

6.3 Defence Against Infectious Disease

Question Paper

Course	DP IB Biology
Section	6. Human Physiology
Topic	6.3 Defence Against Infectious Disease
Difficulty	Medium

Time allowed: 60
Score: /48
Percentage: /100

Question 1a

- a) Describe how mucous membranes form a primary defence against pathogens that cause infectious disease.

[3 marks]

Question 1b

- b) When the skin is cut microorganisms may enter the body. One defence against this is blood clotting.

Outline the cascade of events that results in blood clotting.

[5 marks]

Question 1c

- c) The table shows data on the number of deaths from coronary thrombosis in the UK.

Year	Number of deaths from coronary thrombosis
2012	562
2014	554
2016	545
2018	538
2020	529

Predict the number of people who died in 2022 if the trend remained the same.

[1 mark]

Question 1d

- d) Stopping smoking has shown to be associated with reducing the incidence of coronary thrombosis.

State one other change of lifestyle that may reduce the incidence of coronary thrombosis.

[1 mark]

Question 2a

- a) Outline the difference between antibodies and antigens.

[2 marks]

Question 2b

- b) The human immunodeficiency virus (HIV) can cause an immune response in its host.

Describe and explain the effect of HIV on the immune system.

[2 marks]

Question 2c

- c) Rhinoviruses that cause the common cold may be destroyed by phagocytosis when they enter a human body.

Describe how this occurs.

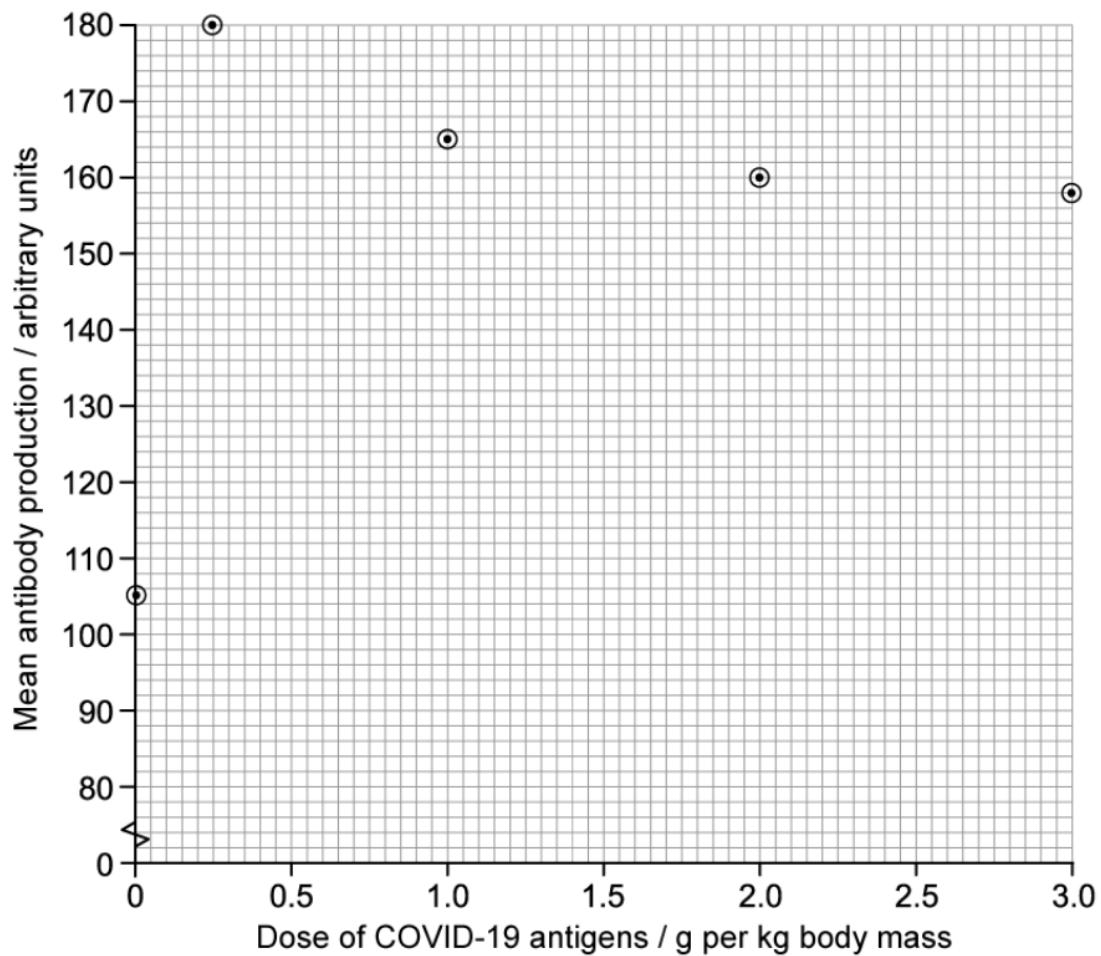
[4 marks]

Question 2d

d) Vaccinations often contain antigens. Scientists investigated whether having a fourth Covid-19 vaccination booster could increase antibody production by the immune system.

- They divided a large number of mice into five groups.
- They injected the mice in each group with a different amount of COVID-19 antigens.
- The scientists then measured mean antibody production in the mice.

The graph below shows their results.



Use the graph to describe the effect of COVID-19 antigens on mean antibody production.

