Communicable diseases,disease prevention & the immune system

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Biodiversity, evolution and disease
Topic	Communicable diseases, disease prevention & the immune system
Booklet	Model Answers 2

Time allowed: **41 minutes**

Score: **/30**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

Influenza (flu) is a disease that affects millions of people worldwide. Many vulnerable people receive vaccinations against flu each year.

(a) A flu vaccination consists of a suspension of antigenic material from the flu virus, which is then injected into patients.

Tick the box that best describes the type of immunity provided by the flu vaccination.

active and natural	
active and artificial	✓
passive and natural	
passive and artificial	

[1]

The flu vaccination involves injecting some of the antigenic material from the virus into the patient. This causes their immune system to launch a response, building immunity to the virus. This is **active** immunity. Because the vaccine has been made, rather than the virus entering the body naturally. Therefore, this is **artificial**.

(b) Fig. 2.1 represents an influenza virus. Various protein antigens are attached to the outer surface of the virus.

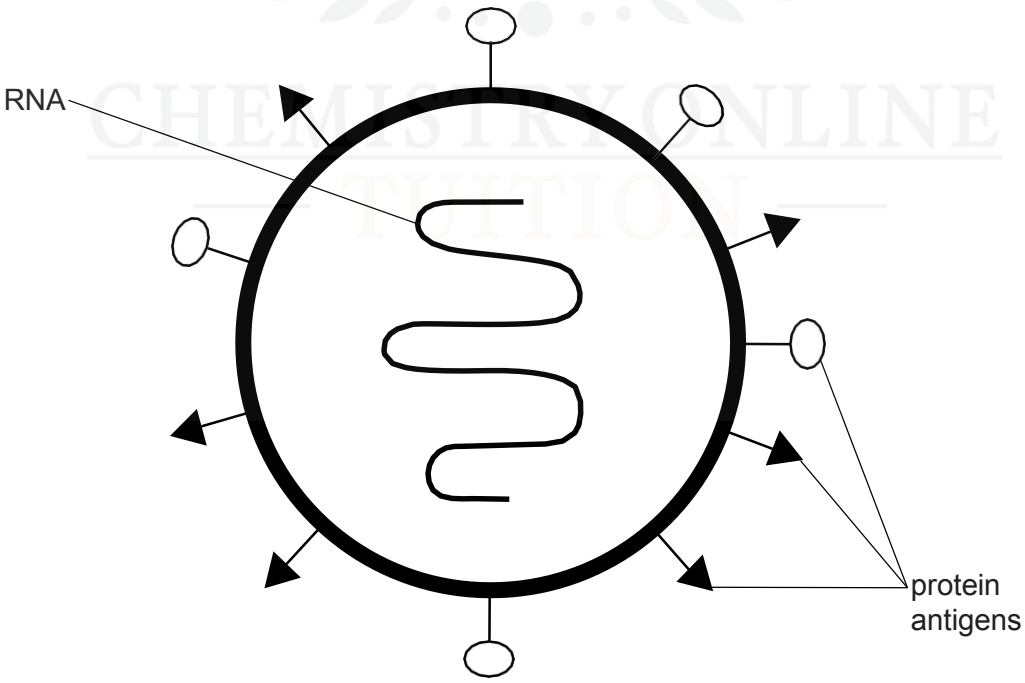


Fig. 2.1

When a virus infects a human host, it causes the host's cells to produce many new copies of the virus.

(i) The flu vaccination must be given each year because there are frequent mutations in the RNA of the virus.

The antigens on the surface of the virus are made of protein.

The virus uses the organelles and enzymes in the host's cells to produce new copies of itself.

Suggest the role of the viral RNA in the production of viral proteins. **[2]**

The role of viral RNA in the production of viral proteins is:

- Viral RNA acts as a host cell
- RNA carries the code for viral protein
- To the ribosomes

***Exam tip**: this is a 'suggest' question. This means that you may not have been taught this content directly. You will need to use the knowledge that you already have. Here, you should be able to link your knowledge of how eukaryotic cells make proteins.*

(ii) Explain why a mutation in the viral RNA leads to a change in the 3-D shape of the protein antigens. **[3]**

A mutation in the viral RNA leads to a change in the 3D shape of the protein antigens because:

- altered base sequence of viral RNA means an altered primary structure of amino acids
- therefore the R-groups interact differently
- The tertiary structure is determined by the primary structure
- The 3-D shape is tertiary structure

***Note:** this is a very common question, which often comes up in different contexts. You need to understand that a change in the primary structure of a protein (amino acid sequence), means that this will have knock on effects on the secondary and tertiary structures. A change in tertiary structure will often have an effect on function*

(iii) The head teacher of a school decided to offer teachers free flu vaccinations every year.

Suggest why the head teacher thought this would be a good use of the school's money. **[1]**

The teacher thought that free flu vaccinations for teachers would be a good idea because:

- money would be saved / education improved / fewer sick days / reduced spread (of virus)

***Exam tip**: this is a 'suggest' question; this means that you may not have been taught this content directly. You will need to use the knowledge that you already have, and apply it to this question.*

(c) Compare the primary and secondary immune response by filling in the table below.

	Primary response	**Secondary response**
Relative concentration of antibodies produced	lower	higher
Relative duration of response	shorter	longer

[2]

The primary response occurs when the body is exposed to the pathogen for the first time. This response creates memory cells, so that when the pathogen enters again, the response can be significantly quicker, meaning that no symptoms will be experienced.

