

Unit 3 Biology

Revision Booklet 6

Topics

Infection

&

Disease

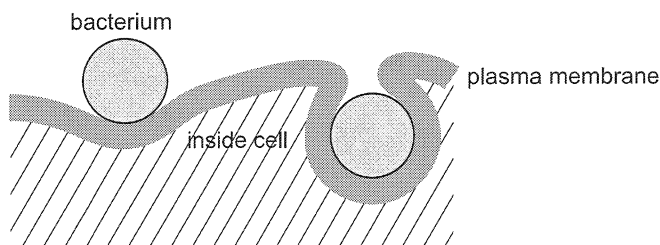
Name:

Question 5

2011

Neisseria meningitidis is a bacterium that causes meningitis. This disease causes inflammation of tissue surrounding the brain and spinal cord in humans.

Bacteria enter through plasma membranes as shown in the figure below.



- a. Name the process shown in the figure.

1 mark

In an attempt to prevent the spread of the bacteria the immune system releases antibodies and macrophages to an area of infection.

- b. Describe how antibodies and macrophages inhibit the spread of *N. meningitidis*.

2 marks

N. meningitidis can protect itself from the immune system by releasing a protease that breaks the subunits of the antibody.

- c. Why is this enzyme named a protease?

1 mark

A patient infected with *N. meningitidis* can be given a drug that acts as an inhibitor to the protease enzyme.

- d. Explain why the drug needs to have a shape complementary to the protease enzyme.

1 mark

Total 5 marks

Question 8

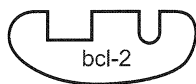
Cancer is a disease characterised by the rapid multiplication of cells. It is often treated with the use of chemicals, however damage may occur to non-cancer cells.

- a. Explain how damaging bone marrow cells could be life threatening.

2 marks

Normally, a protein called BH3 combines with bcl-2 protein to prevent uncontrolled cell production. Cancer patients have very low levels of BH3 protein in their cells.

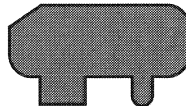
Scientists established the structure of the bcl-2 protein, represented below.



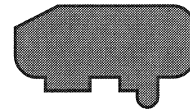
They developed three chemicals that had the potential to have the same action as BH3. The structure of these is shown below.



chemical 1



chemical 2



chemical 3

Each chemical was investigated to test its effectiveness to combine with bcl-2.

- b. i. Suggest which chemical is likely to be the most successful in combining with bcl-2.

- ii. Give a reason for your choice.

1 + 1 = 2 marks

A fourth form of BH3 was developed and found to be more successful than the best of chemicals 1, 2 and 3. Chemical 4 is shown below.



chemical 4

- c. Outline a possible reason why chemical 4 could be more successful in treatment of the patients than the previously tested chemicals.

1 mark

Total 5 marks

Question 8 2007

Viruses are responsible for many diseases.

- a. Name one natural feature of the body that acts as a first line of defence when a person comes in contact with a pathogen.

1 mark

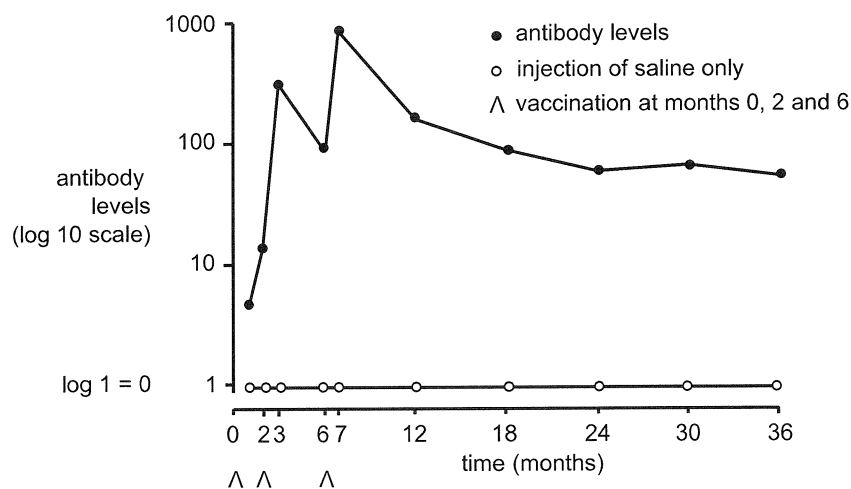
After infection with a virus, some cells secrete interferons.

