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*.

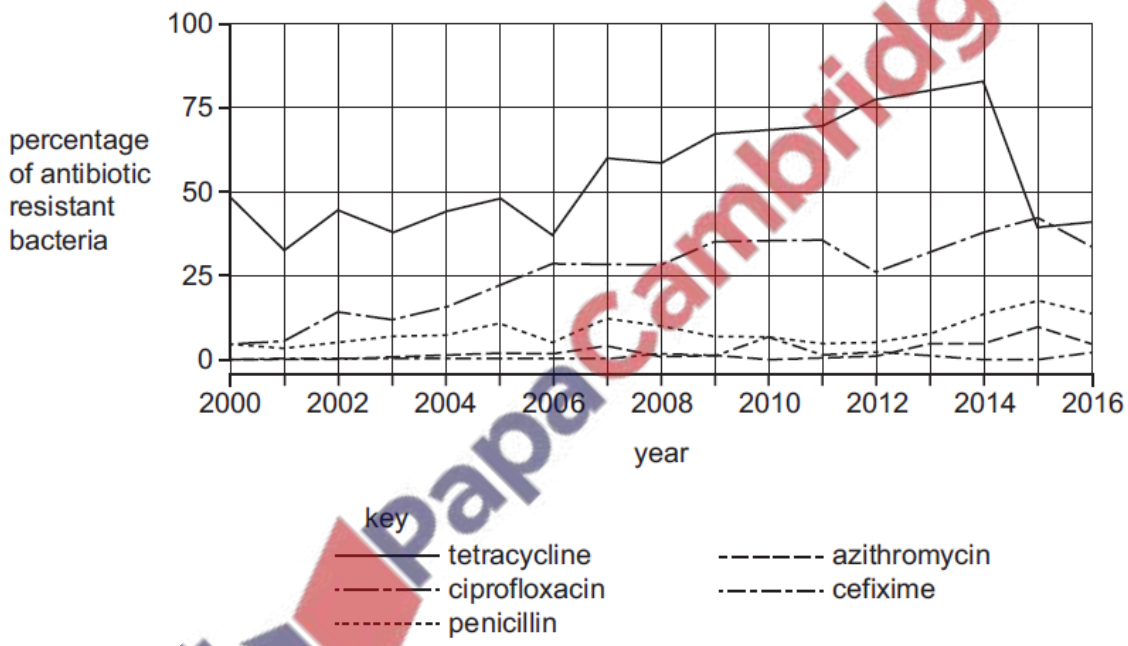
B Mosquitoes are pathogens that cause malaria.

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.

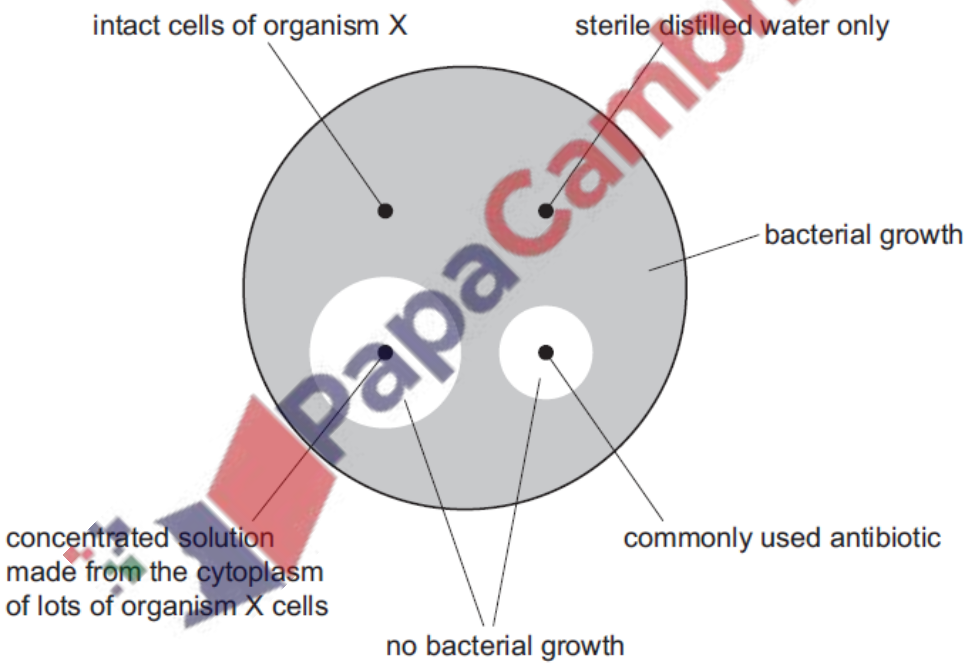
4. Nov/2023/Paper_ 9700/12/No.37

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

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.