[1 mark]

Question 3a

- a) Scientists investigated the presence of bacteria resistant to the antibiotic tetracycline in poultry and in the farmers who kept them. They looked for *Escherichia coli* (*E.coli*) resistant to tetracycline. The scientists took samples of faeces from the poultry birds and the farmers. Turkey farmers often used food containing tetracycline, whereas chicken farmers did not very often.

The bacteria were grown on nutrient agar containing tetracycline. Resistant bacteria grew and were visible as colonies on the agar plates.

The results are shown in the table below.

Sample taken from	Percentage of samples from faeces containing <i>E.coli</i> resistant to tetracycline
Chickens	26
Chicken farmers	9
Turkeys	83
Turkey farmers	56

Suggest a hypothesis the farmers were testing in this investigation.

[1 mark]

Question 3b

- b) Describe the results of the scientists' investigation described in part (a).

[2 marks]

Question 3c

- c) Scientists investigated treatment of a human respiratory infection caused by a species of bacterium. This species of bacterium is often resistant to the antibiotics currently used for treatment. They investigated the use of a new antibiotic to treat the respiratory infection. The new antibiotic blocks DNA replication in bacterial cells.

The scientists tested the new antibiotic on mice with the same respiratory infection. The antibiotics were given to the mice at a dose of 25 mg kg^{-1} per day.

Calculate how much antibiotic would be given to a 33 g mouse each day.

[2 marks]

Question 3d

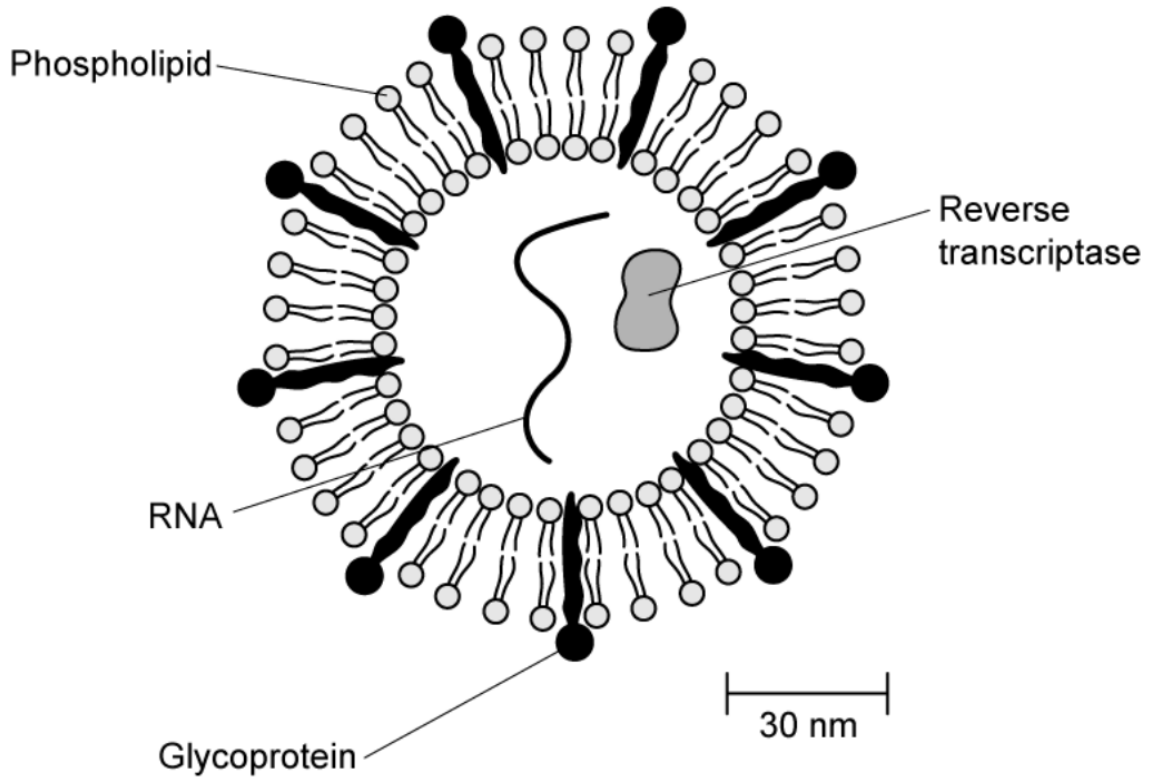
- d) The antibiotic tetracycline is used to treat human bacterial infections such as pneumonia and other respiratory tract infections. This antibiotic is safe to use in humans as it does not inhibit or block processes such as DNA replication, ribosome function, transcription or translation.

Suggest why these processes are not inhibited in humans but can be in bacteria.

[1 mark]

Question 4a

a) The diagram shows a human immunodeficiency virus (HIV).



Suggest, with a reason, which labelled component of the virus is most likely to act as an antigen.

[2 marks]

Question 4b

b) HIV is described as a retrovirus.

Describe what is meant by the term retrovirus.

[3 marks]

Question 4c

- c) Antibiotics are **not** used to treat viral infections, such as HIV.

Explain why.

[1 mark]

Question 4d

- d) Misuse of antibiotics can cause antibiotic resistance.

Outline two ways to prevent antibiotic resistance.

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

- a) Howard Florey and Ernst Chain carried out experiments on mice and humans in the 1930s to test the effectiveness of penicillin.

Describe Florey and Chain's experimental method for testing penicillin on mice.

[5 marks]

Question 5b

- b) Florey and Chain's experiments involved some risks.

Outline the risks involved in their experiments.

[3 marks]

Question 5c

- c) Compare and contrast current drug testing protocols with Florey and Chain's experiments.

[7 marks]