- b. Describe the role of interferons.

1 mark

Cervical cancer is a rare consequence of persistent infection by the Human Papilloma Virus (HPV) in some women. The virus is transmitted sexually and may cause genital warts in both males and females. The natural immune response to this virus is not very effective.

Recently a vaccine has been produced to prevent this viral infection and therefore reduce the incidence of cervical cancer. The vaccine contains virus-like particles from the protein coat of the virus in a saline solution. The graph below shows the antibody response to a trial vaccination program in 16–23-year-old women, to whom three doses were given. Another group of women received injections of saline only.



- c. In the design of the vaccine, what feature prevents the virus-like particles infecting cells and causing disease?

1 mark

- d. What is the purpose of injecting some women with a saline solution?

1 mark

- e. Why does the antibody response increase with each vaccination?

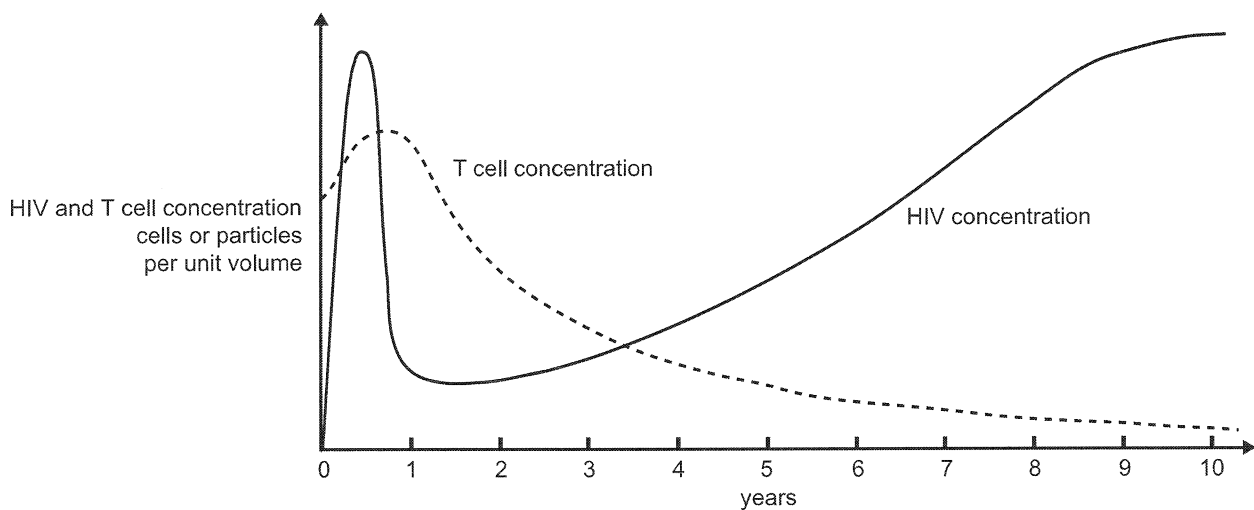
Question 8 2006

The disease AIDS is the result of infection by the human immunodeficiency virus (HIV), a retrovirus which has RNA as its genetic material.

- a. RNA is a nucleic acid, which is described as a polymer composed of a series of monomers. Draw a labelled diagram of a monomer of RNA.

2 marks

A person infected with the HIV virus was monitored for several years for the level of T cells and HIV particles. The results are summarised in the following graph.



- b. Explain what is happening in the first year after infection with the HIV virus.

1 mark

- c. In the second to fifth years (inclusive) after infection the patient has swollen lymph nodes. Explain.

1 mark

- d. Nine years after infection, describe what has happened to the immune system of the patient.