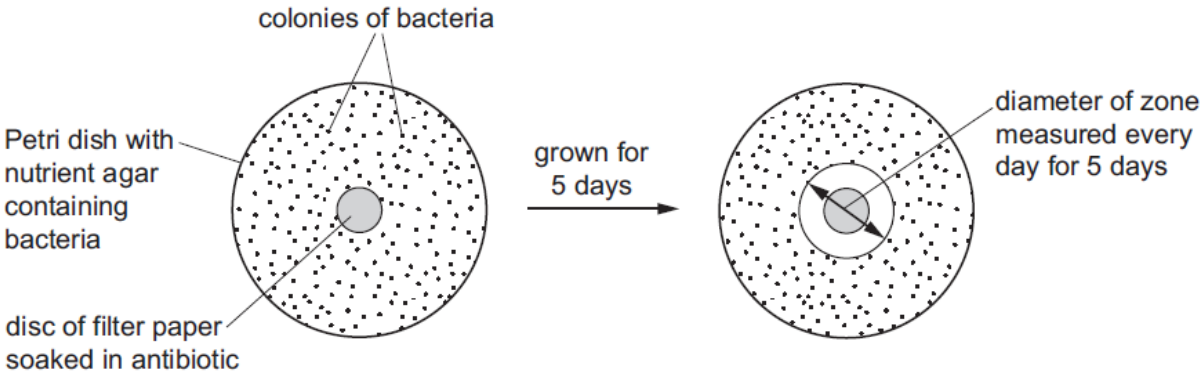
2 Use antibiotics to treat viral infections.

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.

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.

