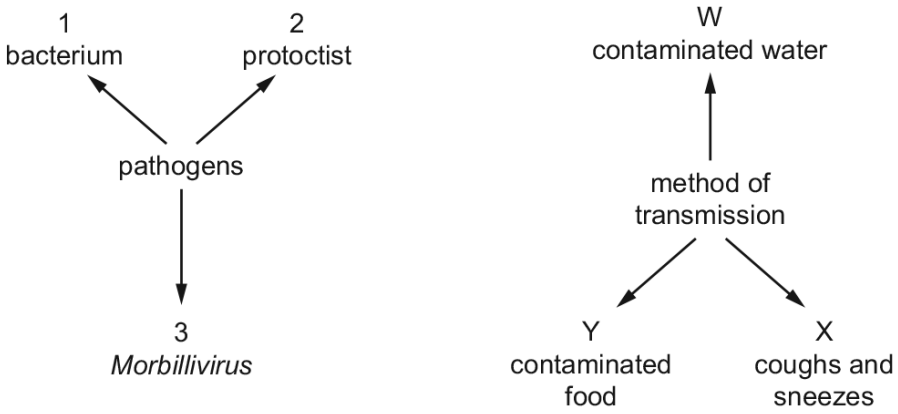
1409. 9700_s20_qp_13 Q: 37

What is correct for tuberculosis (TB)?



1410. 9700_w20_qp_11 Q: 35

The diagrams show some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for the disease TB?

A 1 and W **B** 1 and X **C** 2 and X **D** 3 and Y

1411. 9700_w20_qp_11 Q: 36

The proportion of the local population who have malaria in area R is higher than the proportion in area S.

Which factor causes this difference?

A Area R has a more humid climate than area S.

B Area R is nearer the equator than area S.

C There is a higher population in area R than area S.

D There is less sewage treatment in area R than area S.

1412. 9700_w20_qp_12 Q: 36

An earthquake caused damage to sanitation systems in a large tropical village.

Drinking water became contaminated with sewage. Heavy rain then caused flooding and left large pools of water in the village. Housing was destroyed and people in the village had to live in very overcrowded conditions.

Which infectious diseases could increase in the village population as a result of the earthquake and heavy rain?

1 cholera

2 malaria

3 tuberculosis

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

---

1413. 9700_w20_qp_13 Q: 35

Which row is correct?

	disease	transmission	infectious or non-infectious
A	HIV/AIDS	genetic	infectious
B	lung cancer	pathogen	infectious
C	sickle cell anemia	genetic	non-infectious
D	TB	pathogen	non-infectious

1414. 9700_w20_qp_13 Q: 37

The statements are about infectious diseases.

1 Disease may be spread between humans by contact.

2 Disease-causing organism has many antigenic variations.

3 Spread of disease may be influenced by climate.

4 A vaccination programme is available.

Which row matches the correct statement numbers with each disease?

	cholera	measles	malaria
A	1	1 and 2	1 and 3
B	1 and 4	4	2
C	2 and 3	1 and 3	1 and 4
D	4	1 and 4	2 and 3

1415. 9700_m19_qp_12 Q: 35

Which two diseases are transmitted by airborne droplets?

A cholera and malaria

B malaria and measles

C measles and tuberculosis (TB)

D tuberculosis (TB) and cholera

1416. 9700_m19_qp_12 Q: 36

Which features do the causative agents of measles, malaria and tuberculosis (TB) have in common?

	cytoplasm	the ability to produce ATP	surface antigens
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

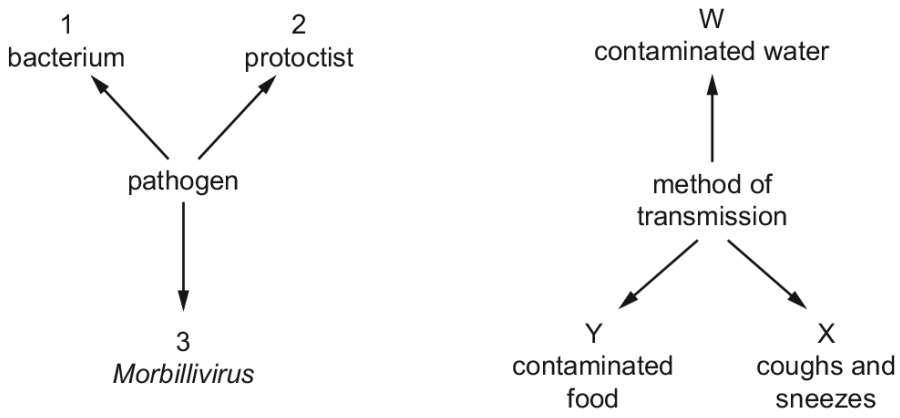
key

✓ = have in common

✗ = do not have in common

1417. 9700_s19_qp_11 Q: 37

The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for measles?

A 1 and X **B** 2 and W **C** 3 and W **D** 3 and X

1418. 9700_s19_qp_11 Q: 38

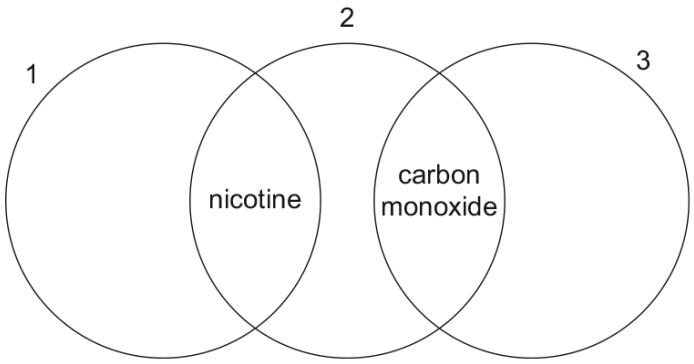
Which row is correct for each disease?

	cholera	HIV / AIDS	malaria	measles
A	caused by a bacterium	can be transmitted in breast milk and across placenta	eradication programme unsuccessful	caused by a virus
B	eating raw shellfish can be a source of infection	may be carried by a vector	carried by male *Anopheles* mosquitoes	can cause blindness
C	air borne infection	caused by a retrovirus	causative agent is a eukaryote	symptoms usually include a rash
D	can be caught by swimming in contaminated water	causes reduction in number of T-lymphocytes	mainly kills children under five years	no effective vaccination available

---

1419. 9700_s19_qp_12 Q: 34

The diagram shows some of the effects of nicotine and carbon monoxide in cigarette smoke.



Which row is correct?

	1	2	3
A	increase in heart rate	short-term effect on cardiovascular system	combines more readily with haemoglobin than oxygen
B	increases diameter of small arteries	can cause chronic bronchitis	combines irreversibly with haemoglobin
C	reduces the oxygen carrying capacity of blood	short-term effect on gas exchange system	reduces the blood supply to hands and feet
D	stimulates goblet cells to secrete more mucus	highly addictive	increases risk of blood clotting

---

1420. 9700_s19_qp_12 Q: 35

Which row correctly identifies the causative organism of each disease?

	cholera	measles	smallpox	tuberculosis
A	*Variola*	*Morbillivirus*	*Vibrio*	*Mycobacterium*
B	*Variola*	*Mycobacterium*	*Vibrio*	*Morbillivirus*
C	*Vibrio*	*Morbillivirus*	*Variola*	*Mycobacterium*
D	*Vibrio*	*Mycobacterium*	*Variola*	*Morbillivirus*

1421. 9700_s19_qp_12 Q: 36

The following advice was given to a person travelling to a country where there had been an outbreak of an infectious disease.

- cook food well and eat it hot
- peel fruit and vegetables
- drink only cool, boiled water
- wash hands often with soap and cool, boiled water

Which infectious disease would this advice help to protect against?

A cholera

B malaria

C measles

D tuberculosis

1422. 9700_s19_qp_12 Q: 37

What is a **social** factor that affects the spread of malaria?

A an increase in drug resistant forms of malaria

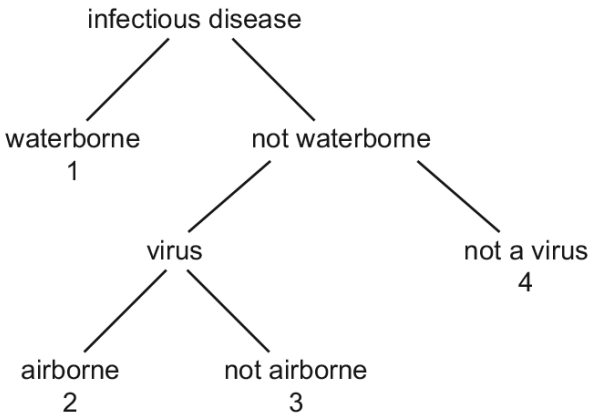
B climate change

C difficulty in producing a vaccine

D migration of people because of wars

1423. 9700_s19_qp_13 Q: 37

The diagram has been used to identify four infectious diseases.



Which row correctly identifies the infectious diseases?

	1	2	3	4
A	cholera	measles	HIV / AIDS	TB
B	cholera	smallpox	malaria	measles
C	malaria	HIV / AIDS	TB	cholera
D	malaria	TB	measles	cholera

1424. 9700_s19_qp_13 Q: 39

Growth factors are chemicals that stimulate a cell to divide.

Growth factors are transported around the body in the blood, and they attach to cells that have complementary growth factor receptors on their surface.

Some cells have too many growth factor receptors on their surface and so the cells continue to divide, forming a tumour.

Trastuzumab is used as a treatment for some cancers.

Trastuzumab works by binding to a specific growth factor receptor on a tumour cell. This stops the cell dividing and the cell dies.

What is trastuzumab?

A a monoclonal antibody

B a vaccine

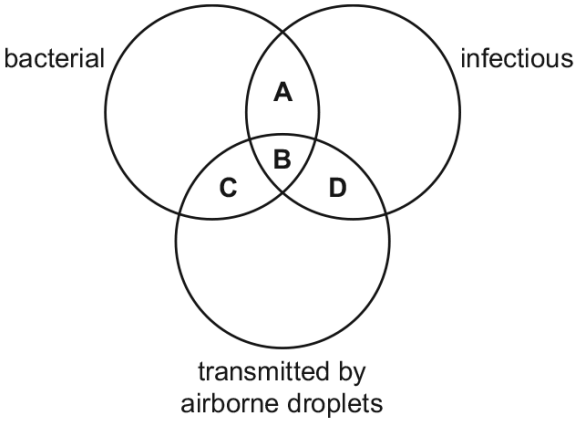
C an antibiotic

D an enzyme inhibitor

1425. 9700_w19_qp_12 Q: 35

The diagram shows properties of diseases.

Which shows the properties that are common to tuberculosis (TB) and measles?



1426. 9700_w19_qp_13 Q: 36

The statements refer to the disease tuberculosis (TB).

1 The pathogen lives inside human cells so is not accessible to the immune system.

2 The bacterial pathogen reproduces slowly.

3 The pathogen is not very sensitive to antibiotics.

Which explains why antibiotic treatment for TB takes a long time?

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

---

1427. 9700_m18_qp_12 Q: 36

Which of these terms can be used to describe the role of mosquitoes in the transmission of malaria?

1 malarial parasite

2 pathogen

3 vector

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

---

1428. 9700_s18_qp_11 Q: 35

Which statements about a non-infectious disease may be correct?

1 It can result from a mutation.

2 It can be transmitted by an insect vector.

3 It can be transmitted from mother to child.

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

---

1429. 9700_s18_qp_12 Q: 36

Which row identifies both the type of pathogen that causes cholera and the way in which cholera is transmitted from person to person?

	type of pathogen	method of transmission
A	bacteria	drinking water contaminated with the pathogen
B	bacteria	inhaling water droplets contaminated with the pathogen
C	virus	drinking water contaminated with the pathogen
D	virus	inhaling water droplets contaminated with the pathogen

---

1430. 9700_s18_qp_12 Q: 37

Why do people with HIV/AIDS have a higher occurrence of malaria than people without HIV/AIDS?

A HIV/AIDS and malaria are both diseases where the pathogen travels in blood.

B HIV/AIDS and malaria are both transmitted in blood.

C HIV/AIDS infects T-lymphocytes which are used by the malaria pathogen.

D HIV/AIDS suppresses the immune response to the malaria pathogen.

1431. 9700_s18_qp_13 Q: 39

Where are antigens found?

	on the surface of pathogen	on the surface of macrophage	in blood plasma
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = antigens found

✗ = antigens not found

1432. 9700_w18_qp_11 Q: 36

Which list contains only infectious diseases?

A cholera, HIV / AIDS, lung cancer and malaria

B cholera, malaria, tuberculosis (TB) and sickle cell anaemia

C HIV / AIDS, malaria, measles and tuberculosis (TB)

D lung cancer, measles, sickle cell anaemia and tuberculosis (TB)

1433. 9700_w18_qp_11 Q: 37

Which disease is caused by a eukaryote?

A cholera

B malaria

C measles

D smallpox

1434. 9700_w18_qp_12 Q: 36

Which statements about infectious diseases are correct?

1 Cholera has a vaccine available and is caused by a bacterial pathogen of the *Vibrio* group.

2 Measles has a vaccine available and is caused by a pathogen called *Morbillivirus*.

3 Smallpox was eradicated by vaccination and was caused by a bacterial pathogen called *Variola*.

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

1435. 9700_w18_qp_13 Q: 35

Which factors affect the distribution of the disease malaria?

1 draining swamps
2 vaccination
3 antibiotics
4 migration of people due to conflict
5 climate

A 1, 2 and 4 **B** 1, 4 and 5 **C** 2, 3 and 5 **D** 3, 4 and 5

1436. 9700_m17_qp_12 Q: 38

The global mortality figures for some diseases in 2002 are shown in the table.

cause of death	millions of deaths	percentage of all deaths
HIV/AIDS	2.8	4.4
TB	1.6	2.7
malaria	1.3	2.2
measles	0.6	1.1

How many millions of people died from viral diseases listed in the table in 2002?

A 2.2 **B** 3.4 **C** 3.8 **D** 4.4

1437. 9700_s17_qp_11 Q: 39

The global mortality figures for some diseases in 2002 are shown in the table.

cause of death	millions of deaths	percentage of all deaths
HIV / AIDS	2.8	4.4
TB	1.6	2.7
malaria	1.3	2.2
measles	0.6	1.1

How many millions of people died in 2002 from the bacterial diseases listed in the table?

A 0.6 **B** 1.6 **C** 2.2 **D** 2.7

1438. 9700_s17_qp_12 Q: 36

What could cause an outbreak of malaria in a country after it had been eliminated?

1 mosquitoes become resistant to insecticides

2 migration of population due to war

3 malarial parasites become resistant to quinine

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

---

1439. 9700_s17_qp_12 Q: 37

Which disease is caused by a bacterium and can be spread by airborne droplets?

A cholera

B measles

C smallpox

D tuberculosis (TB)

1440. 9700_s17_qp_12 Q: 38

Smallpox has been eradicated, but malaria and cholera have not.

Which statements correctly explain this?

1 Cholera pathogens in the intestines are not destroyed by antibiotics.

2 Plasmodium antigens change during the life cycle.

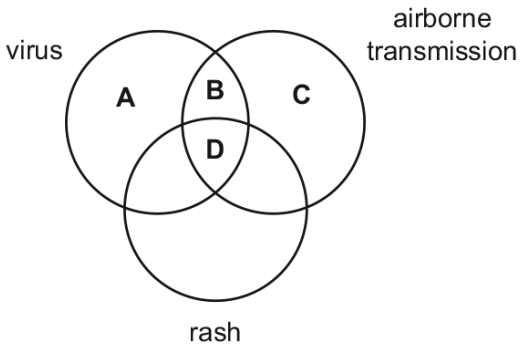
3 Smallpox antigens remain stable.

4 Vaccines only work against viruses.

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

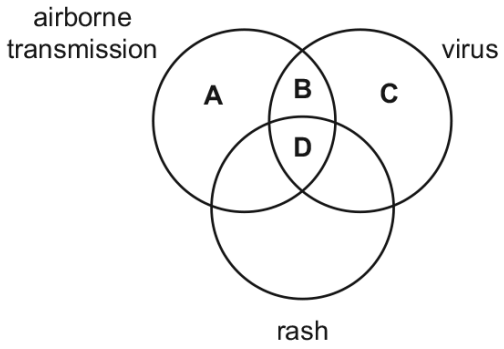
1441. 9700_s17_qp_13 Q: 35

Which is correct for measles?



1442. 9700_w17_qp_11 Q: 35

What is correct for tuberculosis (TB)?



1443. 9700_w17_qp_12 Q: 37

What is the causative agent and method of transmission of smallpox?

	causative agent	method of transmission
A	*Morbillivirus*	direct contact
B	*Morbillivirus*	waterborne
C	*Variola*	direct contact
D	*Variola*	waterborne

1444. 9700_w17_qp_13 Q: 38

Which pathogens are spread by droplet infection?

1 *Mycobacterium tuberculosis*

2 *Vibrio cholerae*

3 *Morbillivirus*

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

---

1445. 9700_m16_qp_12 Q: 35

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

1446. 9700_m16_qp_12 Q: 36

One control method to reduce the spread of malaria is to use an insecticide. It can be used to treat mosquito nets.

Another control method is to completely cover areas of water with insoluble polystyrene balls that float on the surface.

Using this information, what are the reasons for these control methods?

	nets treated with insecticide	polystyrene balls
A	kills all male mosquitoes	prevents adult mosquitoes from laying eggs
B	kills all mosquitoes	releases toxins that kill mosquito larvae
C	kills some mosquitoes	restricts the breathing of the mosquito larvae
D	prevents mosquitoes from breeding	reduces nutrient supply for mosquito larvae

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1447. 9700_s16_qp_11 Q: 37

A person whose immune system is suppressed may become more susceptible to certain diseases.

Which disease will this person **not** become more susceptible to?

A cholera

B measles

C sickle cell anaemia

D TB

1448. 9700_s16_qp_11 Q: 38

Which disease is treated with drugs that have a similar molecular structure to DNA nucleotides?

A cholera

B HIV/AIDS

C malaria

D TB

1449. 9700_s16_qp_12 Q: 35

The table shows the names of five pathogens.

Which row matches the pathogens with the diseases they cause?

	Morbillivirus	*Mycobacterium*	*Plasmodium*	*Variola*	*Vibrio*
A	cholera	measles	TB	malaria	smallpox
B	malaria	smallpox	cholera	measles	TB
C	measles	TB	malaria	smallpox	cholera
D	TB	malaria	smallpox	cholera	measles

1450. 9700_s16_qp_12 Q: 36

Which disease exhibits all the following features?

- It can be transmitted by animals to other animals, including humans.
- One mode of transmission is by transfusion with contaminated blood.
- The causative organism can show multiple drug resistance.
- The majority of humans who die from the disease are children.

A cholera

B HIV / AIDS

C malaria

D tuberculosis

1451. 9700_s16_qp_12 Q: 37

The proportion of the local population who have malaria in area R is higher than the proportion in area S.

Which factor causes this difference?

A Area R has a more humid climate than area S.

B Area R is nearer the equator than area S.

C There is a higher population in area R than area S.

D There is less sewage treatment in area R than area S.

1452. 9700_s16_qp_13 Q: 36

More people are exposed to the risk of contracting malaria due to an increase in the distribution of *Anopheles* mosquitoes.

What could be the cause of this increase?

A drug resistance in *Plasmodium*

B global warming

C insecticide resistance

D no effective vaccine

1453. 9700_s16_qp_13 Q: 38

Which of these pathogens can be transmitted by air?

1 *Plasmodium*

2 *Morbillivirus*

3 *Mycobacterium*

4 *Vibrio*

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

1454. 9700_w16_qp_11 Q: 36

Why is it difficult to control the spread of malaria?

1 Global air travel for commerce and tourism has increased.

2 The mosquito vector rapidly evolves resistance to insecticides.

3 The *Plasmodium* pathogen shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

---

1455. 9700_w16_qp_11 Q: 37

Which description gives the correct cause and transmission for TB, measles and HIV / AIDS?

	TB		measles		HIV / AIDS	
	cause	transmission	cause	transmission	cause	transmission
A	bacteria	airborne droplets	virus	airborne droplets	virus	bodily fluids
B	bacteria	water borne	bacteria	airborne droplets	protoctist	insect vector
C	protoctist	airborne droplets	bacteria	insect vector	virus	airborne droplets
D	virus	bodily fluids	protoctist	bodily fluids	bacteria	bodily fluids

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1456. 9700_w16_qp_12 Q: 37

Which disease is **not** likely to be passed directly from parents to child?

A cholera

B malaria

C sickle cell anaemia

D tuberculosis

1457. 9700_w16_qp_12 Q: 38

Why is it difficult to control the spread of measles?

1 Global air travel for commerce and tourism has increased.

2 The virus that causes measles rapidly evolves resistance to antibiotics.

3 The virus that causes measles shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

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1458. 9700_w16_qp_13 Q: 35

Which row is correct?

	disease	pathogen	method of infection
A	cholera	bacterium	food borne
B	malaria	prokaryote	insect bite
C	measles	bacterium	water borne
D	tuberculosis (TB)	virus	airborne

1459. 9700_w16_qp_13 Q: 36

What do pathogens of HIV / AIDS, malaria and TB have in common?

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

key

✓ present in each causative agent

✗ not present in each causative agent

1460. 9700_w16_qp_13 Q: 37

Which factor might have contributed to the spread of HIV / AIDS?

A few clinics and hospitals

B insufficient education

C malnutrition

D poor sanitation

1461. 9700_s15_qp_11 Q: 34

The first column in the table contains statements about disease. Columns headed 1-4 represent four different named diseases.

statements	1	2	3	4
infectious disease		✓	✓	✓
can be treated with antibiotics			✓	✓
caused by a virus		✓		
degeneration of lung tissue	✓			✓

key

✓ = true

What is the correct set of column headings for the table above?

