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## **BIOLOGY VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2017**

### **TEST 5: RESPONDING TO ANTIGENS**

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#### **SUGGESTED SOLUTIONS AND MARKING SCHEME**

##### **SECTION A – MULTIPLE-CHOICE QUESTIONS**

**Question 1      C**

Leukocytes include all white blood cells. The question asks about the immune system; MHC and antigens are used by leukocytes to distinguish self from non-self, not limited to just B cells.

**Question 2      B**

A routine vaccination usually consists of attenuated antigens and the primary antibody response produced by B memory cells is weak, therefore a stronger antibody response for long-term protection is required, and a booster is given normally two to four weeks after the first.

**Question 3      A**

Mast and basophil cells use immunoglobulin E (IgE) antibodies to detect foreign particles, releasing histamine which increases inflammation and constricts smooth muscles.

**Question 4      A**

Complement proteins are made in the liver and circulate in the blood stream. Interferons are secreted by some cells, cytokines are produced by most immune cells and cytotoxic T cells kill body cells that have been infected with a virus.

**Question 5      D**

Lymph nodes have white blood cells accumulating in them, especially macrophages. B and T lymphocytes are also present and nodes are particularly swollen when an infection or cancer cells are present.

**Question 6      A**

Also known as accessory cells, the main function of dendritic cells is to recognise and process antigen material (MHC) and present it on the cell surface to the T cells of the immune system. They act as messengers between the innate and the adaptive immune systems.

**Question 7      D**

Cell-mediated immunity is an immune response that does not involve antibodies, but rather involves the activation of phagocytes, antigen-specific cytotoxic T-lymphocytes, and the release of various cytokines in response to an antigen.

**Question 8      A**

Helper T cells ( $T_h$ ) recognise class II antigens and stimulate B cells. B cells do not reproduce and form plasma cells without this assistance from  $T_h$  cells.  $T_h$  cells also secrete a protein that stimulates other T cells and B cells.

**Question 9      C**

Although basophils are white blood cells, they are not phagocytic. They are involved in the inflammatory response by releasing histamines.

**Question 10     B**

Microscopic organisms cause infections that elicit an immune response. They can be harmless showing no disease (sub-clinical) or severe and immediate but do not last long (acute) or last a long time (chronic).

**SECTION B – SHORT-ANSWER QUESTIONS**

**Question 1** (1 mark)

An antigen is a molecule which can induce an immune response. It may be self or non-self.

**Question 2** (1 mark)

The role of the immune system is to protect the body from disease-causing organisms and substances, including cancerous cells.

**Question 3** (2 marks)

- intact skin/unbroken skin
- mucus membranes
- sebum
- tears
- 'good' bacteria/microbiota
- specific pH of different parts of the digestive tract

2 marks

**Question 4** (2 marks)

Cell-mediated immunity involves the action of T cells, including helper T cells and killer T cells (cytotoxic T cells). Helper T cells activate the killer T cells. The killer T cells secrete chemicals which poke holes/lyse the foreign cells. 1 mark

Antibody-mediated immunity involves the action of T cells and B cells. The T helper cells activate the B cells to undergo clonal selection dividing into multiple B plasma cells and B memory cells. The B plasma cells secrete specific antibodies against the antigen. B memory cells remember the specific antigen for the future so the response is swift. 1 mark

**Question 5** (4 marks)

a. Helper T cells activate killer T lymphocytes. 1 mark

b. Identification of foreign antigens by macrophages or helper T cells. 1 mark

c. B lymphocytes can be activated by encountering foreign antigens, by helper T cells or by macrophages presenting foreign antigens on its MHC class II markers. 1 mark

d. B plasma cells are short-lived and secrete specific antibodies.  
B memory cells are long-lived and can undergo clonal selection into B plasma cells and more memory cells. B memory cells are remembering a specific antigen and can make a specific antibody against the antigen. 1 mark

**Question 6** (3 marks)

a. phagocytosis 1 mark

b. This is a non-specific response 1 mark  
as the cell is a phagocyte which is not initiated into action through the specific recognition of an antigen; they are generalised leucocytes that will attach to any foreign substance. 1 mark

**Question 7** (3 marks)

a. inflammatory response 1 mark

b. *Any two of:*  
• Histamines are released from mast cells which cause an increase in permeability of blood vessels and blood flow to allow increased delivery of phagocytic cells.  
• Platelets respond to clotting the wound via fibrinogen → fibrin molecules.  
• Phagocytes remove pathogens via phagocytosis and release cytokines to further enhance phagocytes activity. 2 marks

*1 mark for each correct answer.*

**Question 8** (2 marks)

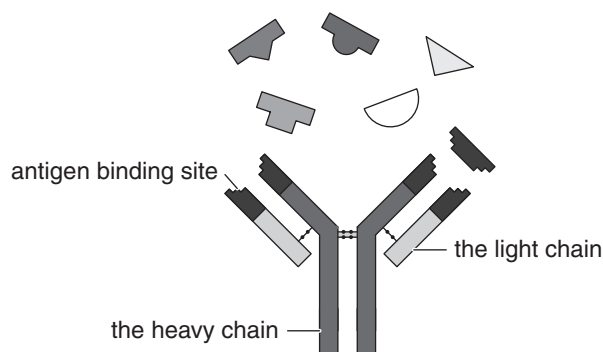
Platelets become very sticky and release chemicals which cause the blood to coagulate and convert fibrinogen into fibrin molecules, 1 mark  
which in turn trap red blood cells, clotting factors, and platelets to form the 'plug'. 1 mark

**Question 9** (5 marks)

- a. humoral immune response or specifically clonal selection 1 mark
- b. B memory cell 1 mark
- c. The purpose of cell type A is to remember the specific antigen for the future as it remains in lymphoid tissues for a long time until activated by exposure to the same antigen that triggered its formation. It will then undergo clonal selection and the resulting plasma cells will secrete specific antibodies against the antigen. 1 mark
- d. B plasma cell 1 mark
- e. B plasma cells secrete specific antibodies against specific antigens. 1 mark

**Question 10** (5 marks)

- a. antibody 1 mark
- b. i., ii. and iii.



3 marks

*1 mark for each correct label.*

- c. The variable region is different for different specific antigens so the antibody can bind. 1 mark

**Question 11** (2 marks)

When activated by an antigen, they secrete cytokines that promote B cells, T cells and phagocytes to respond to that specific antigen. 2 marks