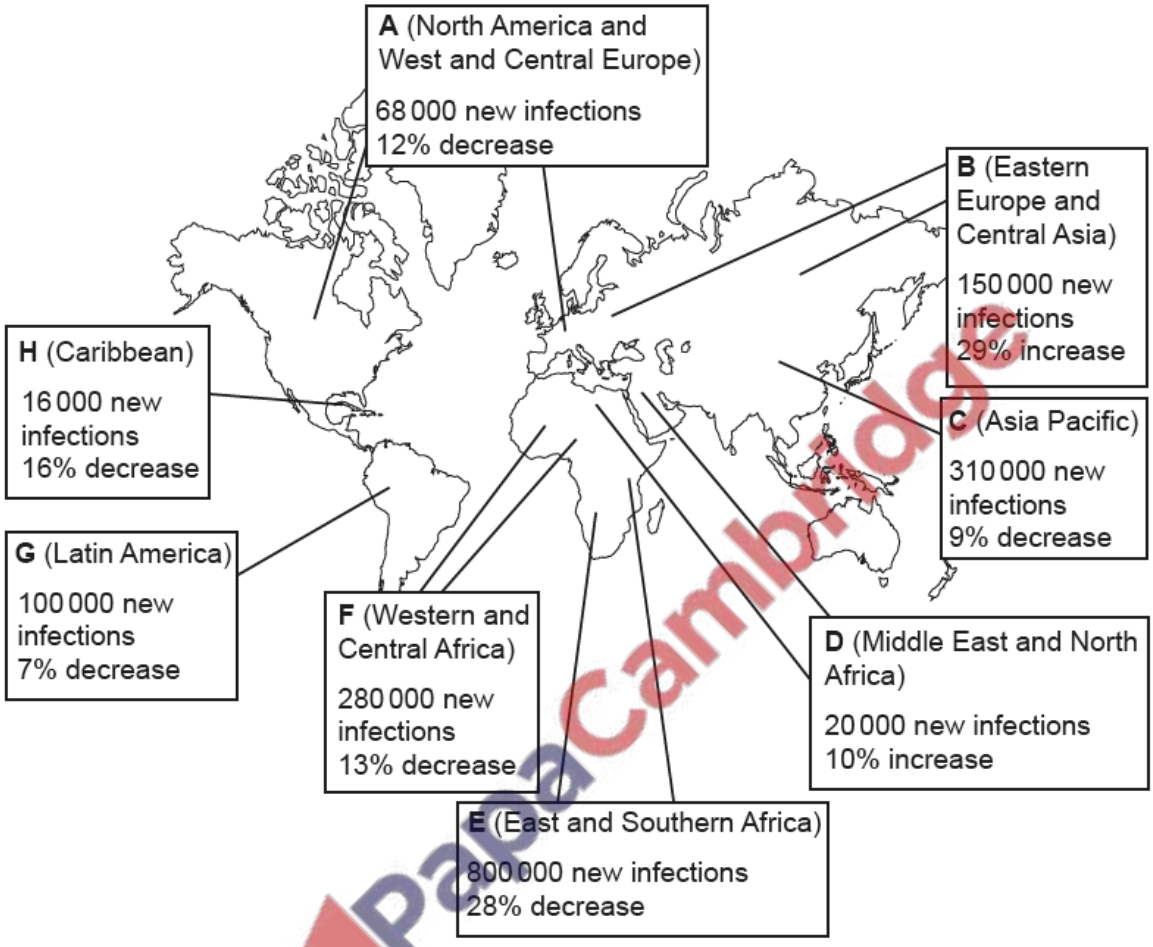


Fig. 4.1

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

..... [1]

(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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(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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(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.

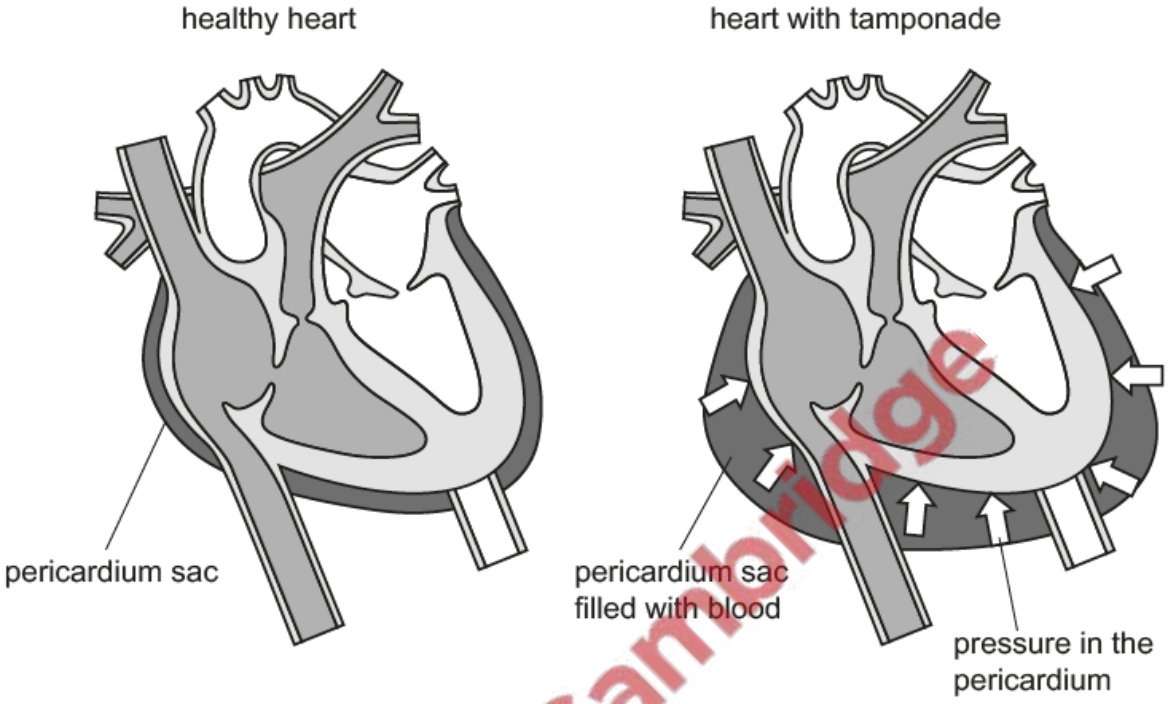

Fig. 4.2

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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[Total: 13]

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.

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(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.

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(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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(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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(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]

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.

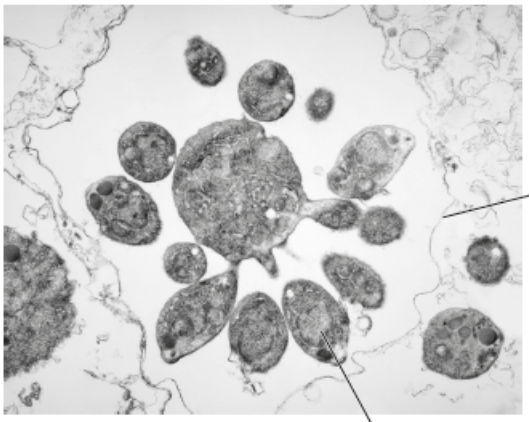

Fig. 1.1

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

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(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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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™ 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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(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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[Total: 14]