	1	2	3	4
A	bronchitis	measles	TB	smallpox
B	emphysema	HIV / AIDS	cholera	TB
C	emphysema	measles	cholera	lung cancer
D	lung cancer	HIV / AIDS	measles	TB

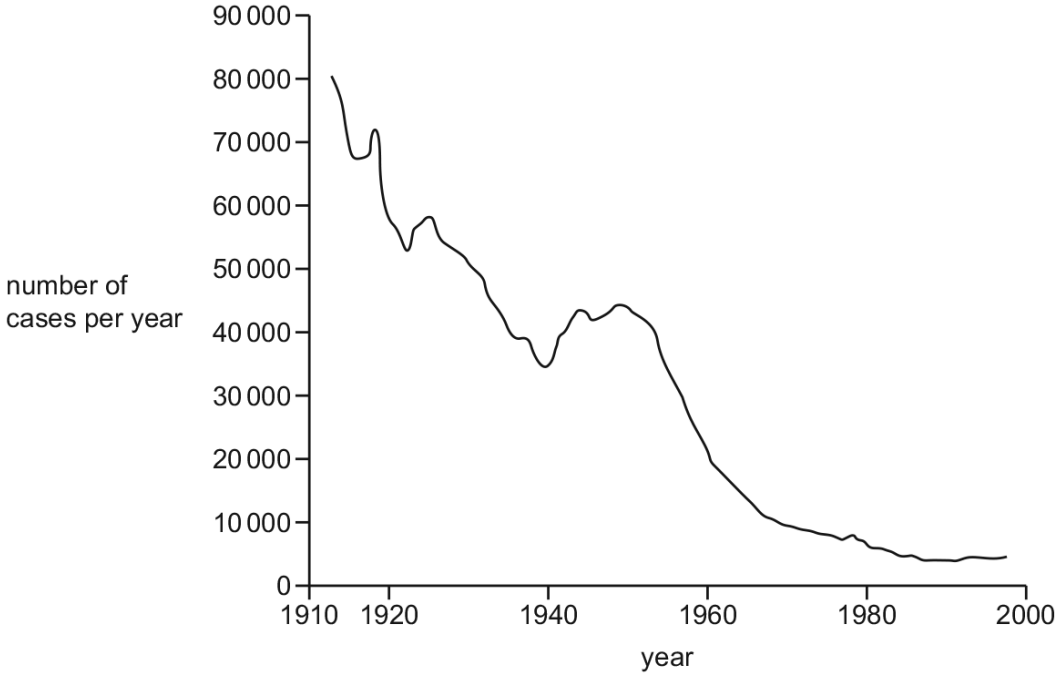
1462. 9700_s15_qp_11 Q: 35

Which row is correct for malaria?

	nature of disease	method of transmission	pathogen
A	infectious	insect vector	species of *Plasmodium*
B	infectious	water-borne	species of *Vibrio*
C	non-infectious	insect vector	species of *Plasmodium*
D	non-infectious	water-borne	species of *Vibrio*

1463. 9700_s15_qp_12 Q: 34

The graph shows the fall 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

3 chemical treatment of sewage

4 identification of contacts of people infected with TB

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

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1464. 9700_s15_qp_12 Q: 35

Which row is correct for cholera?

	nature of disease	method of transmission	causative agent (pathogen)
A	infectious	insect vector	species of *Plasmodium*
B	infectious	water-borne	species of *Vibrio*
C	non-infectious	insect vector	species of *Plasmodium*
D	non-infectious	water-borne	species of *Vibrio*

1465. 9700_s15_qp_13 Q: 35

Strains of *Mycobacterium* have been found that are:

- multiple drug-resistant (MDR) – resistant to the drugs most commonly used to control tuberculosis (TB)
- extensively drug-resistant (XDR) – resistant to the drugs most commonly used to control TB and to some of the drugs less commonly used to control TB
- totally drug-resistant (TDR) – resistant to all known drugs used to control TB.

Comparisons of some of these strains of *Mycobacterium* found differences in the thickness of their cell walls, as shown in the table.

Mycobacterium	thickness of cell wall / nm
non-resistant	15
MDR	17
TDR	20

What conclusions may be drawn from this information?

A Bacteria secrete thicker cell walls when in contact with a mixture of drugs.

B The cell walls of TDR bacteria are impermeable to drugs.

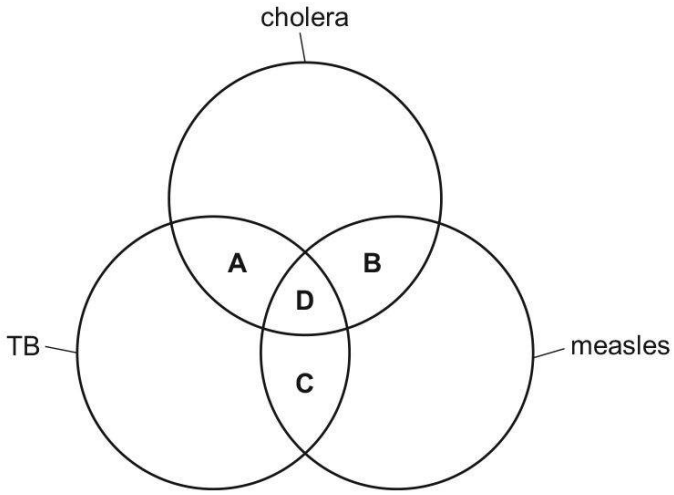
C Thicker cell walls may form a physical barrier to drugs.

D XDR bacteria have cell walls between 17 and 20 nm thick.

10.2 Antibiotics

1466. 9700_m20_qp_12 Q: 37

Which diseases are treated with antibiotics?



1467. 9700_s20_qp_11 Q: 38

The antibiotic teixobactin was discovered in January 2015. Teixobactin kills some bacteria such as *Staphylococcus* and *Mycobacterium*.

Most antibiotics work by binding to proteins. Teixobactin binds to lipids that are used in the synthesis of bacterial cell walls. This means that it is unlikely that bacteria will quickly develop resistance to teixobactin.

Which statements explain why bacteria are unlikely to quickly develop resistance to teixobactin?

1 A mutation in the gene coding for a protein allows selection for resistance.

2 Teixobactin binds to a lipid rather than to a protein.

3 The structure of a lipid is not encoded by DNA.

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

---

1468. 9700_s20_qp_12 Q: 36

The table compares total antibiotic use (X) and the percentage of antibiotic-resistant pneumonia cases (Y) in five countries.

country	(X) total antibiotic use / defined dose per 1000 people per day	(Y) percentage of penicillin-resistant pneumonia cases
Austria	13	10
Denmark	11	4
Iceland	17	15
Spain	30	50
USA	24	33

What is supported by the data?

A When X decreases there is an increase in Y.

B When X increases there is an increase in Y.

C When X increases it causes an increase in Y.

D There is no relationship between X and Y.

1469. 9700_s20_qp_12 Q: 37

Which statement about the development of resistance to antibiotics in bacteria is correct?

A All mutations in bacteria result in resistance to antibiotics.

B Antibiotics increase the rate of mutation in bacteria.

C Mutations leading to antibiotic resistance only occur when antibiotics are used to treat pathogenic bacteria.

D The proportion of antibiotic-resistant bacteria in a population only increases if the antibiotic is used.

1470. 9700_s20_qp_13 Q: 38

Some common antibiotics are listed. The action of each antibiotic is described.

1 rifampicin – inhibits RNA polymerase

2 streptomycin – inhibits 70S ribosomes

3 neomycin – inhibits DNA synthesis

4 ampicillin – inhibits peptidoglycan synthesis

Which of these antibiotics will affect the activities of bacterial cells **only**?

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 4 only

D 4 only

1471. 9700_w20_qp_11 Q: 37

Species X is a single-celled eukaryote.

Species X has been genetically modified to produce penicillin, which does not harm the cell walls of species X.

What may be concluded from this information?

1 The cell walls of species X are chemically different from those of bacteria.

2 The cell walls of species X are made of peptidoglycan.

3 The cell walls of species X are made of cellulose.

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

1472. 9700_w20_qp_12 Q: 37

Which statements about the use of antibiotics could cause an increase in antibiotic-resistant bacteria?

1 Patients do not always complete the course of antibiotics.

2 Patients keep unused antibiotics from previous prescriptions and take them at a later date in smaller doses than prescribed.

3 Antibiotics are used in farming to prevent infections.

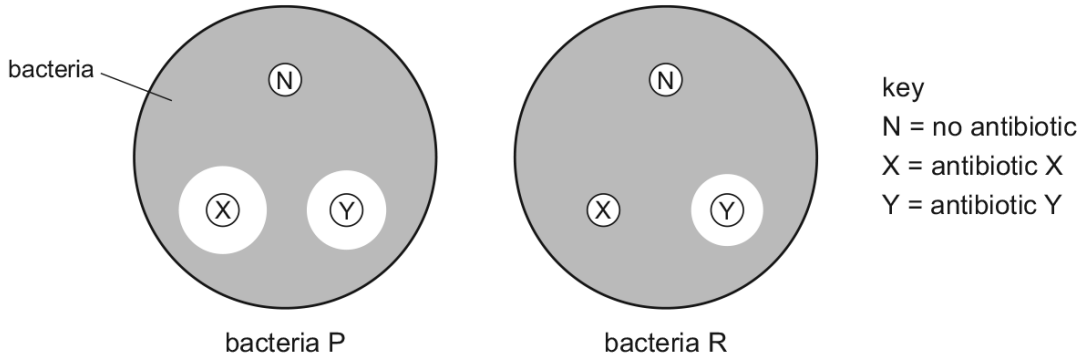
4 Doctors prescribe narrow spectrum antibiotics that only kill a few types of bacteria.

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

1473. 9700_w20_qp_13 Q: 36

The diagrams show the result of incubating two species of bacteria, P and R, on separate Petri dishes each containing nutrient agar.

Three filter paper discs have been added to each Petri dish.



Which statement is correct?

A Antibiotics X and Y are resistant to bacteria P.

B Bacteria P are resistant to both antibiotics.

C Bacteria R have a mutation that makes them resistant to antibiotic Y.

D N is a control disc showing bacteria R grow when antibiotic Y is not present.

1474. 9700_m19_qp_12 Q: 37

What explains why most viruses that cause diseases in humans are unaffected by antibiotics?

A Viral antigens do not bind to antibiotics.

B Viral nucleic acids are protected by a protein coat.

C Viruses contain no ribosomes or mRNA.

D Viruses reproduce inside living eukaryotic cells.

1475. 9700_s19_qp_13 Q: 38

How does penicillin affect bacteria?

A It inhibits DNA replication by binding to nucleotides.

B It inhibits translation by preventing tRNA binding to ribosomes.

C It is a competitive inhibitor of an enzyme in cell wall synthesis.

D It is a competitive inhibitor of an enzyme in protein synthesis.

1476. 9700_w19_qp_11 Q: 36

Outbreaks of cholera commonly occur in refugee camps that are set up after a major natural disaster such as earthquakes.

The list shows some measures that can be taken to limit the spread of cholera in the refugee camps.

1 treating all drinking water supplies with a high concentration of chlorine

2 setting up an emergency treatment centre to isolate cases of cholera and treat them with antibiotics

3 using concentrated disinfectant to clean sewage disposal areas and infected bedding

4 health workers visiting regularly to detect cases

5 keeping good records of the number of cases and deaths at treatment centres

Which features of these control measures involve an economic factor?

A 1, 2, 3, 4 and 5

B 1, 3 and 5 only

C 2, 3, 4 and 5 only

D 2 and 4 only

1477. 9700_w19_qp_11 Q: 37

Which use of antibiotics helps to reduce the spread of resistance in bacteria?

A using high concentrations of the antibiotic to kill all the bacteria

B giving routine preventative antibiotics to people who are having an operation

C regularly changing the type of antibiotic used to treat particular bacterial infections

D giving antibiotics to treat low level infection caused by a bacterium

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1478. 9700_w19_qp_12 Q: 37

Different antibiotics function in different ways. It is important that the antibiotic kills the bacteria, but does not harm the infected human.

The antibiotic tetracycline has been found to affect the way in which human mitochondria function.

Which statements could explain why human mitochondria function is affected by tetracycline?

A The antibiotic prevents the synthesis of peptidoglycan cell walls.

B The antibiotic prevents synthesis of linear DNA.

C The antibiotic prevents translation of circular DNA.

D The antibiotic prevents translation by binding to 70S ribosomes.

1479. 9700_m18_qp_12 Q: 37

Bacteria that infect skin wounds can become resistant to the antibiotic commonly used to kill them.

Which statement explains how these bacteria could become resistant to the antibiotic?

A Exposure to the antibiotic causes a change in the bacterial cell wall, preventing the antibiotic from working.

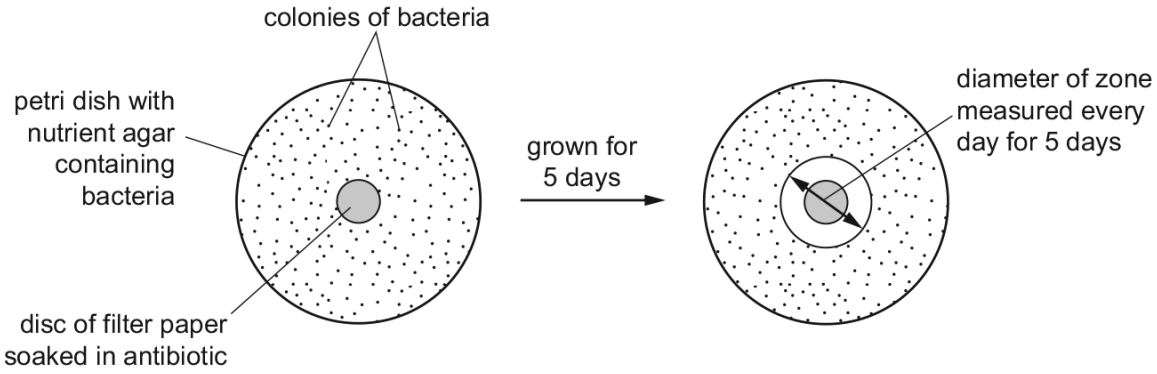
B Other bacteria that normally protect the skin against infection are killed by the antibiotic, allowing the infectious bacteria to survive.

C Random mutations in DNA allow some of the bacteria to survive in the presence of the antibiotic.

D The antibiotic causes the bacterial DNA to mutate, allowing the bacteria to survive in the presence of the antibiotic.

1480. 9700_s18_qp_11 Q: 36

The diagram shows one way of testing the effect of an antibiotic on bacteria.



The table shows the results of testing five different types of bacteria.

Zones of less than 13.0 mm show the presence of resistant bacteria.

type of bacteria	diameter of zone / mm				
	day 1	day 2	day 3	day 4	day 5
1	24.1	21.9	19.0	17.6	14.3
2	18.6	15.4	12.2	9.0	2.0
3	17.9	12.8	12.4	11.1	10.9
4	19.4	15.3	13.2	8.1	2.0
5	22.0	21.0	20.5	20.4	20.4

Which statement can be supported by this data?

A All the types of bacteria become resistant to antibiotics over time.

B Only types 2, 3 and 4 of the bacteria show resistance to the antibiotic.

C The antibiotic can be used to treat types 1 and 3 only.

D Type 5 of the bacteria can never become resistant to the antibiotic.

1481. 9700_s18_qp_11 Q: 37

Some animals have genes that code for small peptides called cathelicidins. These peptides kill a wide range of bacteria by attaching to lipids in bacterial membranes, so weakening or disrupting them.

Scientists have produced a synthetic version of the cathelicidin that kills bacteria that are resistant to a number of antibiotics such as tetracycline.

Which pair of statements explain how this synthetic cathelicidin might help with the problem of antibiotic resistance?

1 It is synthetic so bacteria can never become resistant to it.

2 It could be used instead of tetracycline, allowing tetracycline resistance to be reduced.

3 The only way a bacterium could develop resistance to it is by altering all the lipids in its membranes.

4 It could be used to kill multidrug-resistant strains of bacteria for which there is no effective antibiotic.

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

1482. 9700_s18_qp_13 Q: 38

Some antibiotics work by binding to ribosomes.

Which statement explains why these antibiotics kill bacteria cells but do not kill most human cells?

A mRNA in bacteria is formed in the cytoplasm from naked DNA.

B The antibiotics cannot pass through human cell membranes.

C The codes used for amino acids in bacteria are different from those used by humans.

D The ribosomes of bacteria have a different structure from those of humans.

1483. 9700_w18_qp_12 Q: 37

The antibiotic tetracycline binds to the small subunit of bacterial ribosomes, stopping protein synthesis.

Bacteria have become resistant to tetracycline due to the effect of mutations.

Which effect could produce resistance to tetracycline?

A preventing tetracycline from binding to the bacterial cell wall

B preventing tetracycline from entering the bacterial cell

C preventing tetracycline from inhibiting transcription

D preventing the production of tetracycline by ribosomes

1484. 9700_w18_qp_13 Q: 36

Which diseases **cannot** be treated with antibiotics?

1 cholera

2 HIV/AIDS

3 measles

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

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1485. 9700_s17_qp_12 Q: 35

Some common antibiotics are listed. The action of each antibiotic is described.

1 rifampicin – inhibits RNA polymerase

2 streptomycin – inhibits 70S ribosomes

3 neomycin – inhibits DNA synthesis

4 ampicillin – inhibits peptidoglycan synthesis

Which of these antibiotics will affect the activities of bacterial cells **only**?

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 4 only

D 4 only

1486. 9700_s17_qp_13 Q: 36

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 Human cells may stop responding to these antibiotics.

B Humans may be allergic to these antibiotics.

C Pathogenic bacteria may develop resistance to these antibiotics.

D Useful gut bacteria may be killed by these antibiotics.

1487. 9700_s17_qp_13 Q: 37

In what order do the following processes occur to produce a population of bacteria that are resistant to a new antibiotic?

1 change in reproductive success of bacteria

2 increase in frequency of the resistance allele in the population

3 increase in genetic variation within the population

4 random mutation occurs in bacterial DNA

A $1 \rightarrow 3 \rightarrow 2 \rightarrow 4$

B $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$

C $3 \rightarrow 4 \rightarrow 1 \rightarrow 2$

D $4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

1488. 9700_w17_qp_12 Q: 38

A scientist investigated the effect of an antibiotic on the treatment of cholera.

320 people suffering with cholera were split into two groups. One group was treated with an antibiotic while the other group was not given antibiotics. Both groups were given fluids containing sugars and mineral salts (oral rehydration therapy).

The scientist recorded the number of days that each person suffered from diarrhoea.

The table shows the results.

treatment	mean time person had diarrhoea / days
antibiotic and oral rehydration therapy	3.2
oral rehydration therapy	5.3

What is the percentage decrease in the mean time that a person suffered from diarrhoea when they were treated with the antibiotic?

A 39.6% **B** 60.4% **C** 165.6% **D** 252.4%

1489. 9700_w17_qp_13 Q: 37

The antibiotic penicillin prevents the formation of cross-links between peptidoglycans during bacterial cell wall synthesis by blocking the enzyme transpeptidase.

Which statements describe the action of penicillin on bacteria?

1 It is an enzyme inhibitor.

2 It weakens the bacterial cell wall.

3 It will work at any stage during the bacterial life cycle.

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

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1490. 9700_m16_qp_12 Q: 37

What is **not** an example of antibiotic action?

A damage to cell surface membranes

B prevention of protein synthesis

C prevention of synthesis of new cell walls

D stimulation of antibody production

1491. 9700_s16_qp_13 Q: 37

An antibiotic inhibits the formation of cross-links between the molecules that form cell walls in bacteria.

Which statements explain why bacteria are killed by the antibiotic?

1 The bacterial cell is destroyed by osmotic lysis.

2 Cellulose molecules cannot form hydrogen bonds.

3 The cell wall is no longer selectively permeable.

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

1492. 9700_w15_qp_12 Q: 34

Why is it necessary for a person with a bacterial infection to take antibiotics at evenly spaced time intervals?

A to increase the concentration of antibiotic slowly to a level which is lethal to the bacteria

B to maintain a concentration of antibiotic in the body which is lethal to the bacteria

C to prevent the development of resistant strains of bacteria

D to select and kill the resistant strains of bacteria

1493. 9700_w15_qp_13 Q: 35

The data shows how the number of human deaths caused by the bacterium *Staphylococcus aureus* has changed over a period of five years.

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

year	total number of deaths caused by *S. aureus*	total number of deaths caused by MRSA
1	369	355
2	452	431
3	456	681
4	420	890
5	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 than *S. aureus*.

C Resistant strains of MRSA are becoming more common.

D *S. aureus* will always cause humans to die.

Chapter 10

Infectious disease

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10.1 Infectious diseases

183. 9700_s19_qp_22 Q: 4

The bacterium *Vibrio cholerae* is the causative organism of the infectious disease cholera.

V. cholerae has structural features typical of all bacterial cells. It also has a flagellum for movement.

(a) Fig. 4.1 is an outline drawing of *V. cholerae*.

Complete Fig. 4.1 by drawing **and** labelling the structures found in *V. cholerae*.

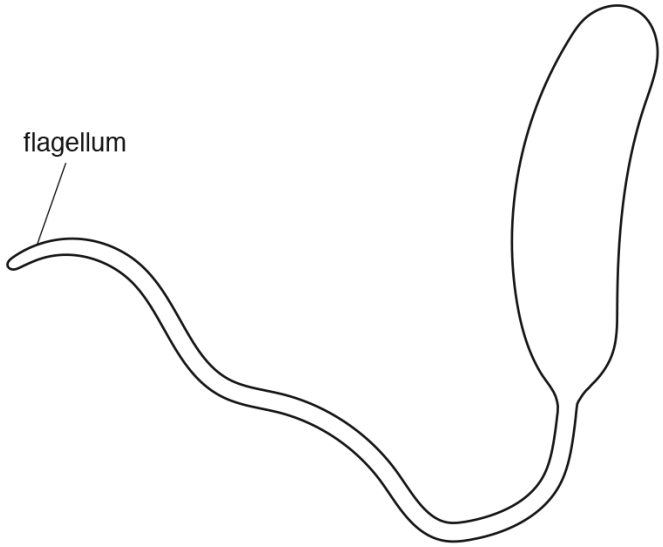


Fig. 4.1

[4]

(b) The World Health Organization (WHO) collects data about cholera from the 194 countries that are members of the World Health Assembly (WHA).

In 2015:

- there were cases of cholera in 42 of the member countries of the WHA
- the total number of cases of cholera reported was 172 454
- there were deaths as a result of cholera in 23 of these countries
- the total number of deaths from cholera reported was 1304.

The case fatality rate for cholera is the proportion of cases of cholera that results in death within a particular time period.

A country with cases of cholera that are properly treated should have a case fatality rate of less than 1%.

(i) Calculate the case fatality rate for the 42 member countries of the WHA for 2015.

Give your answer to the nearest 0.1%.

case fatality rate = ... % [1]

(ii) Many of the 23 countries reporting deaths from cholera in 2015 had a case fatality rate of less than 1%.

However, two of the 23 countries had case fatality rates greater than 5%.

Suggest **two** explanations for the higher case fatality rate in these two countries.

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(c) In 2010, the country of Haiti experienced a major earthquake. This led to an outbreak of cholera.

(i) Explain why an earthquake may lead to a cholera outbreak.

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..... [1]

(ii) Fig. 4.2 shows data about cholera collected by WHO over a period of 8 years, from 2008 to 2015. These data include:

- the total number of cases of cholera for each year
- the number of countries in each year that had cases of cholera.

