Model Answers: Medium

1

The correct answer is **D**, this statement is incorrect because:

- The activation of the immune system to produce **antibodies** by plasma cells is **active immunity**
- The activation of the immune system would produce memory cells, so the protection would be long-lived

A, B & **C** are incorrect as all of these answers describe correctly how the body defends itself against infectious disease.

2

The correct answer is **D** because:

- The antiserum will contain **antibodies** that can bind to the toxin; the transfer and use of antibodies provides **passive** immunity as the immune system has not been activated
- The antiserum has not been produced by the patient but made in the horse and injected - this would make it **artificial**

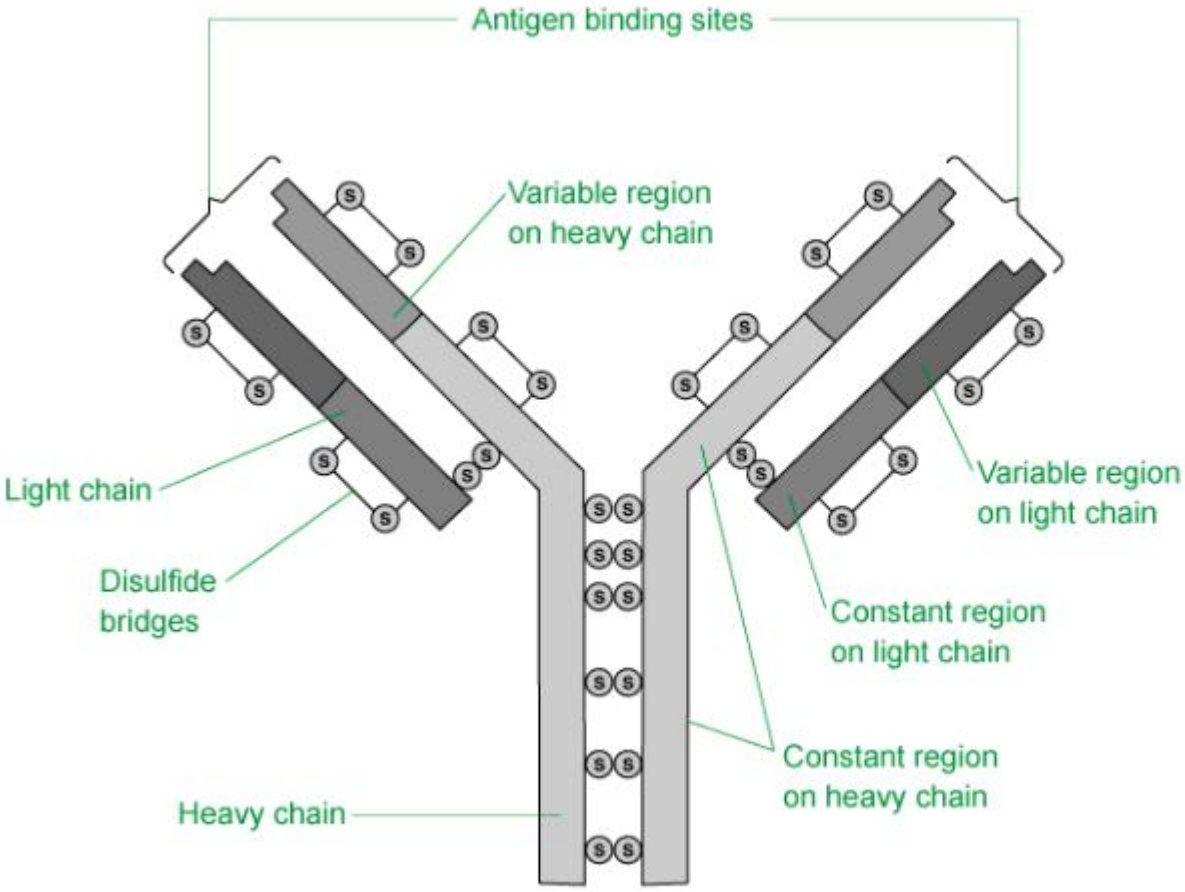
A is incorrect as the process involves an injection, this would be an artificial process.

