



# VCE BIOLOGY 2014

## YEAR 12 UNIT 3

### Topic Test 3 – Detecting & Responding (2)

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**Time allowed: 50 minutes**

**Total marks: 40**

14 Multiple Choice Questions

4 Short Answer Questions

**An Answer Sheet is provided for Section A.**

**Answer all questions in Section B in the space provided.**

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**STUDENT NUMBER**

Letter

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Student Name.....

**VCE Biology 2014 Year 12 Topic Test 3 Unit 3**

**Detecting & Responding (2)**

**Student Answer Sheet**

There are 14 Multiple Choice questions to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase and enter the correct answer. Marks will not be deducted for incorrect answers.

<i>Question 1</i>	A	B	C	D	<i>Question 2</i>	A	B	C	D
<i>Question 3</i>	A	B	C	D	<i>Question 4</i>	A	B	C	D
<i>Question 5</i>	A	B	C	D	<i>Question 6</i>	A	B	C	D
<i>Question 7</i>	A	B	C	D	<i>Question 8</i>	A	B	C	D
<i>Question 9</i>	A	B	C	D	<i>Question 10</i>	A	B	C	D
<i>Question 11</i>	A	B	C	D	<i>Question 12</i>	A	B	C	D
<i>Question 13</i>	A	B	C	D	<i>Question 14</i>	A	B	C	D

# VCE Biology 2014 Year 12 Topic Test 3 Unit 3

## Detecting and Responding (2)

### SECTION A – Multiple Choice Questions

#### Question 1

The first line of defence in the human immune system includes

- A. B cells.
- B. mast cells.
- C. the inflammatory response.
- D. the acidity of the gastric juice.

#### Question 2

An individual suffers from a rare disease that renders his thymus gland dysfunctional. This would have a direct impact on the

- A. action of existing plasma cells.
- B. maturing of T cells.
- C. maturing of B cells.
- D. action of phagocytes.

#### Question 3

Which of the following statements is correct?

- A. Memory T cells have the ability to recognise foreign antigens so that a secondary response, of about the same speed and intensity as the primary response, can occur.
- B. Cytotoxic T cells will attack and destroy free viruses in the body.
- C. Natural Killer cells require a specific MHC-antigen interaction to be activated.
- D. B cells will undergo a process called clonal expansion, provided they have been presented with a specific antigen on a MHC class 2 marker and a T Helper cell has activated them.

#### Question 4

The main difference between a virus and a prion is that a

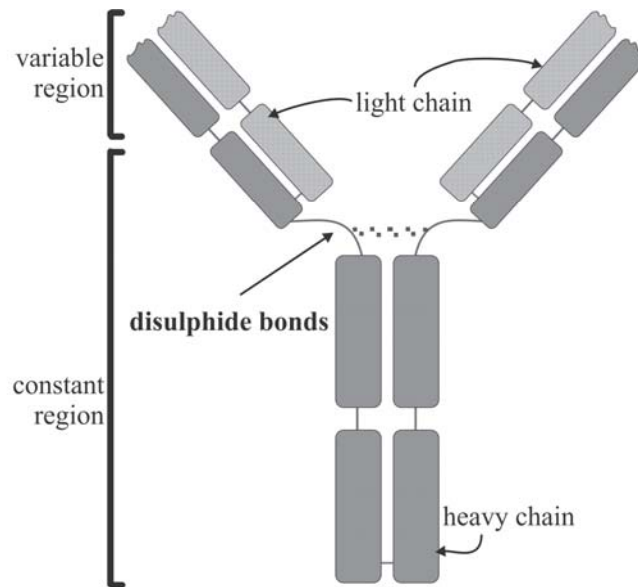
- A. virus contains DNA while a prion contains RNA.
- B. prion contains genetic material wrapped in a protein coat while a virus only consists of genetic material.
- C. virus contains genetic material wrapped in a protein coat while a prion only consists of protein.
- D. virus consists of eukaryotic cells while a prion consists of prokaryotic cells.

#### Question 5

One advantage of having a fever during an immune response is that

- A. invading microbes do not reproduce as well at higher body temperatures.
- B. phagocytes are able to engulf more microbes than usual.
- C. it is more difficult for microbes to enter the body.
- D. the binding specificity between antibodies and antigens is not as high.