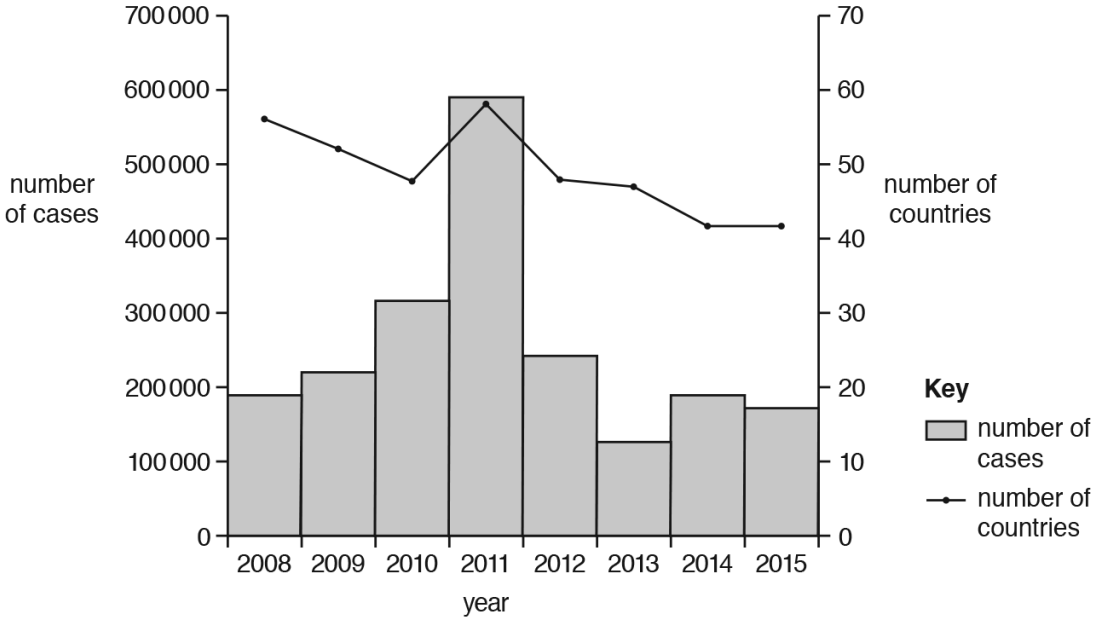


Fig. 4.2

Comment on the trends shown in Fig. 4.2.

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[Total: 11]

184. 9700_s18_qp_22 Q: 5

When tobacco smoke is inhaled, chemicals such as nicotine and carbon monoxide enter the circulatory system through the gas exchange system. Tar builds up on the lining of the gas exchange system.

Many people decide to give up smoking tobacco in order to improve their health.

(a) Some of the structures in the human gas exchange system through which tobacco smoke passes are shown in Fig. 5.1.

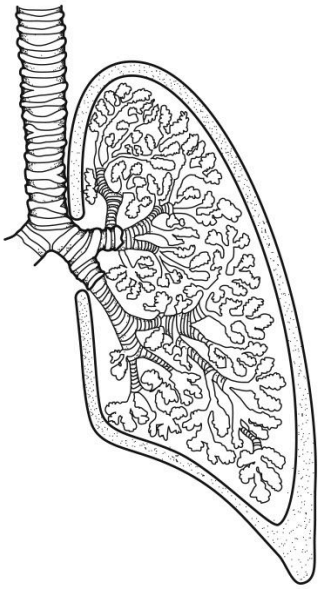


Fig. 5.1

Describe the gross structure of the human gas exchange system.

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.....[3]

(b) Soon after a person stops smoking, the short term effects of nicotine are reversed.

State the **changes** that will occur in the cardiovascular system as a result of reduced nicotine levels.

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.....[2]

(c) Fig. 5.2 shows oxygen dissociation curves for adult haemoglobin.

Curve **A** shows measurements obtained from a person who is a heavy smoker.

Curve **B** shows measurements obtained several weeks after the same person stopped smoking.

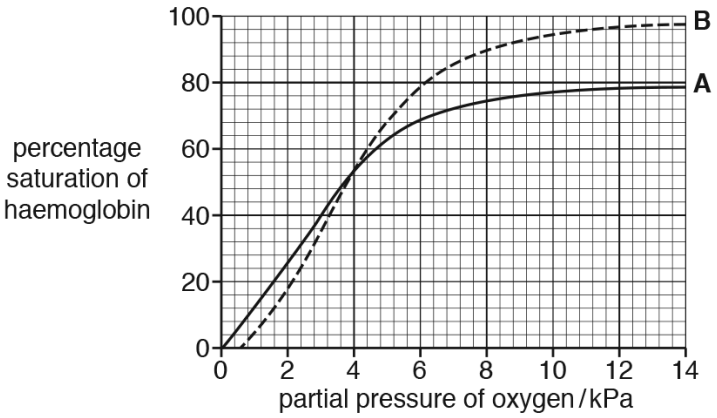


Fig. 5.2

With reference to Fig. 5.2, describe and explain how the results show some of the health benefits of stopping smoking.

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(d) A person who gives up smoking decreases their risk of developing lung cancer, a non-infectious disease.

Explain why lung cancer is described as a *non-infectious disease*.

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[Total: 11]

185. 9700_s18_qp_23 Q: 4

Oxygen enters the blood stream from the alveoli in the lungs and carbon dioxide leaves the bloodstream to enter the alveoli. Most of the oxygen is carried by haemoglobin in red blood cells to the body tissues.

(a) Outline how oxygen enters the blood stream from an alveolus.

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.....[3]

Fig. 4.1 is an oxygen dissociation curve for adult haemoglobin. The curve shows the affinity of haemoglobin for oxygen at the range of partial pressures found in the body.

The values for plotting the curve are obtained in the laboratory by bubbling oxygen at different partial pressures through a solution of haemoglobin at 37 °C and pH 7.4. At a different temperature or pH the measured values will change, resulting in a different oxygen dissociation curve.

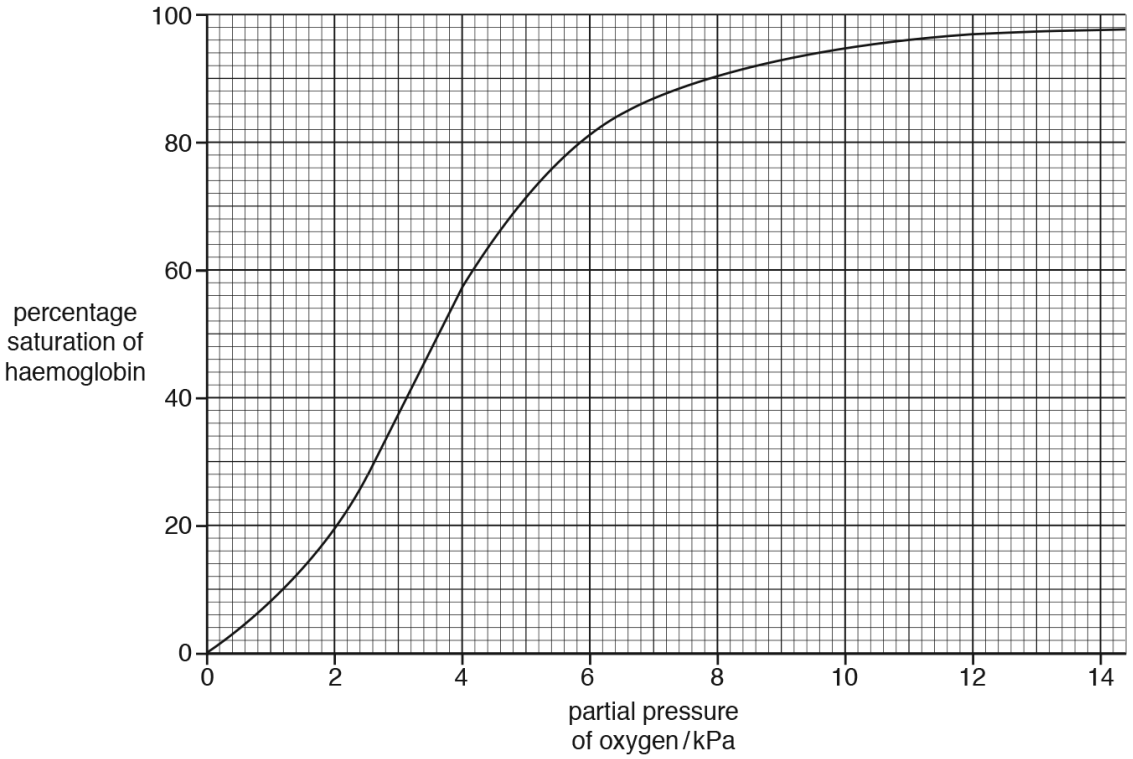


Fig. 4.1

(b) Fig. 4.1 shows that the percentage saturation of haemoglobin changes at different partial pressures of oxygen.

(i) Use Fig. 4.1 to calculate the difference in percentage saturation of haemoglobin at the lower partial pressure of oxygen of 2.7 kPa compared to the higher partial pressure of 13.0 kPa.

Show your working.

difference = ...[1]

(ii) Explain the advantage of having a difference in percentage saturation of haemoglobin at lower and higher partial pressures of oxygen.

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.....[3]

In a person with sickle cell anaemia, the ability of haemoglobin to transport oxygen and carbon dioxide is severely affected.

The cause of this disease is a mutation in the gene coding for the β-globin polypeptide of haemoglobin.

(c) Define the term *disease*.

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.....[2]

(d) Outline the differences between the Hb^A (normal) and Hb^S (sickle cell) alleles of the gene coding for the β-globin polypeptide **and** explain how these differences lead to a change in the haemoglobin molecule formed.

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[Total: 14]

186. 9700_s18_qp_23 Q: 6

(a) Fig. 6.1 is a list of infectious diseases. Each of the statements **A** to **D** describes a feature that applies to one or more of these diseases.

cholera
HIV/AIDS
malaria
measles
smallpox
tuberculosis (TB)

Fig. 6.1

For each of the statements **A**, **B**, **C** and **D**, name **all** the diseases in Fig. 6.1 that match the feature described.

A The causative organism of the disease is a virus.

.....

B The causative organism of the disease is a prokaryote.

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C The disease is transmitted by a faecal-oral route, for example, sewage containing the pathogen contaminates drinking water.

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D The causative organism of the disease spends part of its life cycle inside an insect, which acts as a vector of the disease.

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[4]

(b) Although many infectious diseases are caused by prokaryotic organisms, there are some that are caused by eukaryotic organisms.

Complete Table 6.1 to show some differences between a prokaryotic cell and a eukaryotic cell.

Table 6.1

prokaryotic cell	eukaryotic cell
no true nucleus, genetic material not enclosed	true nucleus, genetic material enclosed by a double membrane known as a .....
..... DNA	linear DNA
70S ribosomes only	70S and ..... ribosomes
no double membrane-bound organelles	double membrane-bound organelles such as .....
cell wall contains	where cell wall is present, generally contains mainly cellulose or chitin

[2]

[Total: 6]

187. 9700_w18_qp_23 Q: 5

The bacteria that cause tuberculosis (TB) can be found in many parts of the body including the lungs.

(a) (i) State the name of the bacterium that causes TB.

..... [1]

(ii) The presence of the pathogen in the lungs attracts phagocytes to the area of infection. The phagocytes release elastase, which digests elastin.

Many people with TB feel tired all the time.

Suggest **and** explain how the effect of phagocytes on tissues in the lungs leads to people feeling tired all the time.

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..... [3]

(b) Discuss the **biological** factors and **social** factors that make TB a difficult disease to control.

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[Total: 9]

188. 9700_s17_qp_22 Q: 3

Malaria is a disease caused by the protoctist, *Plasmodium*. The organism has a very complex life cycle as it has two hosts, a human and a mosquito.

(a) Name **one** of the four species of *Plasmodium* that infects humans.

.....[1]

(b) State the name of the mosquito that is host to *Plasmodium*.

.....[1]

Fig. 3.1 is a transmission electron micrograph showing the developing *Plasmodium* cells inside a protective structure known as an oocyst. In this stage of the life cycle the oocysts are found in the mosquito gut. When mature, the *Plasmodium* cells are released and travel to the salivary glands of the mosquito.

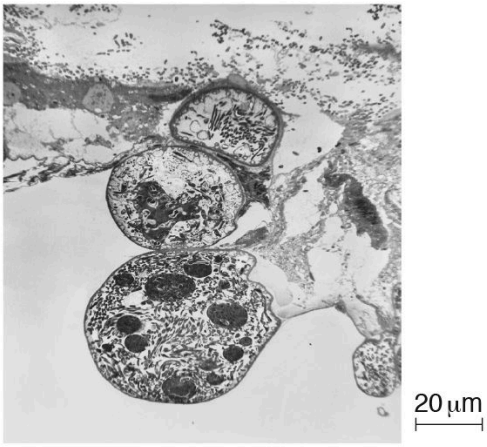


Fig. 3.1

(c) The magnification used in Fig. 3.1 can also be obtained using a light microscope.

Suggest why an electron microscope was used to obtain this image instead of a light microscope.

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.....[2]

(d) Use the scale bar to calculate the magnification of the image shown in Fig. 3.1.

Write down the formula and use it to make your calculation. Show your working.

formula

magnification × .....[3]

(e) Outline the role of the mosquito in the transmission of malaria.

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.....[2]

[Total: 9]

189. 9700_s16_qp_21 Q: 1

Table 1.1 shows features of three infectious diseases: malaria, tuberculosis (TB) and cholera.

Complete Table 1.1.

Table 1.1

feature	malaria	tuberculosis	cholera
name of pathogen	……..…. *falciparum*	*Mycobacterium tuberculosis*	……..…. …….….
type of organism	……..….	bacterium	……..….
method of transmission	……..…. ……..…. ……..….	……..…. ……..…. ……..….	drinking water and food contaminated with human faeces

[6]

[Total: 6]

190. 9700_s15_qp_22 Q: 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.

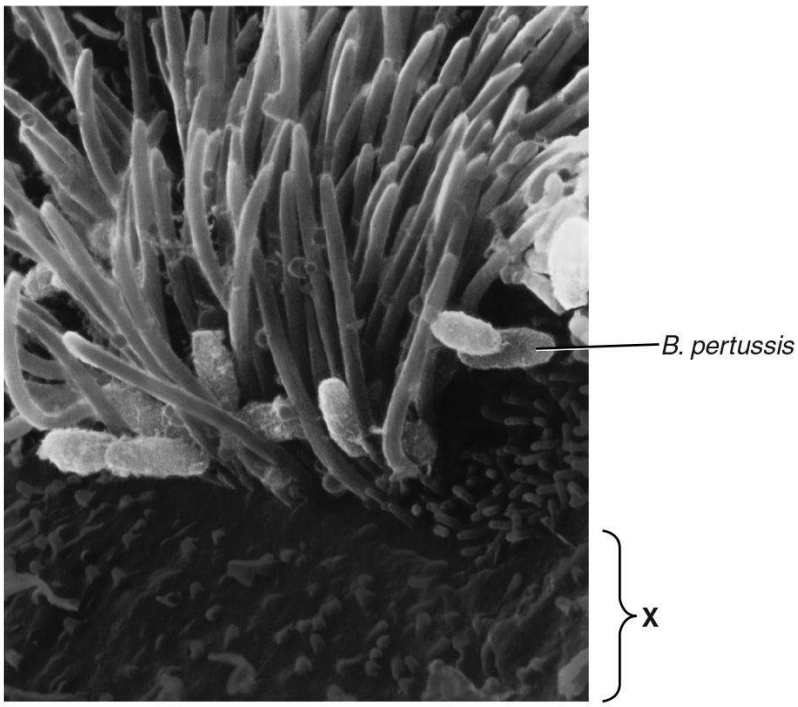


Fig. 2.1

(a) Describe the damage caused by *B. pertussis* that is shown in the area labelled **X** on Fig. 2.1 **and** explain how this will affect the functioning of the epithelial tissue of the trachea.

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.....[3]

(b) Goblet cells produce mucus. Name one other structure in the gas exchange system that also produces mucus.

.....[1]

(c) Suggest how whooping cough is transmitted.

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.....[2]

(d) The presence of *B. pertussis* stimulates the production of mucin, a gel-like glycoprotein that is the main component of mucus.

The mucin produced by the cell is packaged into vesicles ready for exocytosis.

(i) The first stage in the production of mucin involves transcription of the gene *MUC5AC*.

Outline the stages occurring in transcription.

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.....[4]

(ii) Following translation, the polypeptide formed is modified by the addition of many short chains of monosaccharides in a process called glycosylation.

Suggest where glycosylation occurs in the cell **and** explain why mucin is packaged into vesicles.

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.....[2]

(e) Overproduction of mucus is one of the symptoms of chronic obstructive pulmonary disease (COPD).

Describe the signs and symptoms that enable diagnosis of COPD.

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.....[4]

[Total: 16]

191. 9700_w15_qp_22 Q: 5

Diseases can be infectious or non-infectious.

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

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..... [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.

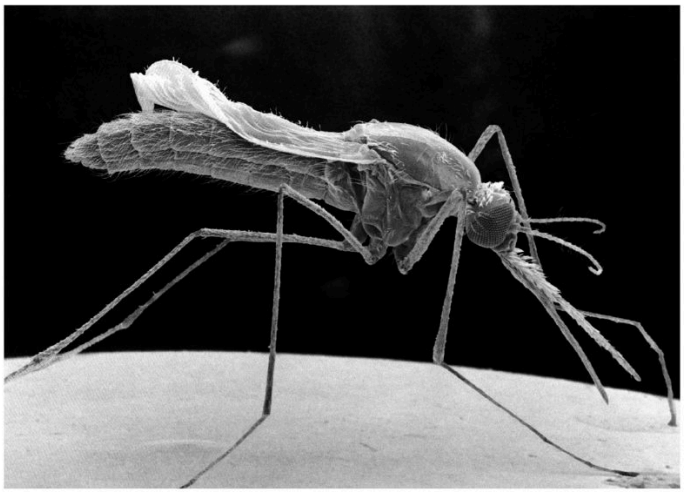


Fig. 5.1

(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.

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..... [2]

(c) Fig. 5.2 shows the global distribution of those species of *Anopheles* that are able to act as hosts for Plasmodium.

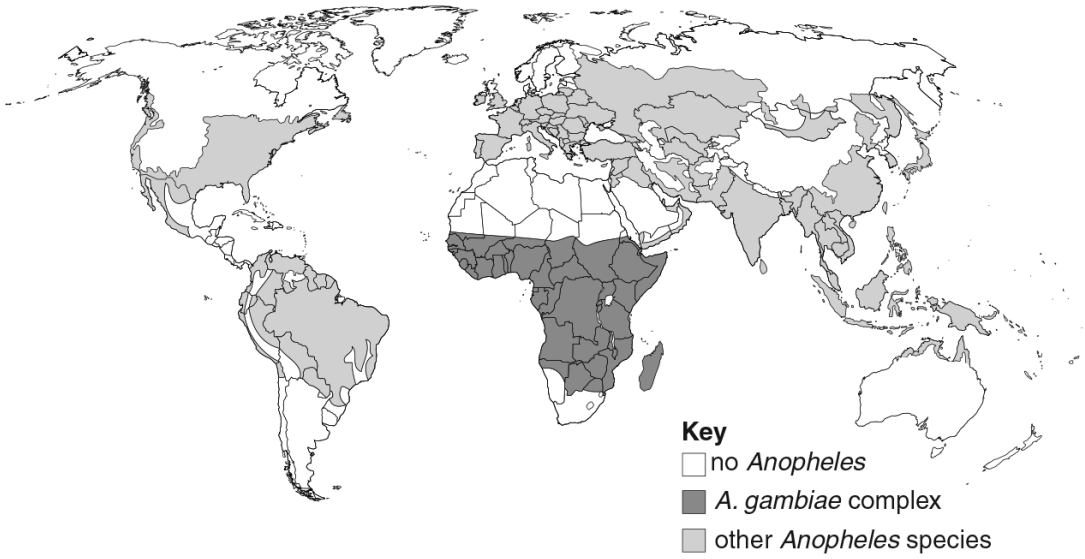


Fig. 5.2

(i) Describe **and** explain the difference between the global distribution of *Anopheles* shown in Fig. 5.2 and the global distribution of malaria.

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..... [3]

(ii) The distribution of *Anopheles* shown in Fig. 5.2 includes over forty different species that are vectors of malaria. The areas with the highest number of cases of malaria are also the areas where *Anopheles gambiae* occurs. *A. gambiae* is responsible for most of the transmission of the disease in these areas.

Suggest why *A. gambiae* is responsible for most of the transmission of *Plasmodium*.

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..... [3]

Fig. 5.3 is part of a complex food web in an area of Kenya where the larvae and adults of *A. gambiae* occur.

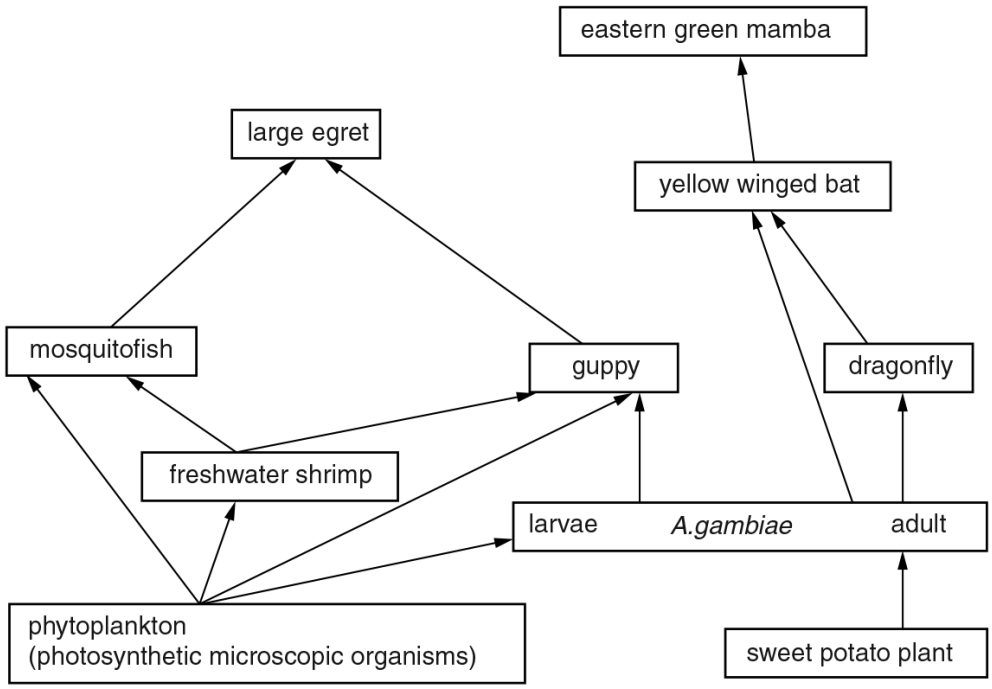


Fig. 5.3

(d) (i) Name **one** organism in Fig. 5.3 that is a tertiary consumer.

..... [1]

(ii) Explain, in terms of energy transfer, why it is likely that the eastern green mamba feeds on other organisms in addition to yellow winged bats.

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..... [3]

(iii) Suggest how the information in Fig. 5.3 can be used in the control of malaria in other areas of Kenya.

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..... [2]

(e) Both male and female adult *A. gambiae* feed on sweet potato plants. Fig. 5.4 shows a sweet potato plant.