B & **C** are incorrect as this would be a passive process and does not involve the activation of the immune system.

3

The correct answer is **C** because:

- Antibodies do have both a **tertiary and quaternary** structure; as more than **one polypeptide chain** is needed to make an antibody
- The antibody structure is held together by **disulfide bonds** between the heavy and the light chain at the hinge region and between the two heavy chains – see diagram below



- The secondary and tertiary structure of the peptide molecule will depend on the **hydrogen and peptide bonds**

A, B & **D** are incorrect as the four polypeptide chains give two antigen-binding sites.

4

The correct answer is **D** because:

- The changing **antigens** on the surface of the pathogen means that new antibodies need to be produced to target each type of antigen.
- **Antibodies** are specific for the antigen they are made for, so if changes to the **antigen** structure occur then any antibodies produced from activated memory cells from a previous infection/vaccination would more than likely not be effective.
- This is the biggest problem when developing vaccines for infections caused by viruses responsible for colds and flu – these viruses have high mutation rates which can lead to changing antigens.

A, B & **C** are incorrect as these statements would not prevent a vaccine from being produced.

5

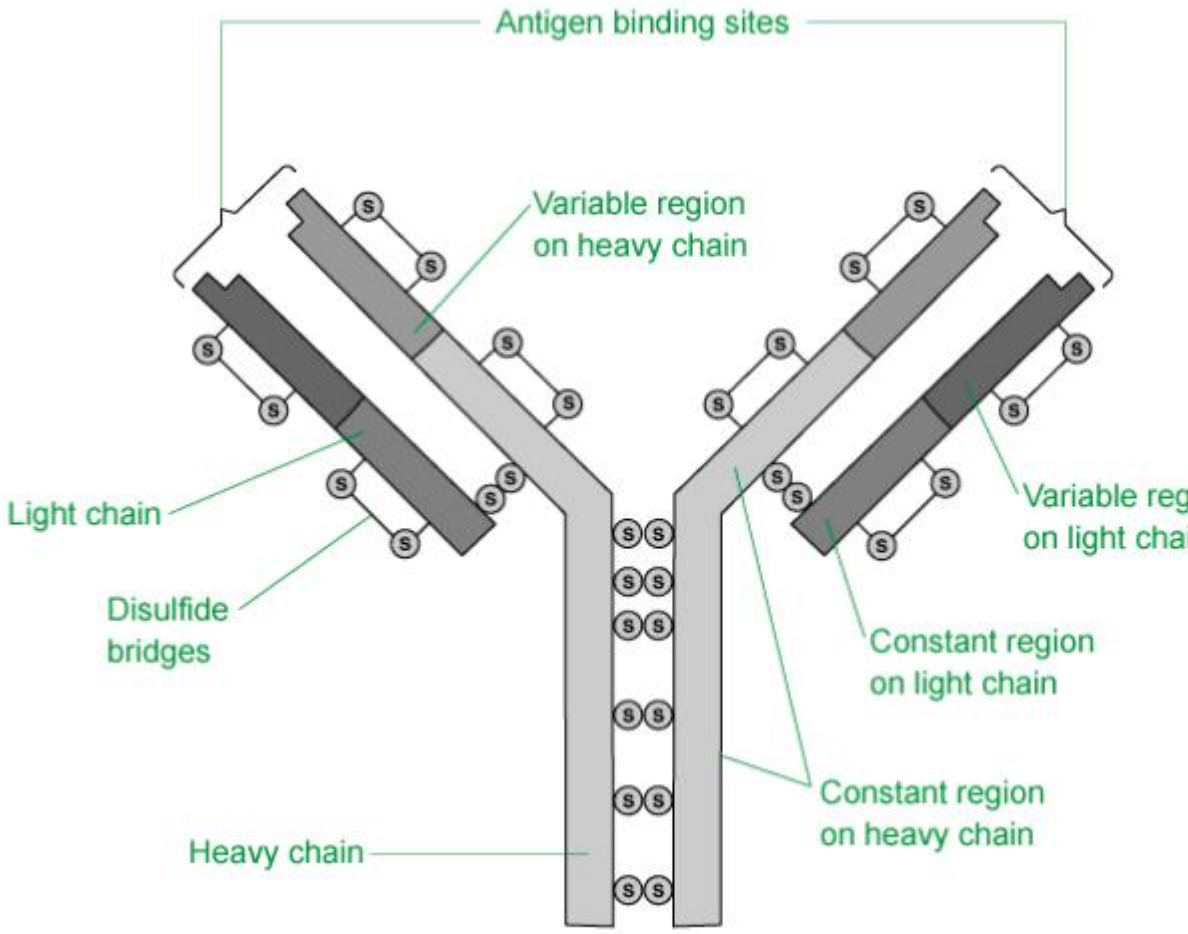
The correct answer is **B** because:

- The antibody has four polypeptide chains with two binding sites
- The 'hinge' region exists between the heavy chains and two light chains – it is a highly flexible part of the molecule that attaches the two light chains to the heavy chains
- If the enzyme breaks the fragment into three only **two** of them will contain the two binding sites

6

The correct answer is **A** because:

- The heavy chain labelled **Q** is **constant** and the same in all **antibodies** that are formed from four polypeptide chains (the amino acid structure is conserved)
- **R** is the **variable region**; this is the region that is specific to each **antigen**
- The binding site is formed by the variable regions



7

The correct answer is **A** because:

- The **colostrum** is the milk expressed in the first few days after the birth of a baby. This milk contains a high number of **antibodies** to provide **passive natural immunity** to the baby
- **Active immunity** is immunity that involves activation of T and B cells resulting in the formation of plasma cells (which make antibodies) and memory cells
- **Artificial immunity** results from an injection of antibodies or delivery of a vaccine

8

The correct answer is **C** because:

- **Memory cells** would be formed from some of the activated B-lymphocytes following vaccination (the other activated B-lymphocytes form plasma cells which secrete antibodies)

- The **memory cells** provide **long-term immunity**; these cells remain circulating in the body for a long time and will divide rapidly (forming some plasma cells and some memory cells) if/when the antigen is encountered again
- The formation of these memory cells will occur within the first 20 days (when antibody concentration has risen and then fallen)

A is incorrect as the second exposure occurred before day 25.

B is incorrect as T-helper cells would have been activated earlier in the immune response. T-helper cells activate the B-cells to produce plasma cells that make the antibodies – this would happen before the antibody concentration started to rise.

D is incorrect as **active immunity** requires the formation of a population of memory cells (both T and B cells) – this would occur as the antibody concentration starts to rise (as memory cells are formed alongside plasma cells).

9

The correct answer is **D** because:

- The cells fused with the **myeloma** to produce the **hybridoma** are the B-lymphocytes
- The B-lymphocytes will develop into a population of plasma cells that produce **antibodies**
- When fused with the myeloma cells the **hybridoma** will produce many copies of the same antibody – these are **monoclonal antibodies**

A is incorrect as T-helper cells do not divide to form a population of plasma cells that can produce antibodies.

B is incorrect as this combination of cells would not produce antibodies – although memory cells can divide to produce more memory cells and plasma cells it is the B plasma cells that must be fused.

C is incorrect as T cells do not produce antibodies, they are matured in the thymus and either circulate as helper cells or killer cells.

10

The correct answer is **A** because it's the **variation** in the amino acid sequence that changes the structure of the **variable region** which gives specificity against a huge (millions+) number of potential **antigens.**

B is incorrect as the antigen-binding site of antibodies does not bind to phagocytes.

C is incorrect as the hinge region does provide flexibility to allow the antibody to bind around an antigen, but this is not a correct statement about the property of the binding site.

D is incorrect as antigen-binding sites are formed from variable regions in both the light and heavy chains.