(d) Name **two different** types of T-lymphocytes **and** describe their roles in the immune response.

[2]

T-lymphocytes found in the immune system are:

- Helper cells that release cytokines to stimulate B cells
- Killer cells secrete toxic substances to kill infected cells
- Memory cells allow a faster secondary immune response

[Total: 11]

Question 2

Antibodies are important biological molecules.

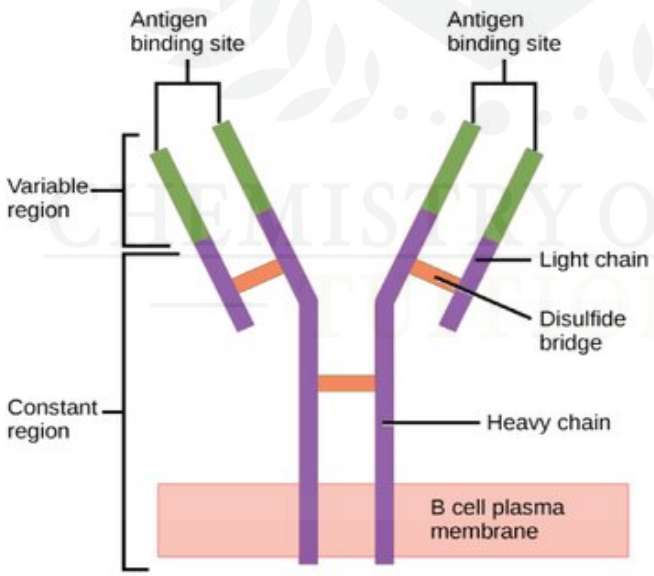
(a) Describe how the structure of antibodies allows them to perform their function.

In your answer you should clearly link structure to function. **[7]**

Antibody structure links to function:

- Made of 2 light chains and 2 heavy chains
- disulfide bonds hold light and heavy chains together
- variable region allows binding to antigen
- two variable regions allow binding of more than one antigen
- variable region on different antibodies allows specificity to different antigens
- constant region allows recognition by phagocytes
- hinge region allows flexibility

Diagram to show the structure of an antibody:



***Exam tip**: to gain a QWC mark here, you need to include a statement linking structure and function for the constant region, and one other region.*

(b) Antibodies can defend the body against pathogens in a number of ways.

Outline the mode of action of antibodies in defending the body against pathogens by describing the processes of **neutralisation** and **agglutination**. **[4]**

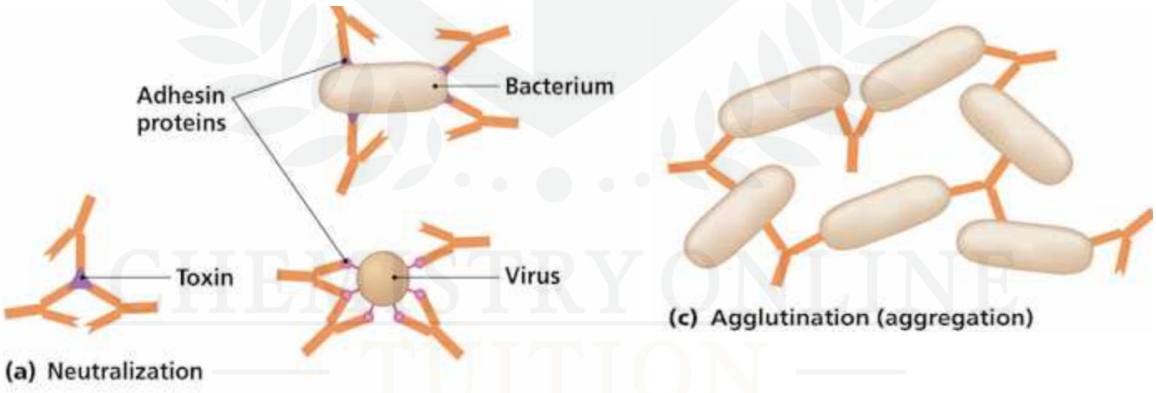
Neutralisation:

- blocks binding site
- bind to toxins
- prevents entry to host cell

Agglutination:

- clump together many pathogens
- the clump is too large to enter host cell
- more can be consumed by phagocyte at once

Diagram to show processes of neutralisation and agglutination:



[Total: 11]

Question 3

Vaccination can provide immunity to disease.

(a) Complete the following passage by using the most appropriate term from the list.

active **antigen(s)** **double-helix** **membrane(s)** **memory**

mutation **passive** **phagocytic** **receptor(s)**

species **specific** **strand** **strain** **white blood**

Some vaccines contain a dead or weakened form of a pathogen. The Antigens on the cell surface of the pathogen are still able to trigger the production of specific antibodies in the person being vaccinated. Cells called memory cells are also produced, which retain the ability to divide and produce the antibodies quickly, should the pathogen return.

A new strain of pathogen can arise if there is a mutation in the DNA of the pathogen. If this happens, the original vaccine is not likely to be effective.

[5]

(b) The term *immunity* is often used when describing how vaccines work.

In a piece of school homework a student wrote:

"Bacteria can evolve quickly and many are now immune to antibiotics."

Explain why the student's use of the word 'immune' was incorrect. **[3]**

The use of 'immune' is incorrect because:

- Because immunity involves an immune system
- The correct term is resistant
- bacteria are unicellular and only multicellular organisms have an immune response

[Total: 8]