Fig. 5.4

Suggest the parts of the sweet potato plants that are the main source of food for adult *A. gambiae* **and e**xplain your answer.

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..... [2]

[Total: 18]

10.2 Antibiotics

192. 9700_w20_qp_21 Q: 3

(a) The circulatory system of mammals is a double circulation.

(i) Explain what is meant by the term double circulation.

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..... [1]

(ii) Fig. 3.1 is a photograph showing one valve in the mammalian heart.

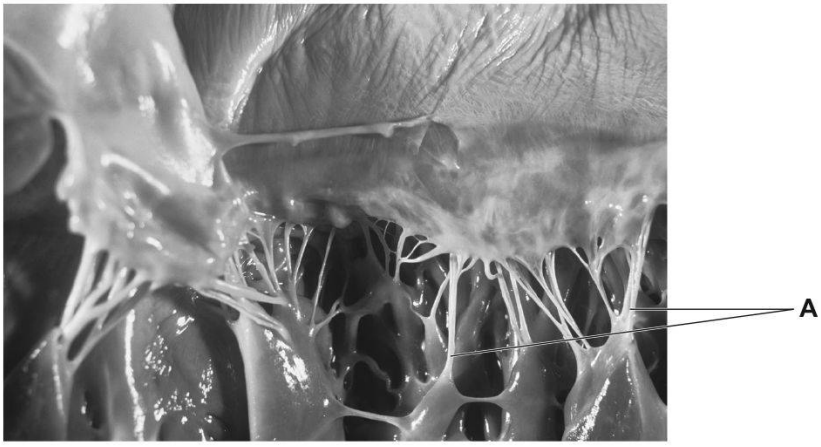


Fig. 3.1

Identify the structures labelled **A** in Fig. 3.1 **and** describe their role during the cardiac cycle.

structure **A** .....

role of structure **A**

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[3]

(b) The endocardium is a thin layer of tissue lining the chambers of the heart. A serious condition called endocarditis results if bacteria infect this tissue.

Endocarditis is treated with a combination of antibiotics. This increases the effectiveness of the treatment and reduces the risk of antibiotic resistance in bacteria.

Table 3.1 shows the action of two antibiotics used together to treat endocarditis.

Table 3.1

antibiotic used in treatment	action of antibiotic
gentamicin	binds permanently to the bacterial ribosomes
penicillin G	inhibits an enzyme involved in cell wall synthesis

(i) With reference to Table 3.1, explain why treating endocarditis with a combination of gentamicin and penicillin G reduces the risk of developing antibiotic resistance.

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..... [2]

(ii) Describe how the bacteria that cause endocarditis could become resistant to gentamicin.

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..... [3]

[Total: 9]

193. 9700_w20_qp_22 Q: 2

The treatment for people with active tuberculosis (TB) lasts six months and involves a combination of antibiotics. This is usually very effective if the person has a susceptible (non-resistant) strain of *Mycobacterium tuberculosis*, the causative organism of TB.

Table 2.1 summarises one recommended treatment strategy that involves a combination of antibiotics.

Table 2.1

antibiotic	length of treatment	mode of action of antibiotic
rifampicin (R)	6 months	enters bacterial cells and inhibits protein synthesis
isoniazid (H)	6 months	prevents the synthesis of cell wall components known as mycolic acids
ethambutol (E)	first two months	prevents mycolic acids from being added to the cell wall
pyrazinamide (Z)	first two months	prevents the synthesis of fatty acids

(a) Susceptible strains of *M. tuberculosis* will be killed using any one of the antibiotics listed in Table 2.1. However, combination treatment is preferred as it is one method that can be used to reduce the impact to society of antibiotic resistance.

With reference to Table 2.1, explain how combination treatment for TB can help to reduce the impact of antibiotic resistance compared to single antibiotic treatment.

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..... [4]

Rifampicin binds tightly to an RNA polymerase molecule close to its active site. This affects the activity of the enzyme.

(b) (i) RNA polymerase catalyses the formation of messenger RNA (mRNA) from DNA.

State the term for this process.

..... [1]

(ii) During the formation of RNA, a number of events occur that involve the action of RNA polymerase.

Suggest ways in which rifampicin can affect the activity of RNA polymerase.

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..... [3]

(c) RNA polymerase is composed of five different polypeptides. Gene *rpoB* codes for one of these polypeptides known as the β-subunit.

One or more mutations in a specific region of *rpoB* result in strains of *M. tuberculosis* that are resistant to rifampicin. In these strains, mutations often occur in two DNA triplets in this region, in positions 526 and 531.

Table 2.2 summarises the results of an investigation into seven rifampicin-resistant strains, **A** to **G**, that have amino acid changes for positions 526 and 531.

Table 2.2 includes:

- the change in the **mRNA codon** for position 526 or position 531
- the amino acid change that has occurred as a result of the mutation
- the minimum concentration of rifampicin required to inhibit growth of the bacterial strain (MIC)
- the number of **other** mutations occurring within the specific region of *rpoB*.

Table 2.2

Key
≈ approximately ⩾ greater than or equal to ⩽ less than or equal to

strain	codon involved	mRNA codon change	amino acid change	MIC / $\mu g\,cm^{-3}$	number of other mutations in the specific region
A	526	CAC ⟶ UAC	His ⟶ Tyr	⩽50	0
B	526	CAC ⟶ AAC	His ⟶ Asn	⩾100	1
C	526	CAC ⟶ CGC	His ⟶ Arg	≈50–75	2
D	526	CAC ⟶ CGC	His ⟶ Arg	⩾100	3
E	526	CAC ⟶ CGC	His ⟶ Arg	≈50	3
F	526	CAC ⟶ UUC	His ⟶	⩾100	3
	531	UCG ⟶ UUG	Ser ⟶ Leu		
G	526	CAC ⟶ UAC	His ⟶	⩾100	3
	531	UCG ⟶ UUC	Ser ⟶ Phe		

(i) Complete Table 2.2 to show the amino acid changes that have occurred in strains **F** and **G**.

[1]

(ii) With reference to Table 2.2, list the strains of *M. tuberculosis* that show the greatest resistance to rifampicin.

..... [1]

(iii) Suggest reasons to explain why strains **C**, **D** and **E** show:

- resistance to rifampicin
- different levels of resistances to rifampicin.

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..... [3]

[Total: 13]

194. 9700_w20_qp_23 Q: 4

Antibiotic sensitivity tests can be carried out to choose appropriate antibiotics to use for treatment of bacterial diseases.

A researcher carried out an antibiotic sensitivity test using two pathogenic bacteria, **X** and **Y**.

The researcher prepared two Petri dishes containing agar.

- A culture of each bacterium was spread over the surface of the agar.
- Filter paper discs containing antibiotics were placed on the surface of the agar in each dish.
- The Petri dishes were incubated at 25 °C for two days.

The results of the test using three antibiotics, **P**, **Q** and **R**, are shown in Fig. 4.1.

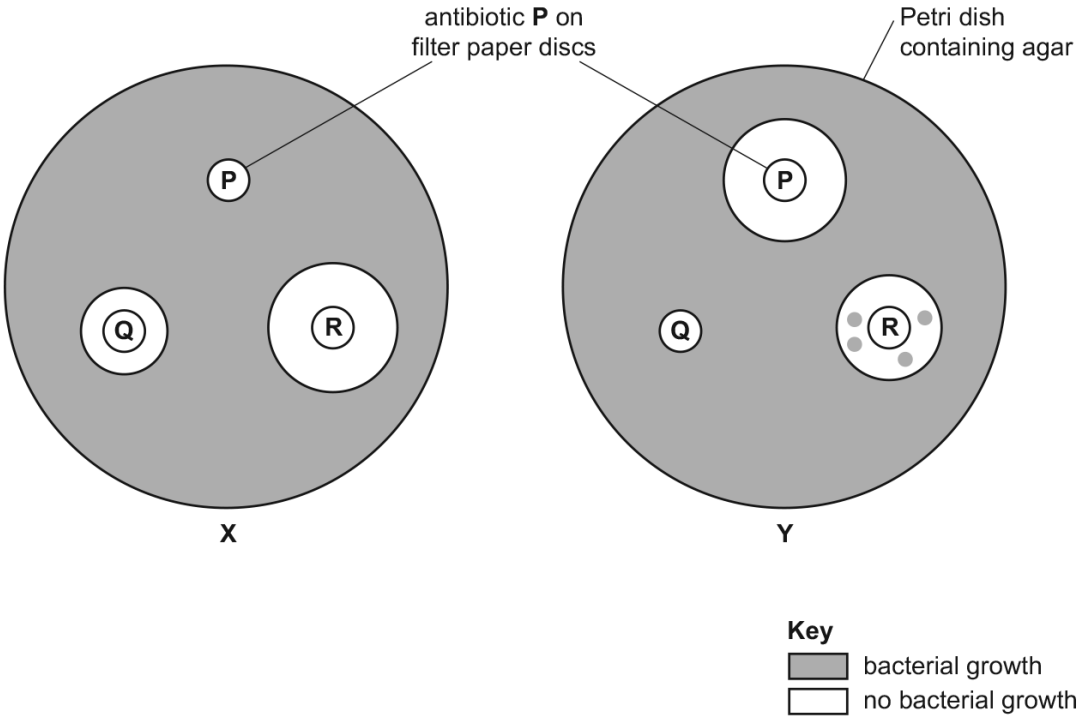


Fig. 4.1

(a) (i) State the most effective antibiotic to treat infections of bacterium **X** and bacterium **Y**.

bacterium **X** .....

bacterium **Y** .....

[1]

(ii) Suggest why bacterium **Y** had a different sensitivity to each of the three antibiotics.

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..... [2]

(b) Explain how the use of vaccines in the control of infectious diseases differs from the use of antibiotics.

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..... [3]

[Total: 6]

195. 9700_s17_qp_21 Q: 6

Cholera bacteria release the toxin, choleragen, when they are in the intestine.

(a) (i) Name the bacterium that is the pathogen of cholera.

.....[1]

(ii) Describe the way in which cholera is transmitted from an infected person to an uninfected person.

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.....[2]

Gangliosides are glycolipids that bind choleragen. These glycolipids are found on many cell surface membranes.

When choleragen is released from the bacteria in the intestine, it binds to gangliosides on epithelial cells and enters these cells as shown in Fig. 6.1.

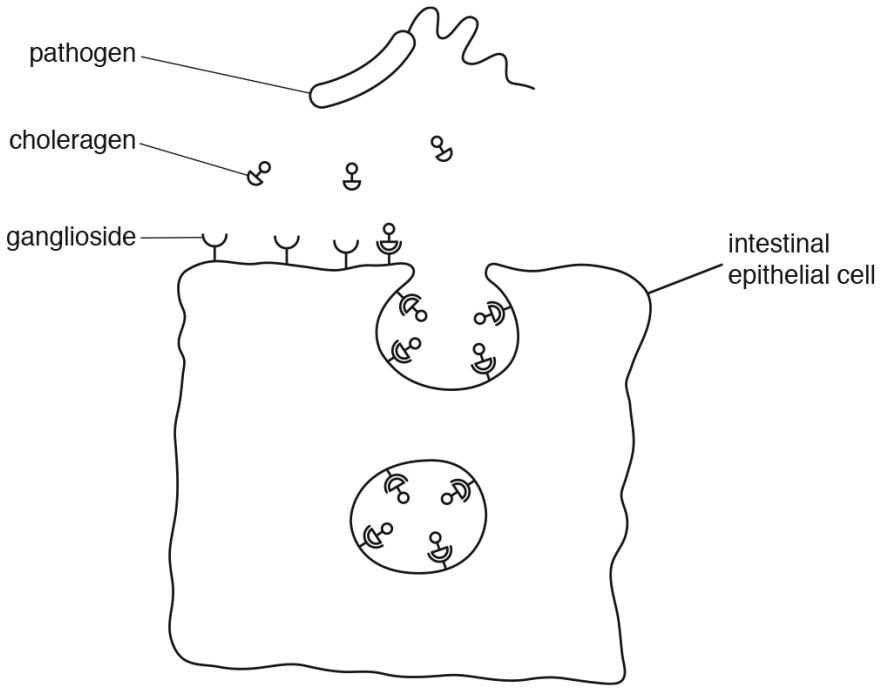


Fig. 6.1 not drawn to scale

(b) Suggest how choleragen interacts with gangliosides on intestinal epithelial cells.

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.....[2]

(c) Name the process by which choleragen enters the intestinal epithelial cell as shown in Fig. 6.1.

.....[1]

Once inside the cells choleragen is activated. One effect is to increase the movement of chloride ions through channel proteins out of cells.

(d) Suggest **and** explain the likely consequences on the intestinal epithelial cells of the loss of chloride ions through the channel proteins.

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.....[2]

(e) Health authorities recommend that antibiotics, such as tetracycline, are **only** to be used for treating people with severe cases of cholera.

Explain why it is recommended that antibiotics should **not** be given to people with mild cases of cholera or to protect people from cholera.

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.....[3]

[Total: 11]

196. 9700_s17_qp_23 Q: 3

(a) Name the causative organism of tuberculosis (TB).

.....[1]

(b) Fig. 3.1 shows the number of deaths from TB and the number of new cases of TB from 1925 to 2010 in Canada.

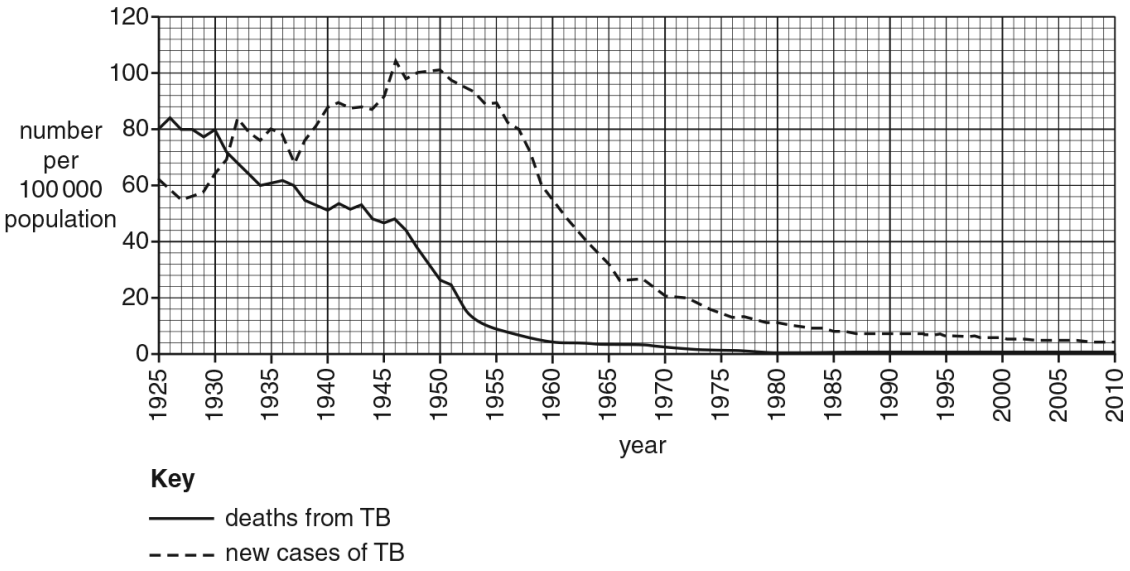


Fig. 3.1

The vaccine for TB was introduced in Canada for widespread use from 1948.

Antibiotics, such as streptomycin, were introduced in Canada from 1940.

Use the information in Fig. 3.1 to comment on the effect of the introduction of the vaccine and antibiotics on the number of new cases and deaths from TB.

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.....[5]

(c) In 2010, Swaziland had one of the highest death rates from TB in the world.

Swaziland also had a high number of new cases of HIV infection in its population in 2010.

People who are infected with HIV are described as HIV+ and people who are **not** infected with HIV are described as HIV–.

Table 3.1 shows the number of deaths from TB in Swaziland in 2010.

Table 3.1

HIV status	number of deaths from TB per 100 000 population
HIV+	400
HIV–	91

Using the information in Table 3.1, suggest why the number of deaths per 100 000 population of people who are HIV+ is much higher than that in people who are HIV–.

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.....[3]

[Total: 9]

197. 9700_s16_qp_23 Q: 5

Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*.

(a) Describe how TB is transmitted.

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.....[2]

(b) Streptomycin was the first antibiotic used to treat TB.

During the first few years after the introduction of streptomycin treatment, an increasing number of *M. tuberculosis* bacteria developed resistance to streptomycin.

Outline how this happened.

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.....[4]

(c) The antibiotic rifampicin was introduced as an alternative to streptomycin.

Rifampicin acts by inhibiting the enzyme RNA polymerase.

RNA polymerase is the enzyme used in transcription.

(i) Explain what is meant by transcription.

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.....[2]

(ii) *M. tuberculosis* and humans both use RNA polymerase for transcription.

Suggest why rifampicin does **not** affect transcription in human cells.

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.....[1]

(d) Other drugs such as isoniazid are also used in the treatment of TB.

Some bacteria are now resistant to more than one of these drugs. These bacteria are known as multi-drug resistant (MDR) bacteria.

Outline the steps that can be taken to reduce the impact of drug resistance in bacteria.

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.....[3]

(e) Explain why antibiotics can be used to treat bacterial infections and not viral infections.

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.....[2]

[Total: 14]

198. 9700_w16_qp_21 Q: 4

(a) **(i)** Name the bacterium that causes cholera.

.....[1]

(ii) Describe how cholera is transmitted from an infected person to an uninfected person.

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.....[2]

(iii) Suggest **and** explain why cholera outbreaks are common after natural disasters.

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.....[2]

(b) The bacteria that cause cholera can become resistant to antibiotics by a substitution mutation.

A substitution mutation occurs when one nucleotide in the DNA sequence is replaced by a different nucleotide.

(i) Explain how a substitution mutation could result in a change in the amino acid sequence of a polypeptide.

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.....[2]

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(ii) The antibiotic nalidixic acid acts as an inhibitor of an enzyme involved in DNA replication in the bacteria that cause cholera.

The gene *gyrA* codes for this enzyme. A substitution mutation in this gene results in resistance to the antibiotic nalidixic acid.

Suggest how a change in the amino acid sequence of the enzyme results in antibiotic resistance.

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.....[2]

(c) Some of the strains of bacteria that cause cholera are resistant to more than one antibiotic (multiple resistance).

Discuss the consequences of multiple resistance for health authorities.

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.....[4]

[Total: 13]

199. 9700_w16_qp_23 Q: 2

(a) Explain how enzymes lower the activation energy needed to allow reactions to proceed.

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.....[2]

(b) Folic acid is a molecule used by all cells for growth. Bacteria cannot absorb folic acid from their surroundings. Bacteria use an enzyme to make a molecule called PABA. PABA is used to make folic acid.

An investigation was carried out to determine the effect on the production of PABA when the concentration of an enzyme inhibitor is increased. Four different concentrations (1 μM to 30 μM) of the inhibitor were used, together with a control with no inhibitor.

The concentration of PABA produced in each reaction mixture was determined at 10 minute intervals.

The results are shown in Fig. 2.1.

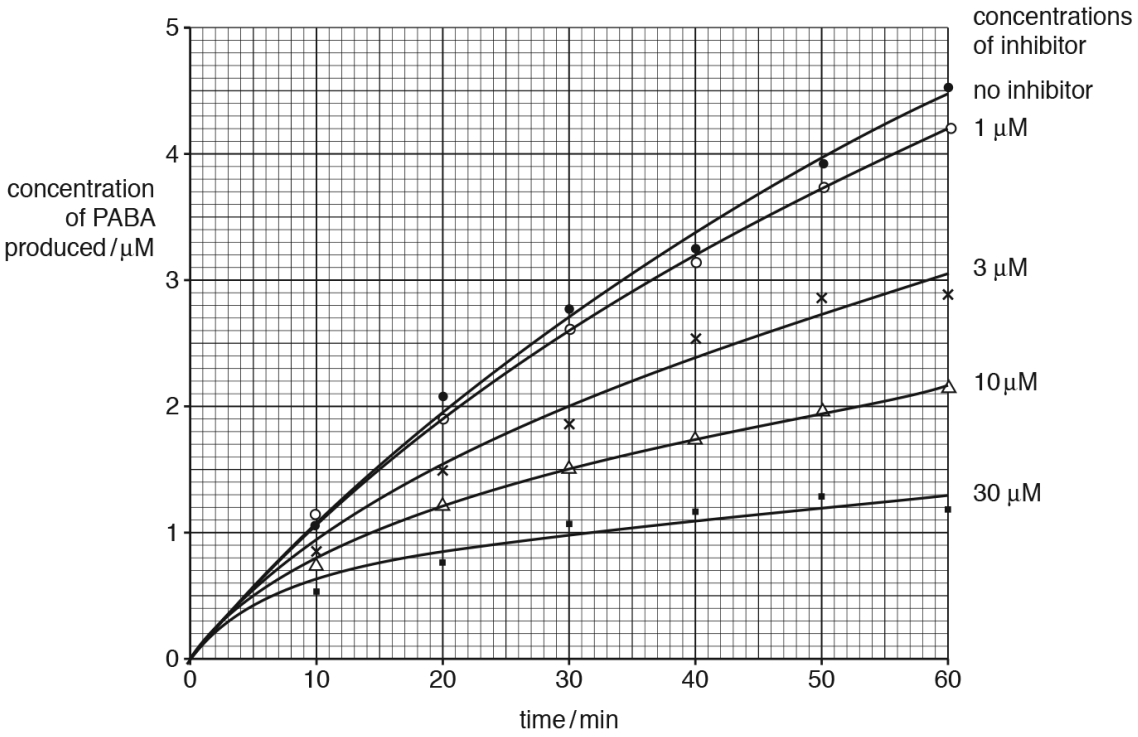


Fig. 2.1

(i) Use Fig. 2.1 to describe the results of the investigation.

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.....[4]

(ii) Outline an experiment that could be carried out to determine whether the inhibitor of the enzyme that catalyses the reaction to produce PABA is competitive or non-competitive.

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.....[3]

(iii) Folic acid from the diet is able to enter human cells, but is **not** able to cross bacterial cell walls. Human cells do **not** have an enzyme to make PABA.

Suggest why the inhibitor of this enzyme could be used as a drug to treat bacterial infections in humans.

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.....[1]

(iv) Suggest why there are few drugs that have any effect on viruses.

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.....[2]

(c) The search for new antibiotics is important because there are many strains of bacteria that are resistant to antibiotics.

Suggest two ways to reduce the spread of antibiotic resistance.

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2 .....

.....[2]

[Total: 14]

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]**

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(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.

For Examiner's Use

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

(a) Describe how the malarial parasite is transmitted.

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..... [3]

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(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]

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(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.