Information shown in **Figure 1** below relates to Questions 6 and 7.



**Figure 1: Diagram of an antibody**

**Question 6**

The variable region of the antibody contains

- A. one antigen binding site.
- B. four antigen binding sites.
- C. no antigen binding sites.
- D. two antigen binding sites.

**Question 7**

The constant region of the antibody

- A. is where it recognises antigens being presented by another cell.
- B. is where the antibody binds to the membrane of the T cell.
- C. will be the same for all antibodies of the same class in a person's body.
- D. will be slightly different for each antibody in a person's body.

**Question 8**

Humoral immunity refers to the part of the immune response involving

- A. B cells.
- B. T cells.
- C. inflammation.
- D. Natural Killer cells.

**Question 9**

Which of the following situations would provide the most effective long term immunity?

- A. A snake bite victim is injected with antibodies.
- B. A small child contracts chickenpox at day-care.
- C. A person is revived via CPR after falling from a boat.
- D. A baby receives antibodies during breastfeeding that act to protect her from the flu.

### Question 10

Laboratory synthesised monoclonal antibodies can be made by fusing mouse B cells with mouse tumour cells after the B cell has been exposed to an antigen. The B cell provides the ability to manufacture specific antibodies and the tumour cells provide immortality to the cell cultures of 'hybridomas' that result from this fusion. Thus large numbers of identical antibodies can be produced for an indefinite period and can be used for a variety of applications. One such application may be in the treatment of viral diseases. If you were given an injection of monoclonal antibodies to prevent a particular virus infection, the type of immunity you would receive would be best described as

- A. natural and passive.
- B. natural and active.
- C. artificial and passive.
- D. artificial and active.

### Question 11

Antibodies do **not**

- A. activate complement proteins.
- B. clump pathogens thus neutralising their harmful actions.
- C. stimulate phagocyte attack.
- D. directly punch holes in pathogen membranes.

### Question 12

During blood transfusions consideration must be given to ABO (A or B) antigens and Rhesus antigens (+). These antigens are found on the surface of red blood cells and the possible phenotypes of these antigens are summarised in the table below.

Blood group (ABO)	Antigens present on the surface of red blood cells
A	A
B	B
AB	A and B
O	none
Blood group (Rhesus)	
+	Rhesus
-	-

If a patient was given packets of red blood cells during their medical treatment, which of the following scenarios would result in blood clotting and thus cause harm to the recipient of the donation?

- A. The donor is O- and the recipient is B+.
- B. The donor is O+ and the recipient is A+.
- C. The donor is B- and the recipient is O-.
- D. The donor is B+ and the recipient is AB+.

**Question 13**

Plants have no immune system, however they have evolved defences against invading pathogens. These include

- A. galls that limit the movement and distribution of parasites.
- B. phagocytes that engulf parasites.
- C. cilia that line the internal vascular tubes of the plant.
- D. complement proteins that act against cellular pathogens.

**Question 14**

After an organ transplant has been completed, the drug cyclosporine must be taken by the organ recipient for the remainder of their lives. This drug stops the immune system from attacking the new organ by specifically interfering with the function of T cells. The drug allows other parts of the immune system to function and thus the transplant recipient's immune system is not completely compromised. Which of the following components of the immune system would remain unaffected in the transplant recipient's immune system?

- A. B cells.
- B. Plasma cells.
- C. Memory cells.
- D. Natural Killer cells.