1 mark

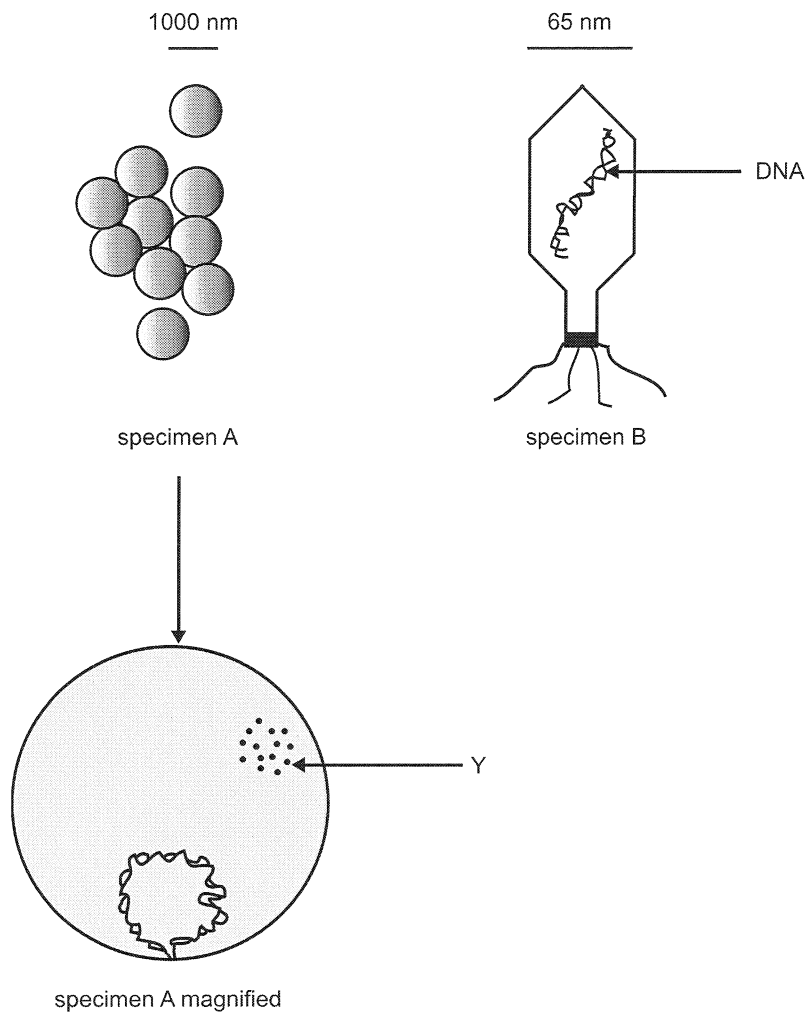
- e. During its cycle in a cell the virus undergoes many changes in its genetic material. This has made treatment very difficult. Currently a mixture of drugs which target different stages of the viral cycle are used. Why has this treatment been more successful than treatment with only one drug?

1 mark

Total 6 marks

Question 2 2005

The following diagram shows two examples of pathogens. The relative size of each is indicated.



- a. i. The structures at Y are distributed uniformly throughout specimen A. What are the structures at Y?
-
- ii. What is the function of these structures?
-

1 + 1 = 2 marks

Specimen B is an example of a pathogenic agent.

- b. i. Name the kind of pathogenic agent.
-
- ii. What is the significant feature that is used to distinguish a pathogenic agent from a pathogenic organism?
-

1 + 1 = 2 marks

Elephantiasis is a human disease caused by the presence in the lymphatic system of a particular parasitic worm, *Wuchereria bancrofti*. The adult worms block the lymphatic vessels so accumulation of lymph causes swelling in the surrounding tissues. Adult female worms produce larvae that enter the human bloodstream.

When an infected person is bitten by a mosquito the larvae pass, with the ingested blood, into the stomach of the mosquito. The larvae burrow their way through the mosquito stomach wall. After going through a series of body changes the larvae move back to the mouth of the mosquito. These larvae are then passed into the blood of a human the next time the mosquito bites a human. The larvae then move to the lymph nodes and mature into adult worms.

- c. What is the role of the mosquito in the life cycle of *Wuchereria bancrofti*?

1 mark

- d. What is one structural feature you would expect to find in the larvae that helps it survive in the mosquito?

1 mark

- e. What is another different structural feature you would expect to find in the larvae that helps it survive in the human?

1 mark

After a person has been bitten by a mosquito carrying the larvae, the symptoms of the disease may not appear for several months or even years.

Millions of people living in tropical areas of the world have been infected with this parasitic worm.

- f. Describe one method that may be used to control the spread of this parasitic worm.

1 mark

Total 8 marks