For Examiner's Use

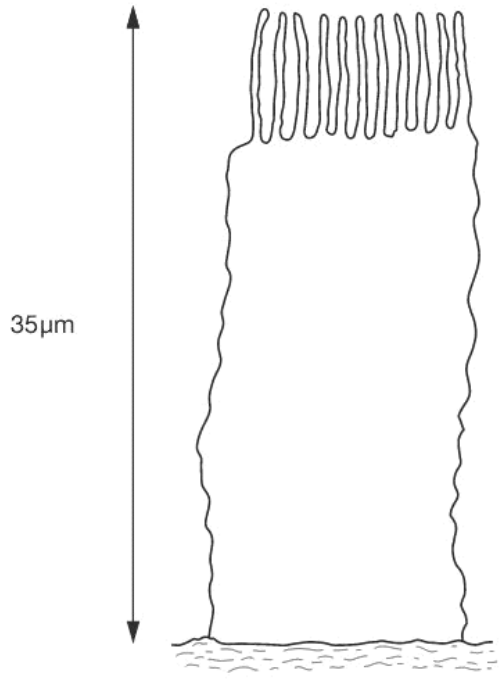


Fig. 1.1

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(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*.

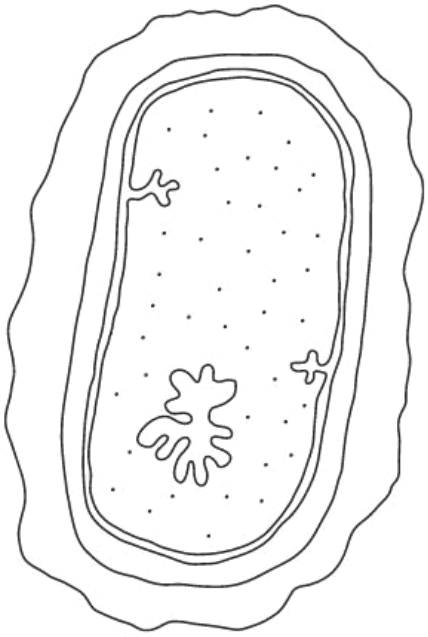


Fig. 1.2

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(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]

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(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]

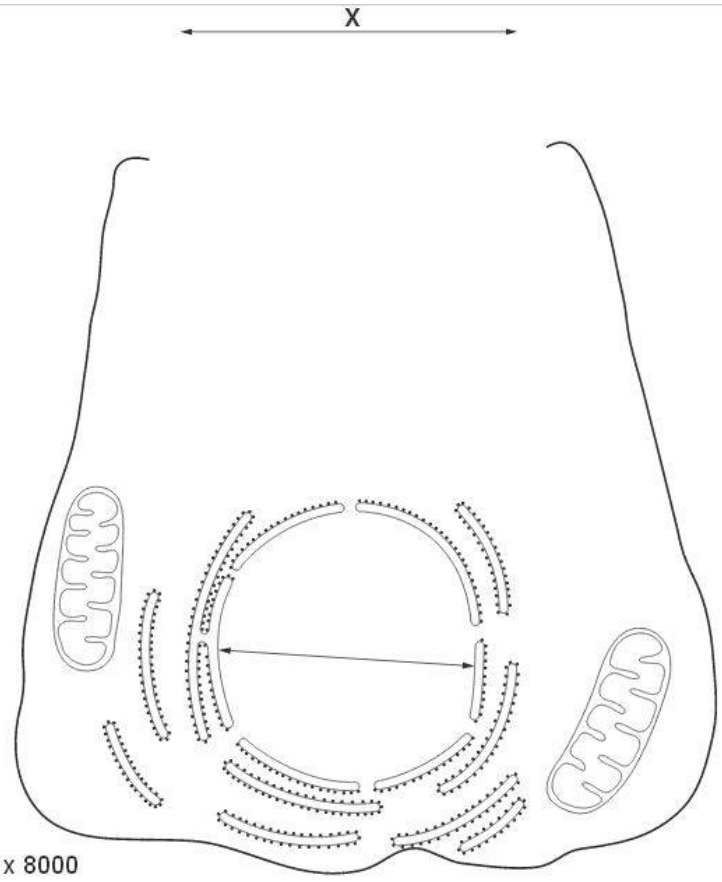
[Total: 15]

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.

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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]

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

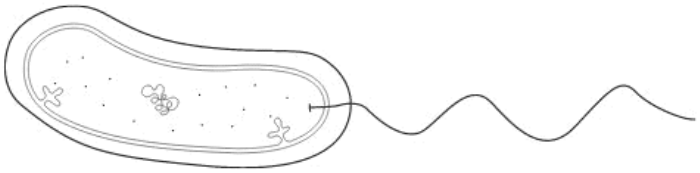


Fig. 1.2

(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]

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(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.

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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.

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.....[2]

Fig. 4.1 shows the worldwide distribution of malaria.



Fig. 4.1

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(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.

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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]

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(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]

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(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.

.....

.....

.....[2]

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(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.

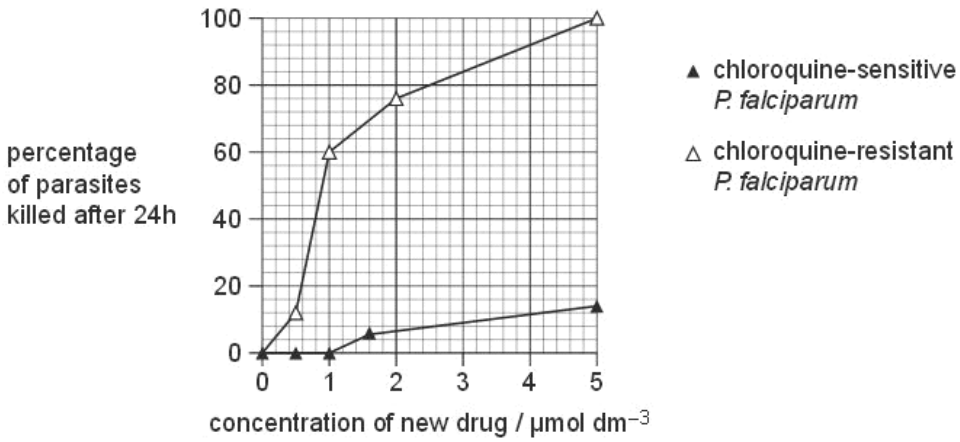


Fig. 4.1

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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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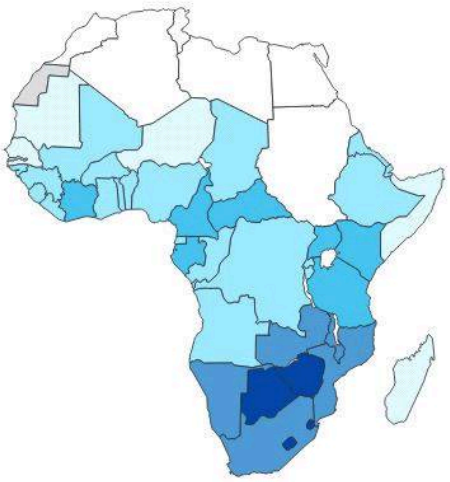
.....

.....[3]

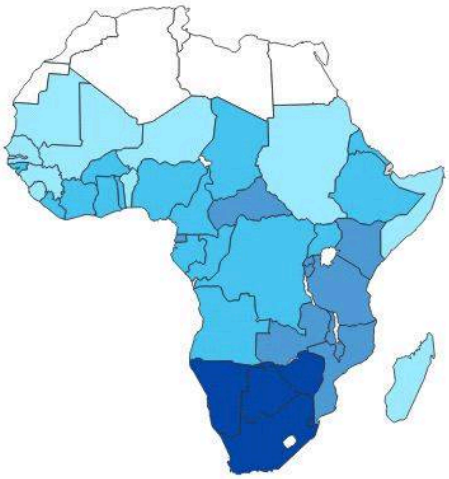
(d) When a person becomes infected with the Human Immunodeficiency Virus (HIV) they become more susceptible to infection by the malarial parasite.

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 (%)

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Fig. 4.2a

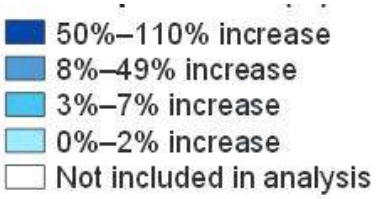


Fig. 4.2b

(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.

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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.

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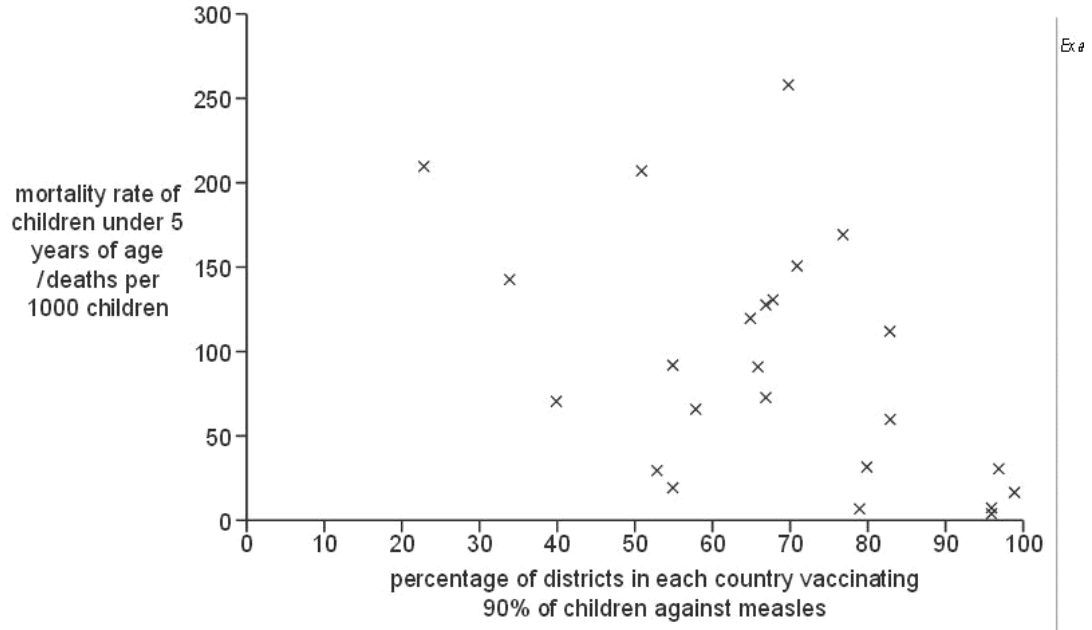


Fig. 6.1

(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.

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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.

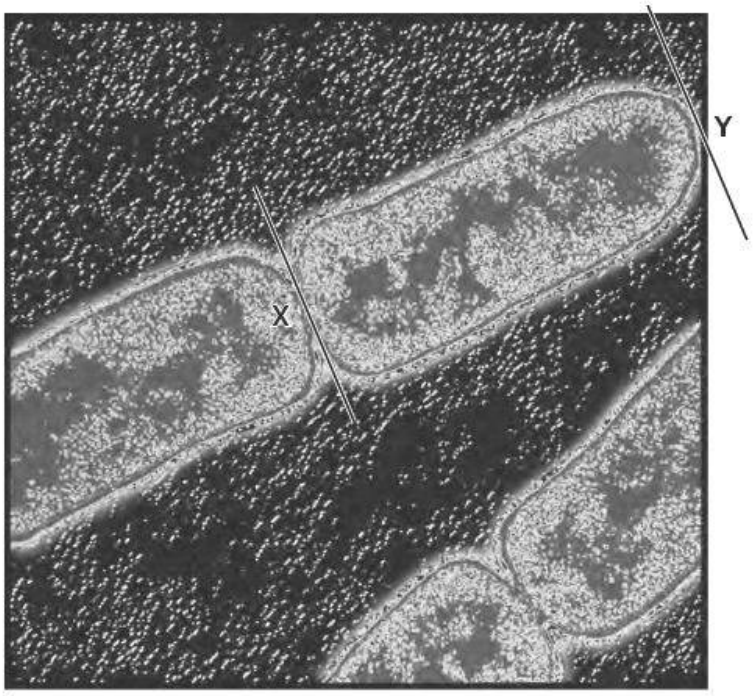


Fig. 4.1

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(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. .....

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3. .....

.....[3]

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(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.

.....

.....[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.

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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]

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(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]

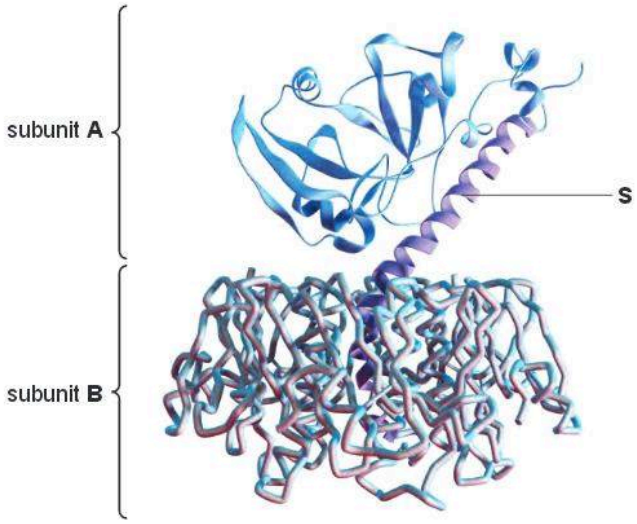
Q13.

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.



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(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]

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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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.....

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.....[2]

[Total: 10]

Q14.

STEMUP.CO.UK

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.

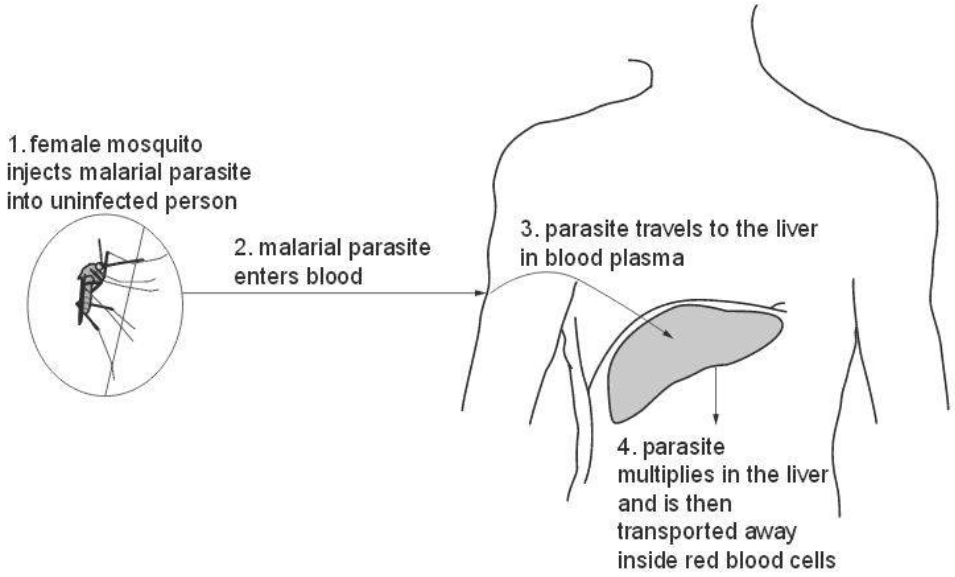


Fig. 5.1

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]

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(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.

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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]**

STEMUP.CO.UK

(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]

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(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]**

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(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'.

.....

.....

.....

..... [2]

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

pathogen .....

transmission .....

.....

[2]

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(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.

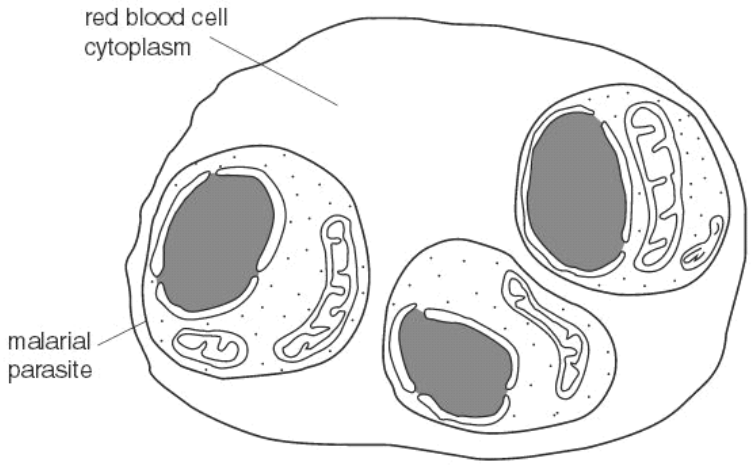


Fig. 5.1

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(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.

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.....[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.

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4 Fig. 4.1 is a diagram of a bacterium.

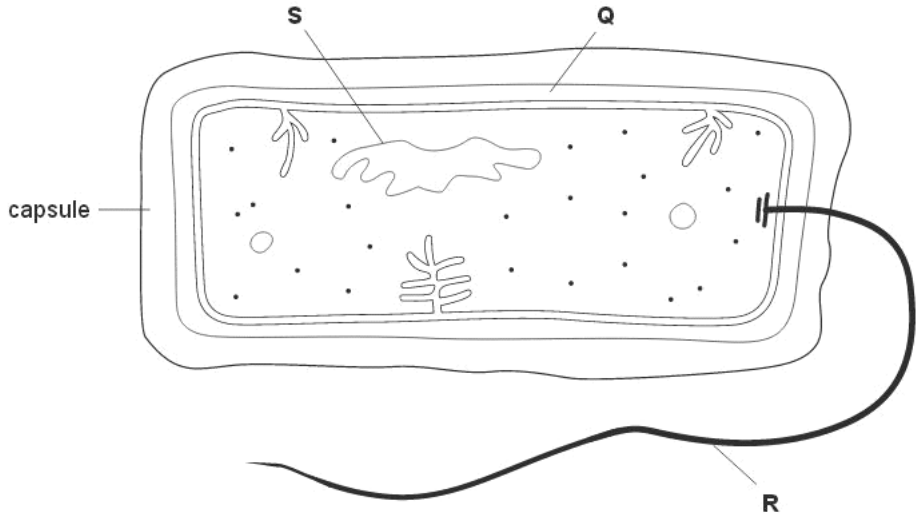


Fig. 4.1

(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]

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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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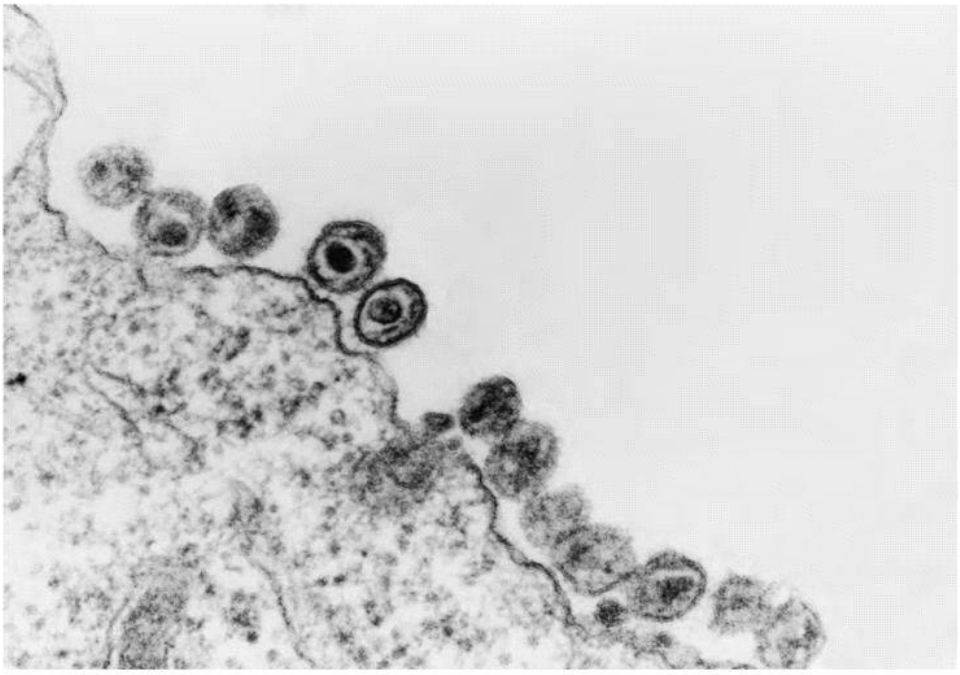
.....[3]

[Total : 12]

Q21.

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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]

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(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]

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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]

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(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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.....

.....

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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.

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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.

.....

.....

.....

.....

..... [2]

For Examiner Use

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

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

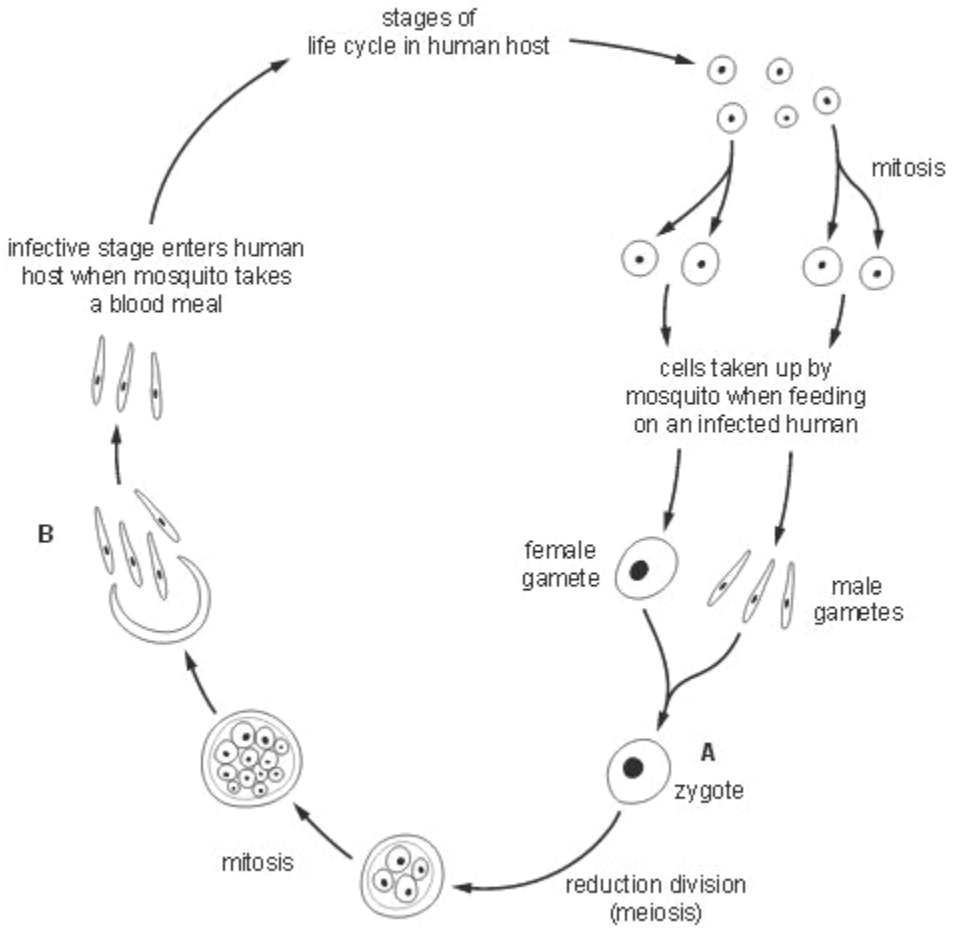


Fig. 5.1

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

A .....