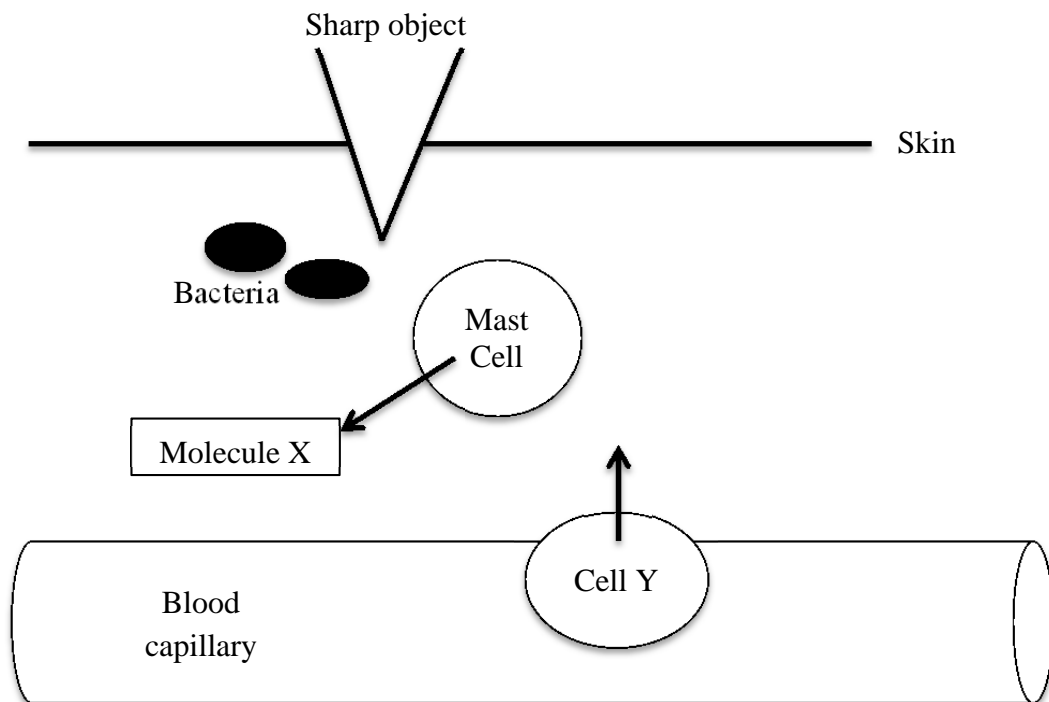
**End of Section A**

# VCE Biology 2014 Year 12 Topic Test 3 Unit 3

## Detecting and Responding (2)

### SECTION B – Short Answer Questions

The information shown in **Figure 2** relates to **Question 1**.



**Figure 2: Tissue trauma and subsequent bacterial invasion**

#### Question 1 (7 marks)

- a. Suggest one way that bacteria may be harmful in this situation. **1 mark**
- 
- b. What response is initiated when tissue trauma occurs? **1 mark**
- 
- c. During tissue trauma, mast cells secrete molecule X. Identify molecule X and describe two effects it has on the nearby blood capillary. **2 marks**
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- d.** Suggest **two** ways the bacteria could be destroyed quickly after the tissue trauma has occurred. **2 marks**

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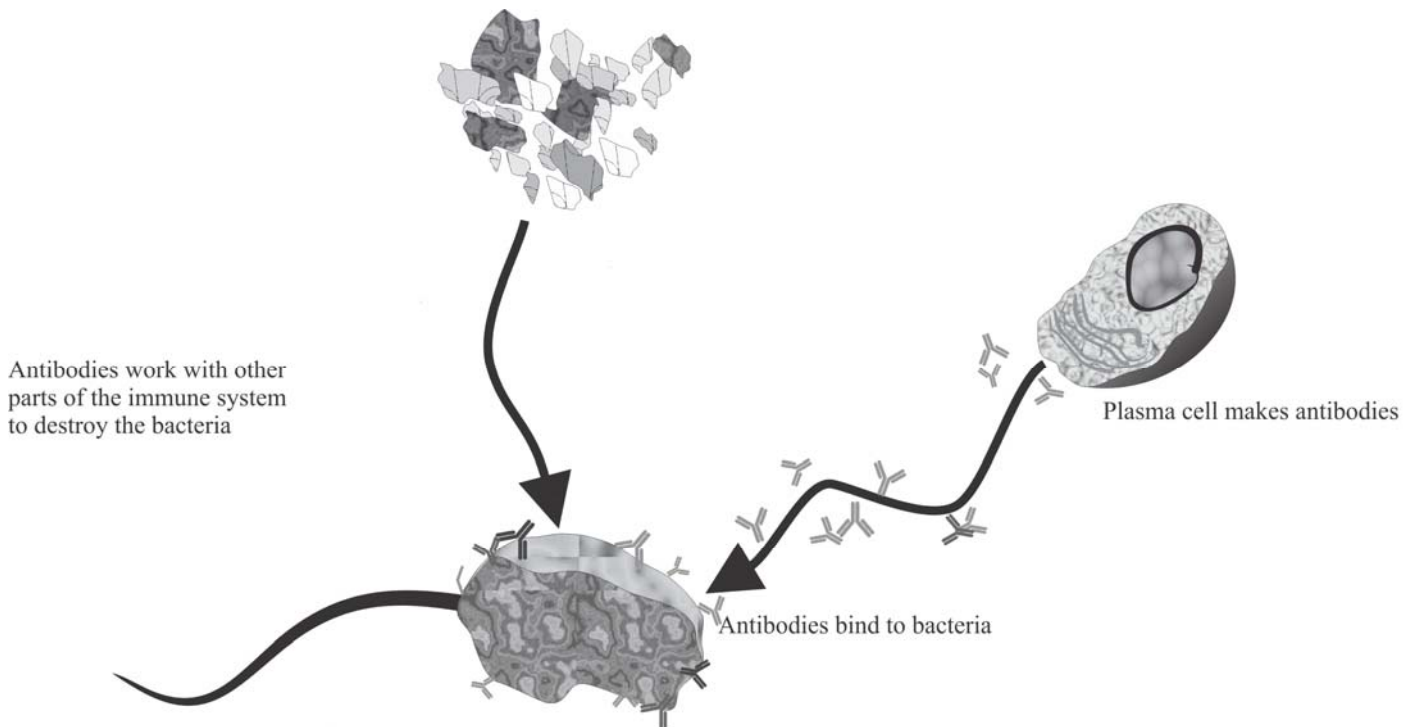