B ..... [2]

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(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.

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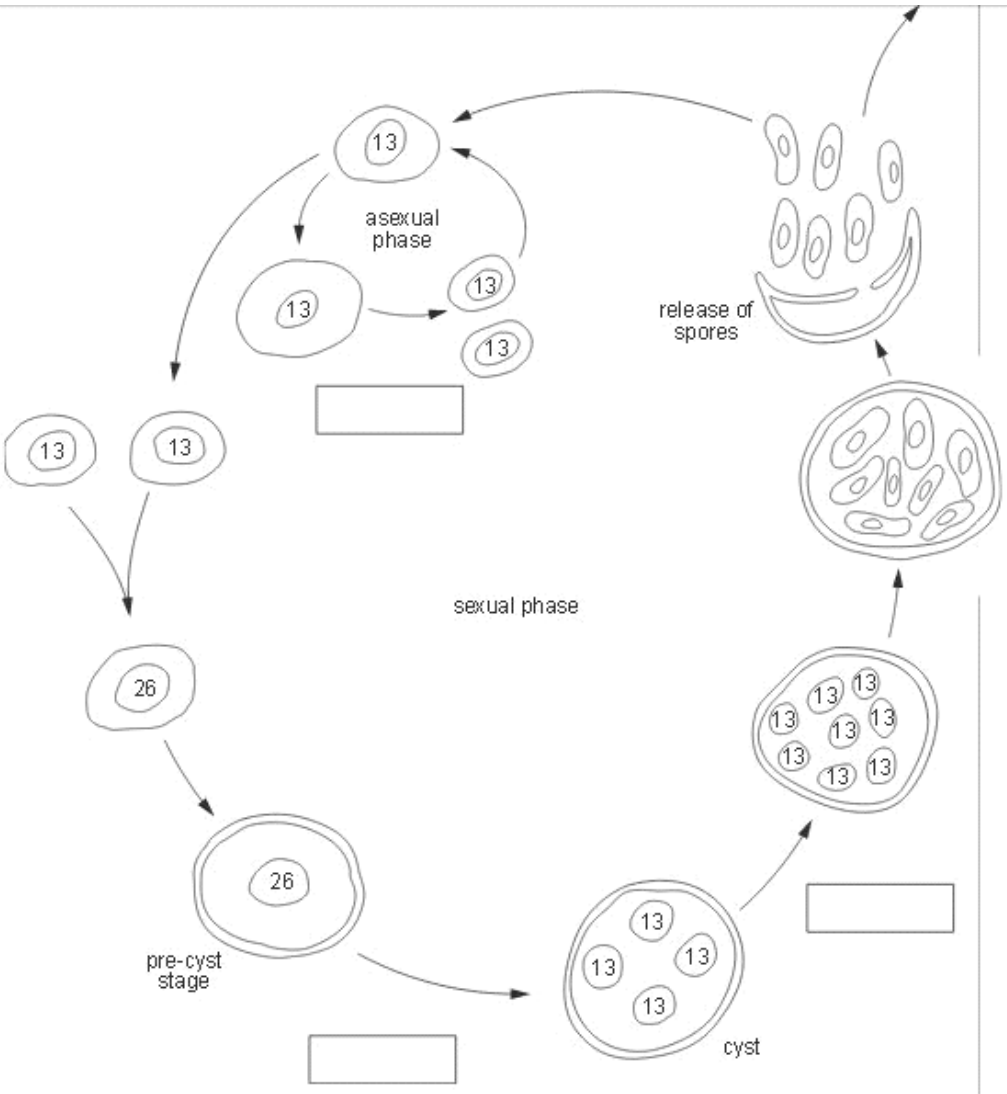


Fig. 5.1

STEMUP.CO.UK

(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.

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.....[2]

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

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.....[4]

[Total: 10]

Q25.

STEMUP.CO.UK

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.

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.....[1]

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

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.....[3]

STEMUP.CO.UK

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.

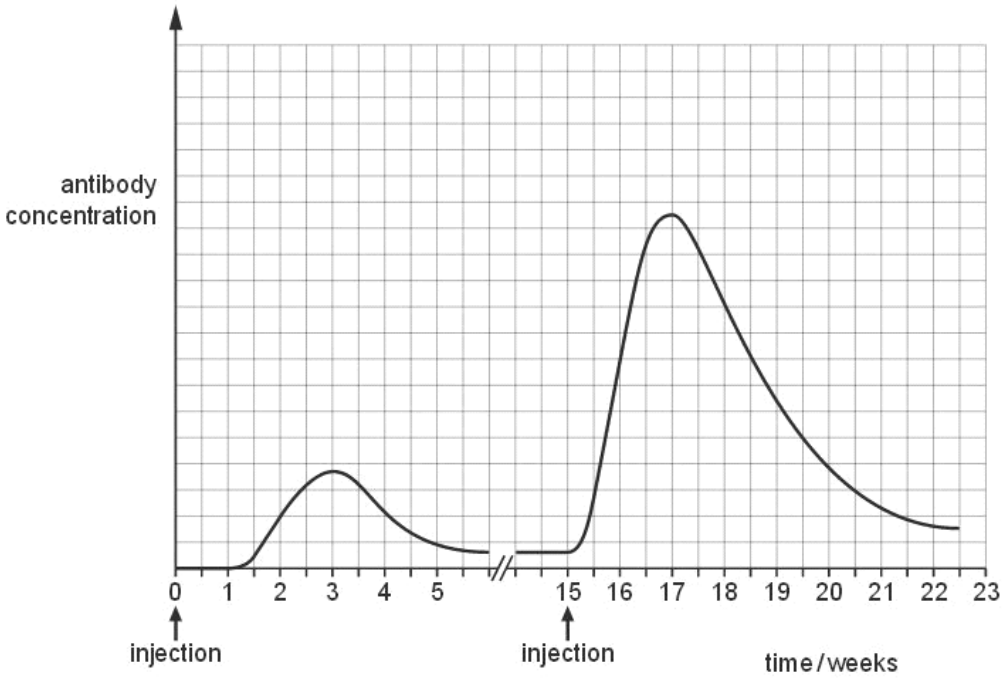


Fig. 4.1

(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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STEMUP.CO.UK

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

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.....[4]

[Total: 13]

Q26.

STEMUP.CO.UK

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.

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..... [2]

STEMUP.CO.UK

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

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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).

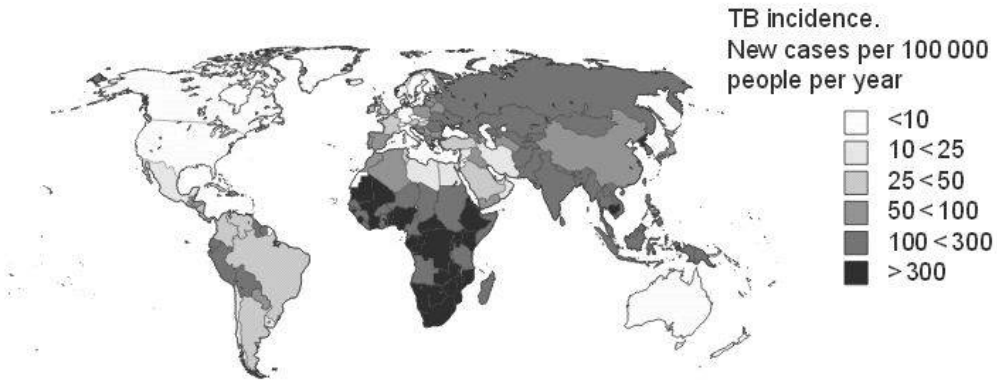


Fig. 2.1

STEMUP.CO.UK

(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.

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(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*.

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.....[2]

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

Fo
Exami
Us

1. .....

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2. .....

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.....[2]

STEMUP.CO.UK

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

cholera .....

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sickle cell anaemia .....

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.....[5]

[Total: 13]

Q29.

STEMUP.CO.UK

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

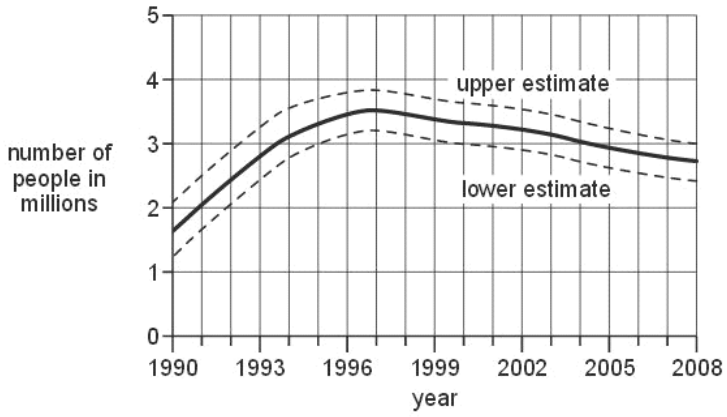


Fig. 4.1

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

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..... [3]

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

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..... [3]

STEMUP.CO.UK

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

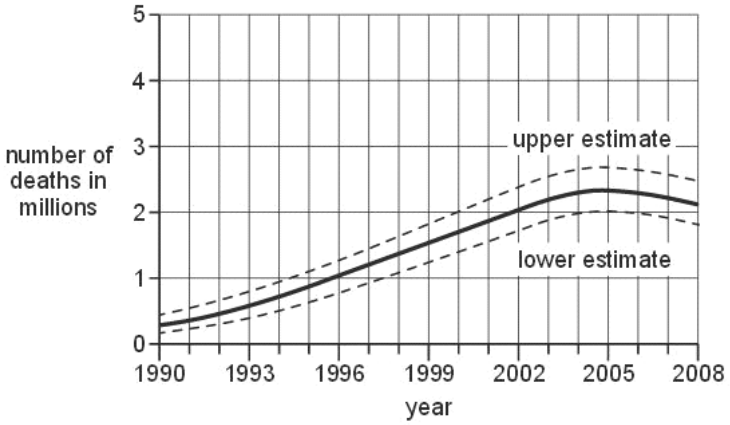
For Examiner Use

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

[Total: 11]

Q30.

STEMUP.CO.UK

4 Diseases are either infectious or non-infectious.

For Examiner 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.

.....

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..... [1]

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(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.

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..... [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.

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..... [3]

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

Suggest an explanation for this observation.

.....

.....

..... [1]

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

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..... [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.

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.....[3]

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

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

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.....[3]

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

Exa

(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.

.....

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.....

.....[3]

[Total: 11]

Q32.

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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.

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.....[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*.

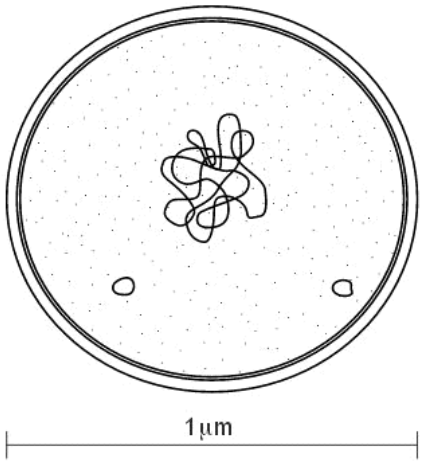


Fig. 4.1

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(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.

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.....[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.

Exa

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

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.....[3]

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(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]

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Infectious diseases – AS 9700 Biology June 2022

1. June/2022/Paper_11/No.37

What will reduce the rate at which bacteria become resistant to antibiotics?

1 prescribing two antibiotics with different modes of action

2 prescribing different antibiotics for the same bacterium

3 finishing a prescribed course of antibiotics

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

2. June/2022/Paper_12/No.22

Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which processes are directly inhibited by this antibiotic?

1 DNA replication

2 enzyme synthesis

3 ATP synthesis

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

3. June/2022/Paper_12/No.37

Why is it difficult to control the spread of tuberculosis?

1 Global air travel for commerce and tourism has increased.

2 The bacterium that causes tuberculosis has evolved resistance to some antibiotics.

3 The bacterium that causes tuberculosis shows great antigenic variability.

4 Civil unrest and poverty result in overcrowded living conditions.

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

4. June/2022/Paper_12/No.38

Rabies is a viral disease which can be spread to humans by a bite from an infected animal.

One method of treatment is to inject the patient with antibodies specific to the rabies virus.

Which statements about this treatment are correct?

1 The patient will have natural passive immunity to rabies.

2 The injected antibodies will be broken down by the patient.

3 The patient's memory cells will be able to produce this antibody more rapidly in the future.

4 The immunity provided will only last a short time.

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

5. June/2022/Paper_13/No.37

Which terms can be used to describe the role of mosquitoes in the transmission of malaria?

1 malarial parasite

2 pathogen

3 vector

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

6. June/2022/Paper_21/No.5

(a) Infectious diseases are caused by pathogens and are described as transmissible diseases.

Explain what is meant by the term transmissible.

.....

..... [1]

(b) *Vibrio cholerae* is the bacterium that causes cholera.

Fig. 5.1 is a transmission electron micrograph of *V. cholerae*.

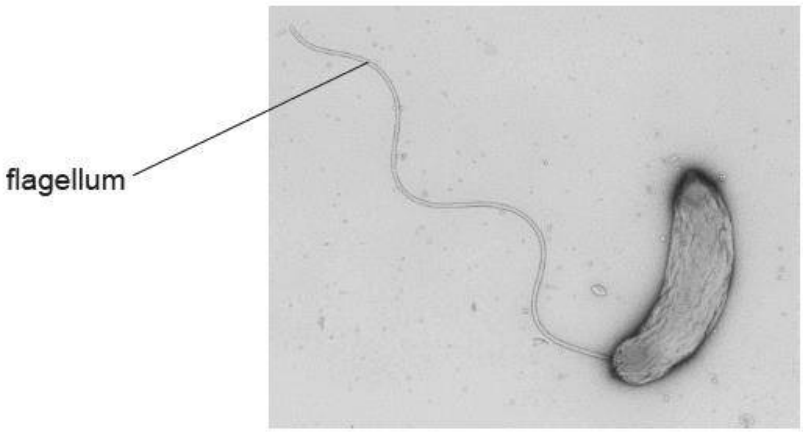


Fig. 5.1

A student wanted to know the actual length of the flagellum shown in Fig. 5.1.

State the information that is needed so that the student can calculate the actual length of the flagellum.

.....

.....

..... [2]

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(c) Table 5.1 shows data on large outbreaks of cholera that occurred in seven countries in 2019.

The case-fatality rate is the number of deaths as a percentage of the number of cases.

Table 5.1

country	number of cases of cholera	number of deaths from cholera	case-fatality rate /%
Cameroon	1307	55	4.2
DR Congo	29087	501	1.7
Haiti	684	3	0.4
Kenya	5150	39	0.8
Somalia	9968	50	0.5
Sudan	346	11	3.2
Yemen	2260495	3767	

(i) Complete Table 5.1 by calculating the case-fatality rate for Yemen. [1]

(ii) Suggest why large outbreaks of cholera occurred in the countries listed in Table 5.1, but there were very few cases in most other countries.

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..... [5]

[Total: 9]

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7. June/2022/Paper_22/No.2

Cholera is a life-threatening and infectious disease caused by the bacterium *Vibrio cholerae*. One of the symptoms of the disease is severe diarrhoea.

V. cholerae O1 and *V. cholerae* O139 are the two forms of the pathogen that are associated with cholera epidemics (large outbreaks). These two forms have different antigens that can be detected.

(a) If an outbreak of cholera is suspected but not confirmed, a standard home treatment for diarrhoeal diseases can be used immediately to help prevent severe illness as a result of dehydration. If cholera is the cause of the disease, this standard treatment also helps to prevent a larger outbreak of the disease.

(i) Outline the standard treatment that can be used for suspected cholera cases.

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..... [2]

(ii) Suggest **and** explain why this treatment can help to prevent a larger outbreak of cholera.

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..... [2]

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(b) Rapid diagnostic testing (RDT) can be used to diagnose cholera by detecting the presence of *V. cholerae*. One type of RDT involves using a dipstick that contains mobile and immobilised monoclonal antibodies.

Monoclonal antibodies (mAbs) are specific in their action.

Fig. 2.1 shows a simplified diagram of an RDT dipstick that can be used to distinguish between *V. cholerae* O1 and *V. cholerae* O139. A faecal sample from a person with suspected cholera is collected and added to a reagent solution to form the test mixture.

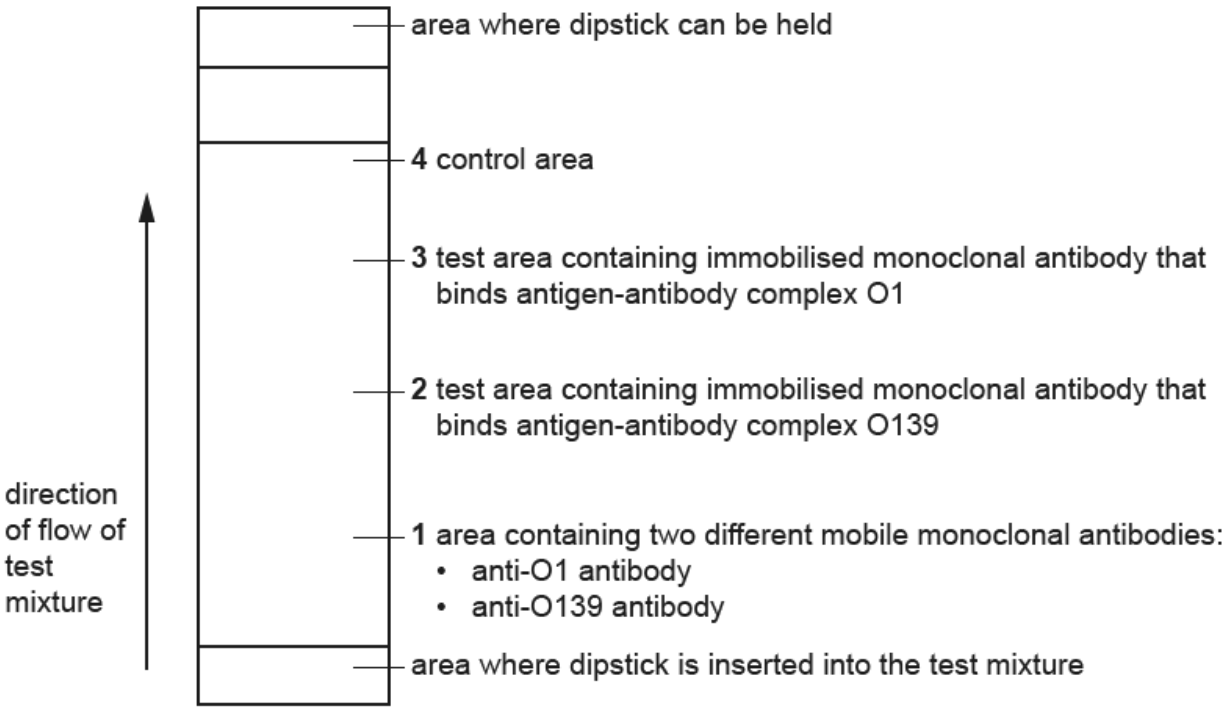


Fig. 2.1

The test mixture moves up the dipstick through area **1**. The mobile monoclonal antibodies are attached to tiny gold particles. If these antibodies collect in test area **2** or **3**, a coloured band becomes visible.

A coloured band that becomes visible in area **4** confirms that the test strip is working and that the results are valid.

(i) Explain how the structure of the monoclonal antibodies in the dipstick allows them to be specific in their action.

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..... [2]

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(ii) Fig. 2.2 shows the results for samples taken from two different people, **A** and **B**, who are suspected of having cholera.

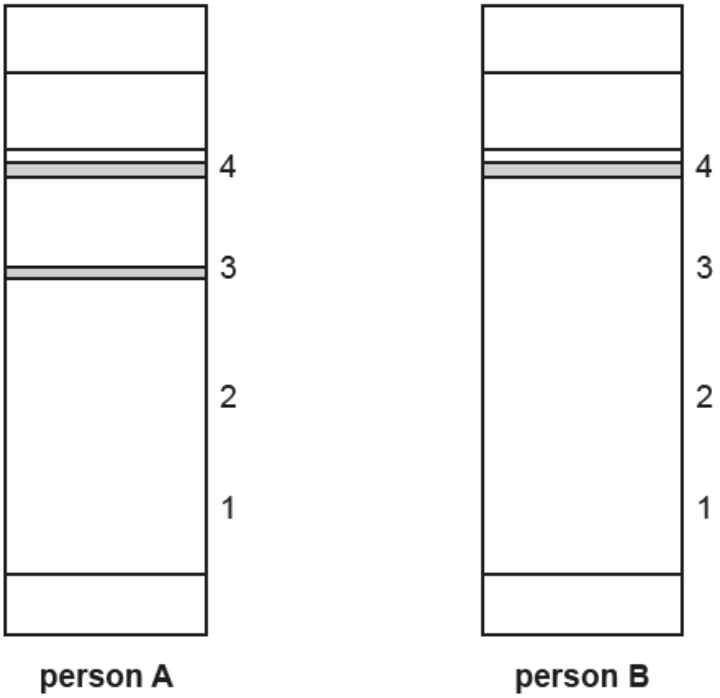


Fig. 2.2

With reference to Fig. 2.2, state **and** explain the conclusions that can be drawn from the results of the RDT dipsticks for each person.

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..... [3]

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(c) Table 2.1 shows the results of an investigation to evaluate the effectiveness of an RDT dipstick in diagnosing cholera.

Samples taken from 156 people were tested using a dipstick and compared to the results obtained by culturing the pathogen in a laboratory for accurate identification.

Table 2.1

	number of test results		
	using culture techniques (to obtain accurate identification)	**using dipstick**	
		correct diagnosis	**incorrect diagnosis**
positive results for cholera	102	97	5
negative results for cholera	54	32	22

(i) With reference to Table 2.1, calculate the percentage chance of an RDT dipstick correctly confirming that a person with cholera has the disease.

[1]

(ii) Using an RDT dipstick to diagnose cholera is much cheaper than culturing the pathogen and requires less technical skill.

Suggest **one** additional advantage of using an RDT dipstick, rather than culture techniques, to diagnose cholera.

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..... [1]

[Total: 11]

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8. June/2022/Paper_23/No.4

There are many different forms of *Vibrio cholerae*, a bacterium that is found naturally in aquatic environments. The bacterium is motile (can move) and uses a cell structure known as a flagellum to allow it to move through water.

Fig. 4.1 is a drawing of four cells of one form of *V. cholerae*.