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- e.** Name Cell Y. **1 mark**

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The information shown in **Figure 3** relates to Question 2.



**Figure 3: B cell response in humans due to bacterial infection**

**Question 2 (6 marks)**

- a.** Which line of defence in the immune system does this scenario relate to? **1 mark**

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- b.** Plasma cells produce and release antibodies after a process called clonal expansion. Describe this process and explain why it is necessary. **2 marks**

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- c.** The involvement of what other cell is required before plasma cells are manufactured to produce antibodies? **1 mark**

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- d. Assuming this is the first exposure to this bacteria, describe the role of memory B cells in this immune response.

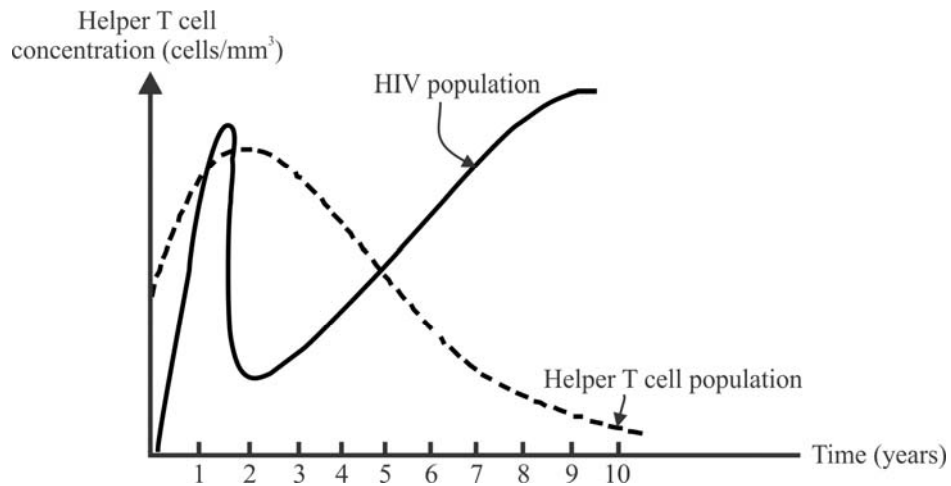
2 marks

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The information shown in **Figure 4** relates to Question 3.



**Figure 4**

**Question 3 (7 marks)**

- a. Describe the changes in the HIV population and Helper T cell count two years after infection.

1 mark

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- b. What effect would the reduction of the Helper T cell population have on other cells in the immune response to HIV?