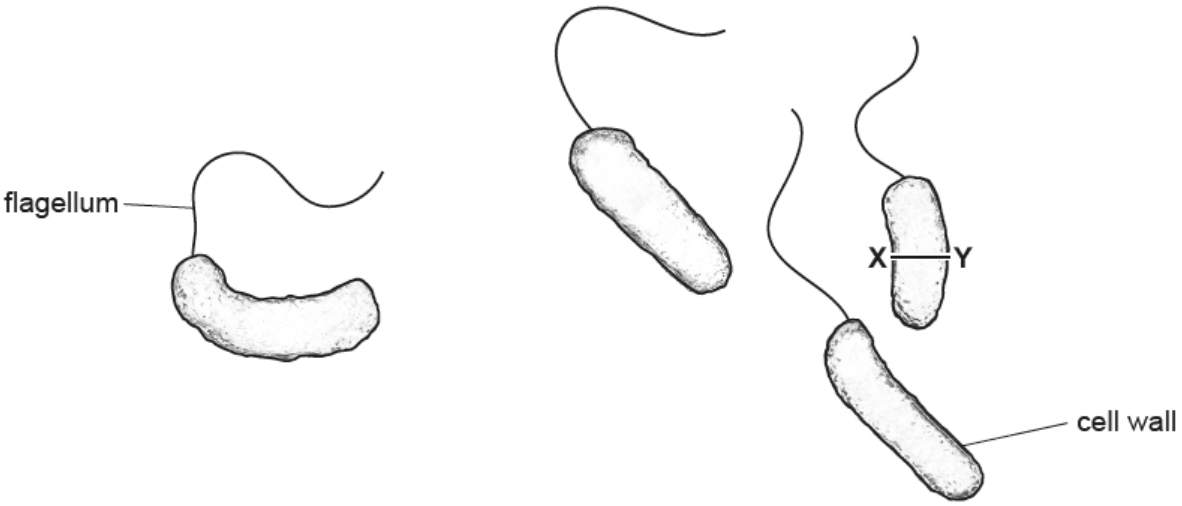


Fig. 4.1

Two main forms of *V. cholerae*, O1 and O139, are able to colonise the small intestine and cause cholera. These two forms are able to produce a toxin, choleragen, which causes the symptoms of diarrhoeal disease. Mutant *V. cholerae* that lack flagella are less able to cause disease.

(a) The magnification of the diagram shown in Fig. 4.1 is ×32 000.

Calculate the actual width **X–Y** in Fig. 4.1 in nanometres (nm) **and** give your answer to the nearest 10 nm.

Complete Fig. 4.2 to show the formula you will use to make your calculation.

actual width =

Fig. 4.2

answer = ... nm [2]

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(b) State the term used to describe disease-causing organisms, such as the bacterium *V. cholerae*.

..... [1]

(c) Outline **one** way in which an uninfected person may become infected by *V. cholerae*.

.....

.....

..... [1]

(d) Choleragen is produced after *V. cholerae* has penetrated (passed through) the mucus lining and attached to intestinal epithelial cells.

Choleragen is composed of two subunits:

- subunit **A** consists of one polypeptide
- subunit **B** consists of five identical polypeptides
- the polypeptide in subunit **A** is different from the polypeptides in subunit **B**.

Two genes, *ctxA* and *ctxB*, are needed to produce choleragen. Only one strand of the DNA forming gene *ctxA* is involved in the production of subunit **A**. Only one strand of the DNA forming gene *ctxB* is involved in the production of subunit **B**.

Explain why only one strand of the DNA of each gene is involved in the production of the subunits.

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..... [3]

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Monoclonal antibodies (mAbs) can be designed to act against components of the cell wall of *V. cholerae*. The cell wall has an outer membrane with lipopolysaccharide (LPS) molecules, shown in Fig. 4.3.

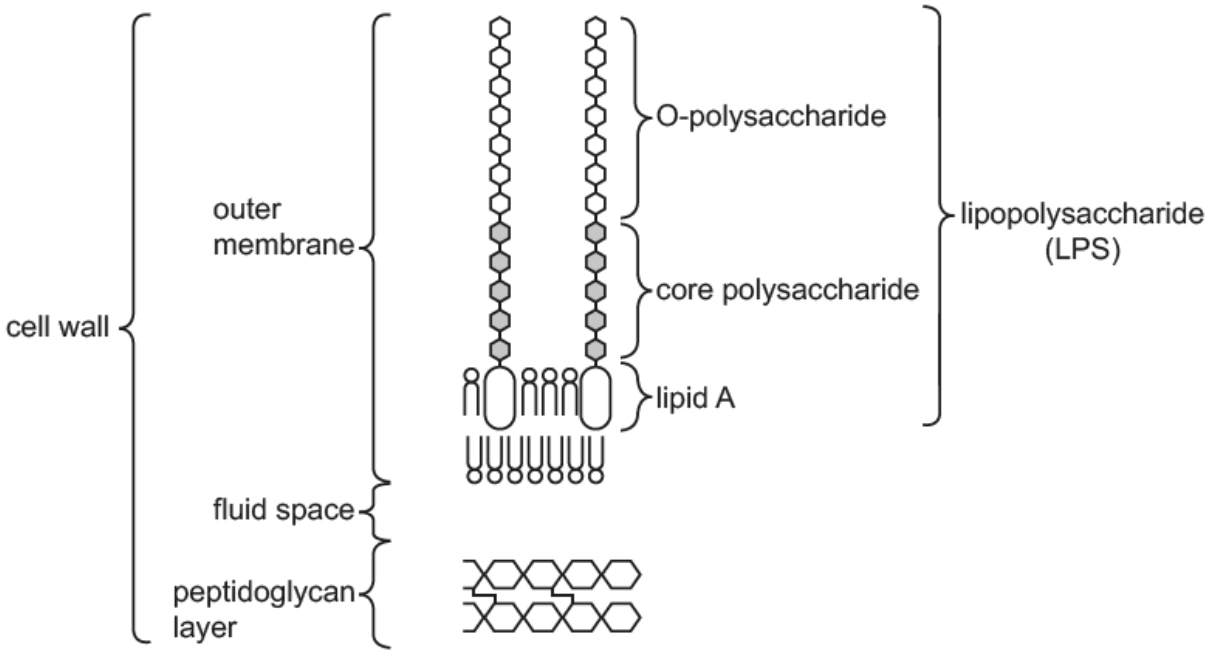


Fig. 4.3

The core polysaccharide and the lipid A components of the LPS molecules are the same in *V. cholerae* O1 and *V. cholerae* O139. However they have different O-polysaccharides.

There are also different types of *V. cholerae* O1 and these have different O-polysaccharides.

(e) Laboratory tests were carried out using two different monoclonal antibodies that had been designed and produced to act against the LPS of bacterial cultures of *V. cholerae* O1:

- mAb 2D6 acts against the O-polysaccharide
- mAb ZAC-3 acts against the core polysaccharide and lipid A components.

(i) Explain why the mAb ZAC-3 produced against the core polysaccharide and lipid A components will not act against the O-polysaccharide of the LPS molecules.

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..... [2]

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(ii) The results of the tests showed that both mAbs were effective in causing agglutination (clumping) of bacteria and in preventing their motility. This suggests they may be useful for preventing cholera and for treating the disease.

Discuss whether mAb 2D6 and mAb ZAC-3 may be useful for preventing cholera **and** for treating the disease.

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..... [4]

[Total: 13]

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Infectious diseases – AS 9700 Biology Nov 2022

1. Nov/2022/Paper_11/No.38

Penicillin is an antibiotic used to treat infections caused by bacteria.

Which events explain how bacteria become resistant to penicillin?

1 The number of bacteria with the allele for resistance to penicillin increases.

2 Resistance to penicillin is the result of a mutation in a bacterium.

3 Bacteria with the allele for resistance to penicillin pass the allele to their daughter cells.

4 The mutation for resistance to penicillin is always caused by the presence of penicillin.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 4 only

D 2 and 3 only

2. Nov/2022/Paper_11/No.39

Which statements explain why some vaccines can be taken by mouth but tuberculosis (TB) vaccine has to be injected?

1 Macrophages present antigens in vaccines to stimulate an immune response.

2 The TB antigens necessary to produce an immune response are proteins which would be digested in the stomach and small intestine.

3 There are no B-lymphocytes and T-lymphocytes in the stomach.

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

3. Nov/2022/Paper_12/No.38

Cholera and tuberculosis are infectious diseases that can spread when people have to live in overcrowded conditions.

Which strategies would help control the spread of cholera **and** tuberculosis?

1 covering food to prevent flies landing on it

2 providing chlorinated drinking water

3 treating severe cases with antibiotics

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

4. Nov/2022/Paper_21/No.4(b)

(b) The glycoproteins haemagglutinin and neuraminidase are found in the influenza virus and in the virosomes used in a vaccine against the influenza virus.

Haemagglutinin binds to a receptor in the cell surface membrane of phagocytes.

Suggest why haemagglutinin is present in virosomes used in the vaccine for influenza.

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..... [2]

5. Nov/2022/Paper_21/No.5d(ii)

(ii) Malaria is another infectious disease that also involves an insect vector.

State the type of organism that causes malaria **and** name **one** organism that causes malaria in humans.

type of organism .....

name .....

[2]

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6. Nov/2022/Paper_23/No.2(b_ c)

(b) Fig. 2.2 shows the reported number of new cases of tuberculosis (TB) in the USA and the number of new cases per 100 000 of the population of the USA between 1993 and 2018.

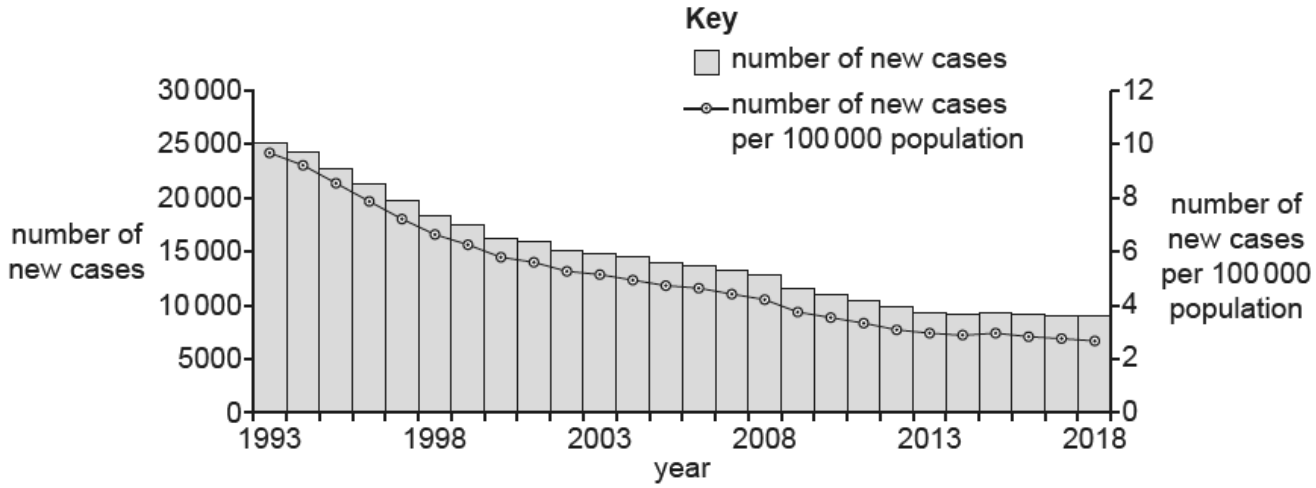


Fig. 2.2

(i) Calculate the percentage change in the number of new cases of TB in the USA between 1993 and 2018.

Show all your working.

answer ..... % [3]

(ii) Use Fig. 2.2 to describe the trend in the number of new cases of TB in the USA between 1993 and 2018.

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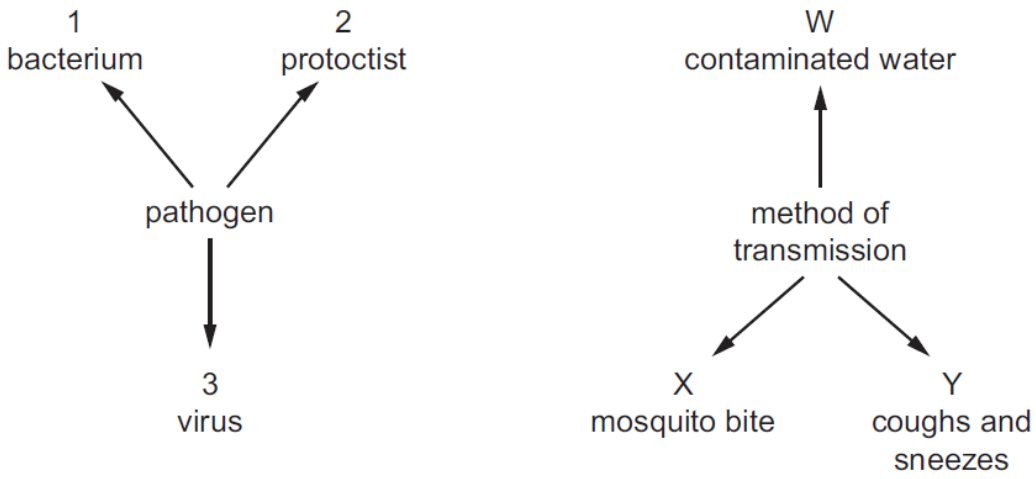
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..... [2]

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1. June/2023/Paper_9700/11/No.36

The diagram shows some of the pathogens that cause disease in humans and some of the ways they are transmitted.



What is the correct pathogen and method of transmission for malaria?

A 1 and X **B** 2 and W **C** 2 and X **D** 3 and Y

2. June/2023/Paper_9700/11/No.37

Some of the processes which result in the formation of a population of bacteria that are resistant to a new antibiotic are listed.

1 change in reproductive success of bacteria

2 increase in frequency of the resistance allele in the population

3 increase in genetic variation within the population

4 random mutation occurs in bacterial DNA

What is the correct order of these processes?

A $1 \rightarrow 3 \rightarrow 2 \rightarrow 4$

B $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$

C $3 \rightarrow 4 \rightarrow 1 \rightarrow 2$

D $4 \rightarrow 3 \rightarrow 1 \rightarrow 2$

3. June/2023/Paper_9700/12/No.38

The statements refer to the disease tuberculosis (TB).

1 The pathogen is **not** accessible to the immune system.

2 The bacterial pathogen reproduces slowly.

3 The pathogen is **not** very sensitive to antibiotics.

Which statements explain why antibiotic treatment for TB takes a long time?

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

4. June/2023/Paper_9700/12/No.39

The average sizes of some pathogens are shown.

pathogen	average size / nm
HIV particle	100
Mycobacterium tuberculosis	3 000
Plasmodium	20 000
Vibrio cholerae	1 500

One type of air filter has been shown to be effective at preventing any pathogens of 1 μm or larger from entering the air system of a room.

Based on their size **and** mode of transmission, which diseases would the air filter prevent from entering the air system of a room?

	HIV infection	TB	malaria	cholera
A	✗	✓	✓	✓
B	✗	✗	✓	✓
C	✓	✗	✗	✗
D	✗	✓	✗	✗

key

✓ = prevented

✗ = not prevented

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5. June/2023/Paper_9700/13/No.39

A student wrote four statements about cholera.

Which statement is **not** correct?

A It can be controlled by vaccination.

B It is caused by bacteria spread by ingestion.

C HIV/AIDS increases the risk of infection.

D It may be transmitted by animal vectors.

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Trypanosoma brucei is a unicellular organism that causes the infectious disease known as sleeping sickness. Insects known as tsetse flies pass on the organism from infected people to uninfected people when male and female tsetse flies feed on human blood.

(a) Fig. 4.1 is a transmission electron micrograph of the form of *T. brucei* found in human blood.

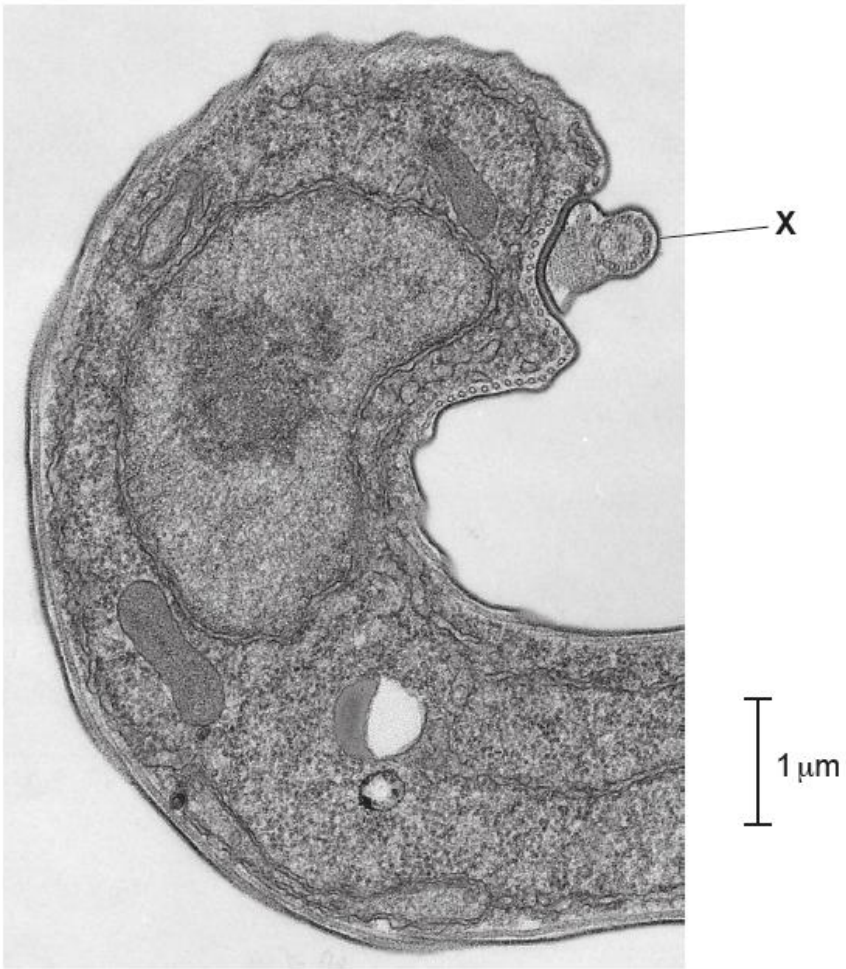


Fig. 4.1

(i) Draw an arrow on Fig. 4.1 to indicate the location in the cell where ribosomal RNA (rRNA) and proteins are assembled to make ribosomal subunits. [1]

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(ii) With reference to Fig. 4.1, explain how the structure labelled **X** provides evidence that *T. brucei* is motile (able to move).

.....

.....

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..... [2]

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(iii) With reference to Fig. 4.1, explain whether *T. brucei* is a eukaryote or prokaryote.

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..... [3]

(b) Malaria is an infectious disease caused by organisms belonging to the genus *Plasmodium*.

(i) State the term used to describe an organism that causes disease.

..... [1]

(ii) Name **one** of the species of *Plasmodium* that causes malaria.

Plasmodium ..... [1]

(c) Outline the similarities **and** differences between the modes of transmission of malaria and sleeping sickness.

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..... [3]

[Total: 11]

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7. June2023/Paper_9700/23/No.2

The number of cases of tuberculosis (TB) is affected by many biological, social and economic factors.

(a) The number of reported cases of TB in the USA between 1980 and 2000 is shown in Fig. 2.1.

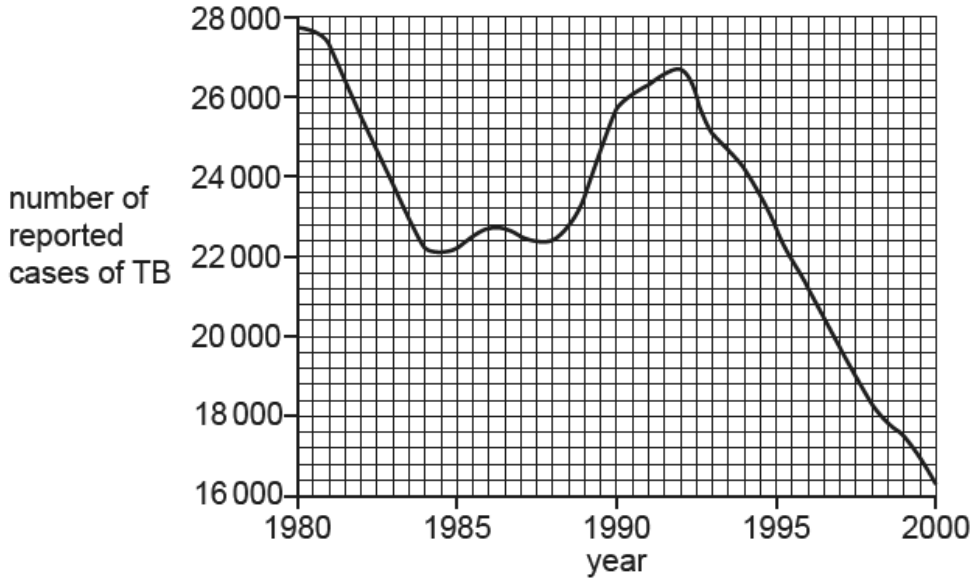


Fig. 2.1

(i) Describe the trends shown in Fig. 2.1 between 1980 and 2000.

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..... [3]

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(ii) The number of reported cases of TB between 1984 and 1992 in the USA may have been affected by an increase in the number of people infected with HIV.

Explain how an increase in the number of people infected with HIV could have affected the number of TB cases.

.....

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..... [2]

(b) *Mycobacterium tuberculosis* is a species of bacterium that causes TB. Strains of *M. tuberculosis* have evolved resistance to some of the antibiotics used to treat the disease.

State **two** ways that the impact of antibiotic resistance can be reduced.

1 .....

.....

2 .....

.....

[2]

(c) TB can affect every part of the human gas exchange system, including the trachea, bronchi and alveoli.

(i) The cartilage in the bronchi can be damaged in some people with TB.

Suggest the effect that damage to cartilage may have on the bronchi.

.....

..... [1]

(ii) Table 2.1 shows four types of cell and three structures found in the gas exchange system.

Complete Table 2.1 to show the distribution of cell types in each structure of the gas exchange system.

Use a tick (✓) if the cell type is present in the structure and a cross (✗) if the cell type is **not** present.

Put a tick (✓) or a cross (✗) in every box.

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Table 2.1

cell type	alveolus	bronchus	trachea
ciliated epithelial cell			
goblet cell			
smooth muscle cell			
squamous epithelial cell			

[3]

[Total: 11]

8. March/2023/Paper_9700/12/No.37

What defines infectious diseases?

A Symptoms are caused by a bacterium that passes from contaminated air, soil or water to a host.

B Symptoms are caused by a pathogen that is transmitted from one host to another.

C Symptoms are caused by a microorganism that is carried by a vector.

D Symptoms are caused by a virus that mutates to infect a new species.

9. March/2023/Paper_9700/12/No.38

A hurricane destroys a large town on an island. People move away from the town and set up tents, where sanitation is poor.

Which disease is most likely to spread within a week of the change in living conditions?

A cholera

B HIV

C malaria

D TB

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10. March/2023/Paper_9700/22/No.4

Tuberculosis (TB), influenza and polio are examples of infectious diseases.

(a) **(i)** Explain what is meant by an infectious disease.

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..... [2]

(ii) Name a species of organism that causes TB.

..... [1]

(b) Immunity can be described as artificial or natural **and** passive or active.

Name the type of immunity that a mother gives to her baby through breast milk.

..... [1]

(c) The influenza virus can mutate frequently to produce different strains of the virus. A new vaccine is often necessary to stimulate the production of new antibodies to these new strains.

Explain why different antibodies need to be produced to give immunity to these new strains.

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..... [3]

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(d) Polio is a serious viral disease affecting young children. In 1996, polio caused paralysis in more than 75 000 children across Africa. A long-term vaccination programme allowed the World Health Organization (WHO) to declare that Africa was largely free of polio in 2020.

(i) Explain how vaccination programmes can help to control the spread of infectious diseases, such as polio.

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..... [3]

(ii) Antibiotics, such as penicillin, do **not** help to prevent the spread of viral diseases, such as polio.

Explain why penicillin is **not** effective against viruses.

.....

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..... [1]

[Total: 11]

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Infectious diseases – AS 9700 November 2023

1. Nov/2023/Paper_ 9700/11/No.36

Which statement is correct?

A Cholera is caused by the virus *Vibrio cholerae*.

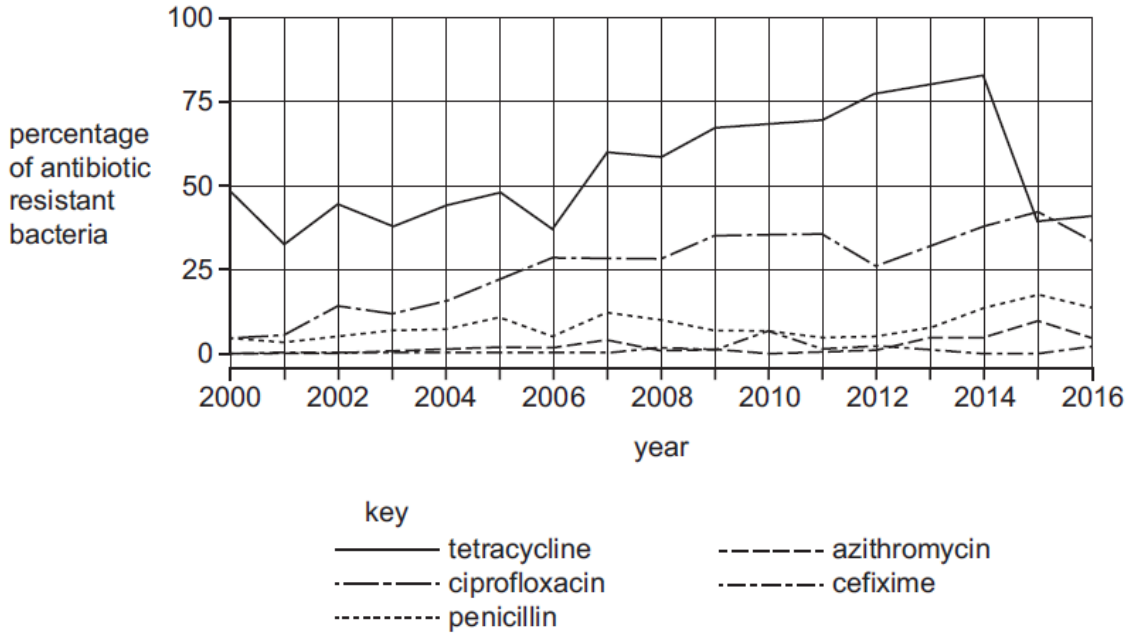
B Mosquitoes are pathogens that cause malaria.

C *Mycobacterium bovis* only causes TB in humans.

D *Plasmodium vivax* is an example of a protoctist.

2. Nov/2023/Paper_ 9700/11/No.37

The graph shows changes in the antibiotic resistance of a species of bacterium between 2000 and 2016 in one country. Samples of bacteria were collected every year from 48 hospitals. The bacteria were tested to see if they showed resistance to five different antibiotics.



What can be concluded from the data in the graph?

A Overuse of ciprofloxacin has caused antibiotic resistance to increase by more than 20% between 2000 and 2016.

B Percentage resistance to three of the antibiotics was at a peak in 2015.

C Changes in treatment guidelines have caused resistance to some antibiotics to decrease from 2015 to 2016.

D The percentage of resistant bacteria is higher in 2016 than 2000 for all antibiotics.

3. Nov/2023/Paper_ 9700/12/No.36

Which statement correctly describes infectious diseases?

A They are diseases caused by environmental factors that are not passed from one person to another.

B They are diseases caused by a fault in the DNA that can be passed from a parent to their offspring.

C They are diseases caused by a lack of a nutrient in the diet, such as a vitamin or mineral.

D They are diseases caused by a pathogen such as a bacterium, fungus, protoctist or virus.

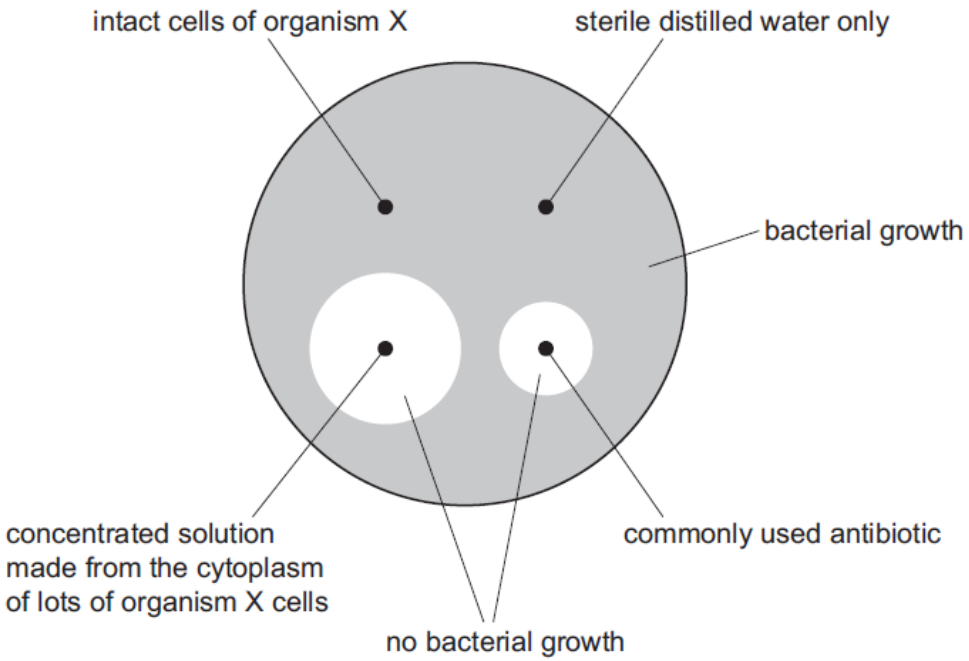
4. Nov/2023/Paper_ 9700/12/No.37

Organism X produces molecule Y, which blocks the activity of 70S ribosomes.

An experiment was carried out to investigate the effect of Y on bacterial cells.

An agar plate with bacteria growing all over its surface had four wells cut into the agar. Different substances were added to each well and the agar plate with bacteria was incubated for a week.

The diagram shows the results after a week.



Which conclusions can be made from these results?

	molecule Y functions as an antibiotic	molecule Y cannot be released from cells of organism X	molecule Y would also affect the synthesis of proteins from nuclear DNA in a human cell
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = can be concluded

✗ = cannot be concluded

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5. Nov/2023/Paper_ 9700/12/No.38

A patient has had repeated infections from the same pathogen over a few months. The patient has been treated with the same antibiotic on each occasion.

Which treatment could prevent an increase in the antibiotic resistance of the pathogen?

A a narrow spectrum antibiotic to treat a non-cellular pathogen

B a repeat prescription for the same antibiotic at a higher dose

C a specific antibiotic after testing for the pathogen

D a wide spectrum antibiotic to treat different strains of the pathogen

6. Nov/2023/Paper_ 9700/13/No.35

Which factors are required for the **efficient** diffusion of oxygen and carbon dioxide in the human gas exchange system?

1 clean and warm air entering the lungs

2 maximised area of exchange surface

3 minimum distance between alveoli and blood

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

7. Nov/2023/Paper_ 9700/13/No.37

Bacteria can become resistant to antibiotics.

What can help reduce the development of antibiotic resistance in bacteria?

1 Use specific antibiotics instead of wide spectrum.

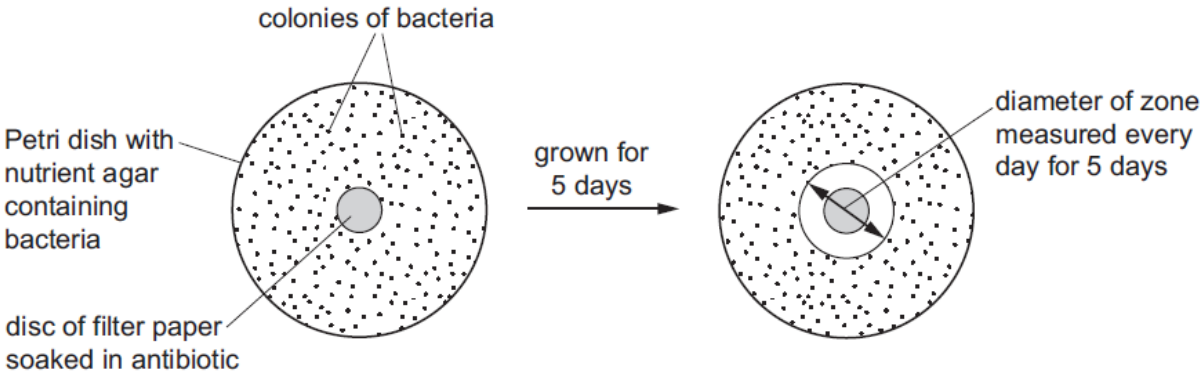
2 Use antibiotics to treat viral infections.

3 Develop new antibiotics.

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

8. Nov/2023/Paper_ 9700/13/No.38

The diagram shows one way of testing the effect of an antibiotic on bacteria.



The table shows the results of testing five different types of bacteria.

Zones of less than 13.0 mm show the presence of resistant bacteria.

type of bacteria	diameter of zone / mm				
	day 1	day 2	day 3	day 4	day 5
1	24.1	21.9	19.0	17.6	14.3
2	18.6	15.4	12.2	9.0	2.0
3	17.9	12.8	12.4	11.1	10.9
4	19.4	15.3	13.2	8.1	2.0
5	22.0	21.0	20.5	20.4	20.4

Which statement can be supported by this data?

A All the types of bacteria become resistant to antibiotics over time.

B Only types 2, 3 and 4 of the bacteria show resistance to the antibiotic.

C The antibiotic can be used to treat types 1 and 3 only.

D Type 5 of the bacteria can never become resistant to the antibiotic.

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9. Nov/2023/Paper_ 9700/21/No.4

Some people who are infected with HIV develop HIV/AIDS.

(a) Fig. 4.1 shows the number of people that have been newly infected with HIV (new infections) in 2018 across the world and the percentage changes in the number of new infections since 2010.

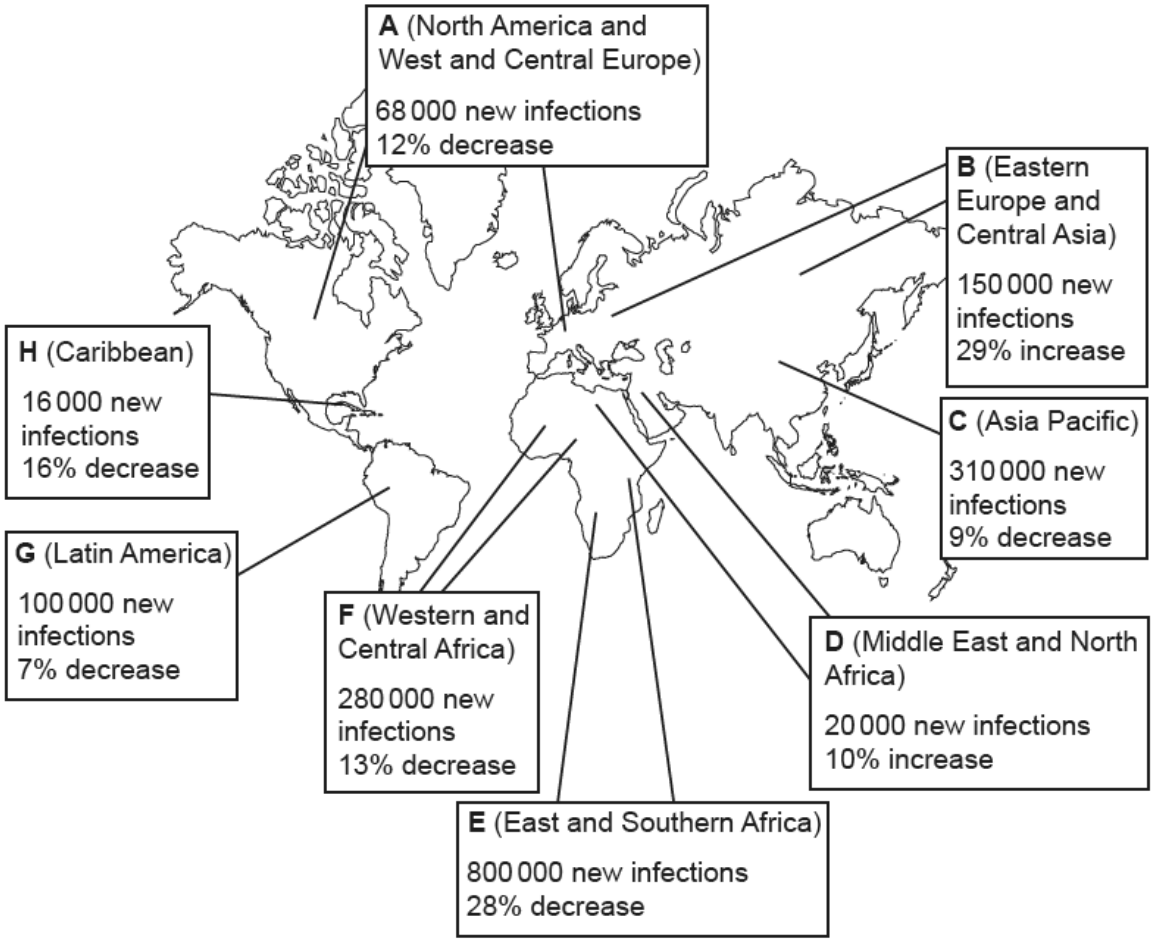


Fig. 4.1

(i) State the full name of the pathogen HIV.

..... [1]

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(ii) Using **only** the data in Fig. 4.1, state what can be concluded about the change in number of new HIV infections across the world between 2010 and 2018.

You may use the letters in Fig. 4.1 to identify the regions of the world.

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..... [4]

(b) People who develop HIV/AIDS have fewer T-helper cells as the pathogen destroys these cells. This makes them more susceptible to tuberculosis (TB).

Explain why people with HIV/AIDS are more likely to develop TB.

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..... [4]

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(c) A person infected with HIV may develop a heart condition called cardiac tamponade.

The pericardium is a thin sac surrounding the heart, as shown in the healthy heart in Fig. 4.2. When a person develops cardiac tamponade, the pericardium starts to fill with blood. This prevents the ventricles functioning efficiently.

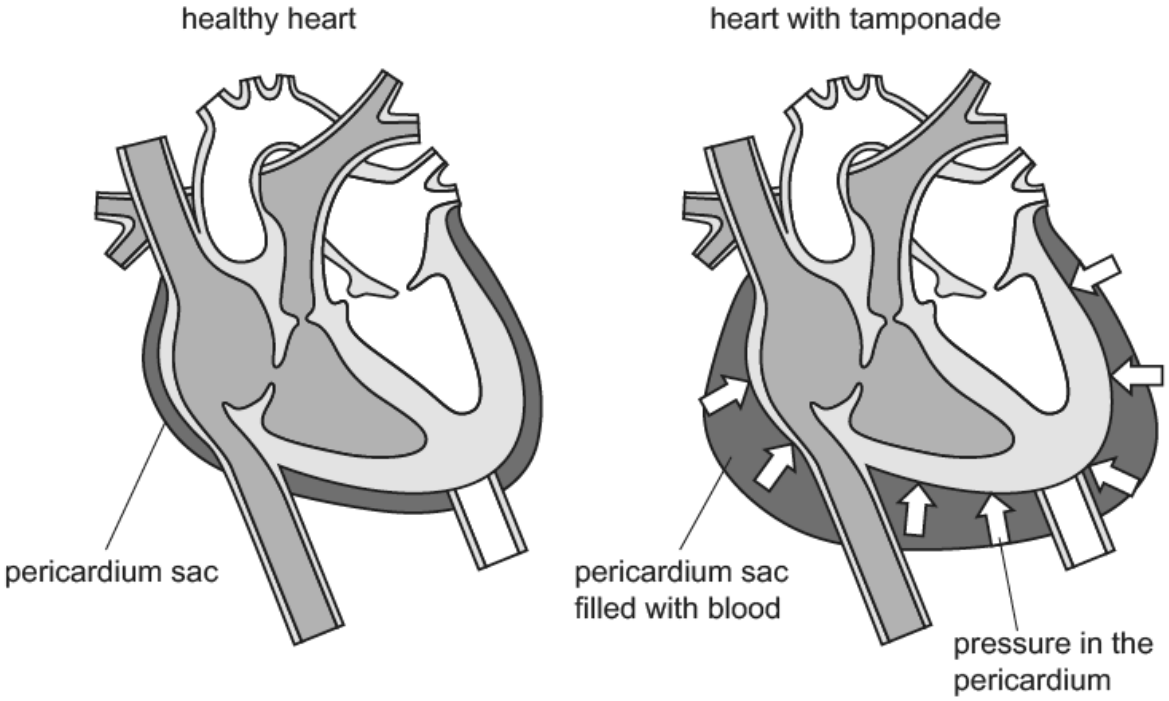


Fig. 4.2

People with cardiac tamponade experience a variety of symptoms including low blood pressure and an increased breathing rate.

Suggest why a person with cardiac tamponade would experience symptoms of low blood pressure and an increased breathing rate.

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..... [4]

[Total: 13]

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10. Nov/2023/Paper_ 9700/22/No.5

Tuberculosis (TB) is an infectious disease caused by a bacterium. In the majority of people, only the lungs are affected.

In most cases, the transmission of TB from an infected person to an uninfected person involves *Mycobacterium tuberculosis*. A different species of bacterium is involved in the transmission of TB from cattle, such as dairy cows, to humans.

(a) Name the species of bacterium causing the transmission of TB from dairy cows to humans.

..... [1]

(b) In some areas, cattle cannot be regularly tested or treated for TB. In these areas, milk and dairy products from infected dairy cattle may enter the human food chain.

Outline a control measure that can be taken to protect people that consume milk and dairy products from these infected cattle.

.....

..... [1]

(c) Cattle are not usually affected by *M. tuberculosis*, but the pathogen can cause disease in other animals.

A few cases of transmission of TB from people to animals have been reported.

Explain the most likely mode of transmission of TB from an infected person to an animal.

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..... [2]

(d) In most people, the response of the immune system to the infection of lung tissue by *M. tuberculosis* can prevent the spread of the bacterium to other organs of the body. The bacterium is contained in the lungs in a dormant state. This is known as latent TB.

Outline the treatment that is used to kill *M. tuberculosis* in latent TB infections.

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..... [2]

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(e) *M. tuberculosis* can spread in the blood and lymph to other organs in the body.

In very rare cases, a disease known as mycotic aneurysm can be caused by infection of the arterial wall, particularly in elastic arteries. The damage caused by the pathogen can lead to a rupture (bursting) of the artery.

With reference to the structure of the wall of **elastic** arteries, suggest how damage caused by *M. tuberculosis* infection can lead to the rupture of the artery.

You may draw a diagram if you wish.

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Space for diagram

[3]

[Total: 9]

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11. Nov/2023/Paper_ 9700/23/No.1

The malarial pathogen, *Plasmodium falciparum*, enters red blood cells after a person becomes infected. After some time, each cell of *P. falciparum* divides to form daughter cells.

Fig. 1.1 shows a cell of *P. falciparum* that is forming many daughter cells.

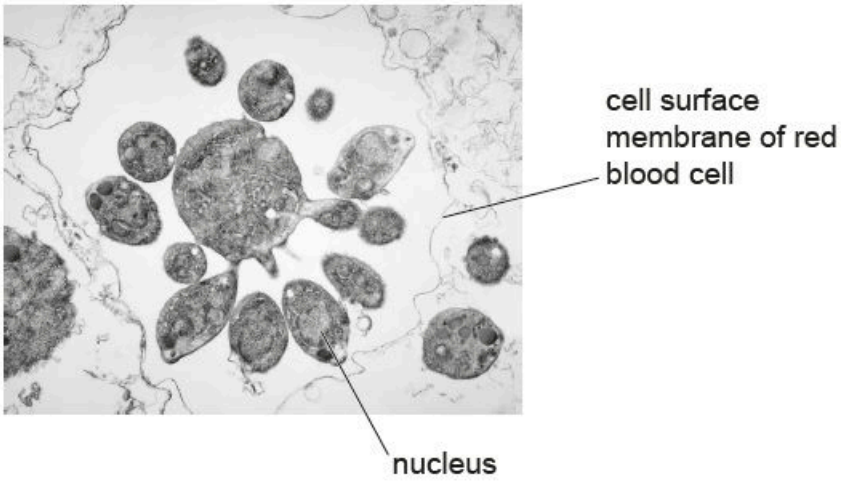


Fig. 1.1

(a) With reference to Fig. 1.1, suggest how the presence of *P. falciparum* affects a red blood cell.

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..... [3]

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(b) When *P. falciparum* divides there is unequal division of the cytoplasm to form small, genetically identical daughter cells.

Outline the events that occur in the cell of *P. falciparum* to form the daughter cells shown in Fig. 1.1.

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..... [3]

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In 2013, the World Health Organization (WHO) set a target for researchers to create a vaccine for malaria. WHO required the vaccine to show 75% efficacy and be ready for use by 2030.

Efficacy is a measure of the effectiveness of a vaccine in reducing the number of new cases of malaria.

A trial of the R21/Matrix-M^{TM} vaccine in Burkina Faso in 2020 achieved a 77% efficacy over a 12-month period. A control group received a vaccine for rabies.

Vaccines stimulate an immune response with the production of antibodies.

(c) Explain how antibodies will reduce the spread of the malarial pathogen through the bloodstream.

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..... [3]

(d) Some vaccination programmes have been more successful than others.

Discuss the factors that contribute to the success of a vaccination programme.

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..... [5]

[Total: 14]

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