2 marks

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**c.** HIV infection leads to a condition known as AIDS (acquired immunodeficiency syndrome). At what point on the graph would you be most confident that the infected individual had AIDS? Explain your answer. **2 marks**

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**d.** HIV infection and AIDS, if left untreated, will ultimately be fatal. What causes the death of the infected individual? **1 mark**

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**e.** Why have HIV infections proven so difficult to treat? **1 mark**

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**Question 4 (6 marks)**

Haemolytic disease in newborns is a condition resulting from Rh<sup>-</sup> mothers carrying Rh<sup>+</sup> foetuses during pregnancy. In this situation, anti-Rh<sup>+</sup> antibodies are produced by the mother's immune system and, in subsequent pregnancies, these anti-Rh<sup>+</sup> antibodies pass across the placenta and attack red blood cells of other foetuses.

**a.** Haemolytic disease of newborns is not categorised as an autoimmune disease. Why? **1 mark**

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**b.** What must happen in the initial pregnancy for this disease to emerge during the second pregnancy? Explain your answer. **2 marks**

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- c.** Why is it important that the mother provides antibodies to the foetus during pregnancy and in the initial stage of a baby's life? **1 mark**

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- d.** Explain how Haemolytic disease of newborns can be avoided by individuals at risk of this condition. **2 marks**

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**End of Section B**

**End of Topic Test 3**

## Suggested Answers

### VCE Biology 2014 Year 12 Topic Test 3 Unit 3

#### Detecting and Responding (2)

##### SECTION A – Multiple Choice Answers

- |      |      |       |       |       |       |       |
|------|------|-------|-------|-------|-------|-------|
| 1. D | 2. B | 3. D  | 4. C  | 5. A  | 6. D  | 7. C  |
| 8. A | 9. B | 10. C | 11. D | 12. C | 13. A | 14. D |

##### SECTION B – Short Answer (Answers)

###### Question 1 (7 marks)

- The bacteria may secrete toxins that cause harm (or any other reasonable answer) **(1 mark)**.
- The inflammatory response **(1 mark)**.
- Molecule X is a histamine **(1 mark)**. Histamines cause blood capillaries to dilate and become more permeable to cells of the immune system such as leukocytes and blood plasma proteins **(1 mark)**.
- Complement proteins may opsonise the bacteria resulting in their destruction and phagocytes could engulf and destroy the bacteria **(2 marks)**.
- Cell Y is a phagocyte **(1 mark)**.

###### Question 2 (6 marks)

- The third line of defence **(1 mark)**.
- After a B cell binds to a specific antigen, it is activated to divide into many plasma cells **(1 mark)**. It is necessary so that enough antibodies specific to the invading antigen are produced to successfully fight the infection **(1 mark)**.
- Helper T cells **(1 mark)**.
- Memory B cells will be created that are specific to this bacteria **(1 mark)**. They will remain in the body for a long period of time and, in the event of reinfection, will quickly differentiate into plasma cells which will produce large quantities of antibodies specific to this bacteria **(1 mark)**.

###### Question 3 (7 marks)

- After two years of infection, the HIV population has increased then decreased while the T cell population has increased **(1 mark)**.
- B cells and cytotoxic T cells would not be able to perform their functions, as they would not be activated by Helper T cells **(1 mark)** and memory cells would not be made **(1 mark)**.
- The infected individual would have AIDS after 10 years **(1 mark)** because this is the point when the Helper T cell population is at its lowest number and thus the individual's immune system would be at its most compromised **(1 mark)**.
- Opportunistic infections cause the death of the infected individual as the immune system cannot fight them **(1 mark)**.
- The virus evolves rapidly **or** the virus hides in the Helper T cells – both make treatment difficult **(1 mark)**.

**Question 4 (6 marks)**

- a.** Haemolytic disease of newborns involves one individual (the mother) producing antibodies that attack another individual (the foetus). An autoimmune disease is one in which an individual will produce antibodies that attack his or her own tissues **(1 mark)**.
- b.** In the initial pregnancy, the mother must be Rh<sup>-</sup> and the foetus Rh<sup>+</sup> and, during labour, the mother's immune system must become exposed to the baby's blood via tissue trauma **(1 mark)**. This results in the mother's immune system mounting a specific response to the baby's Rh<sup>+</sup> red blood cells thus forming large numbers of anti-Rh<sup>+</sup> antibodies and specific memory B and T cells in the mother. In a subsequent pregnancy, the mother will mount a specific immune response against the developing foetus if it is Rh<sup>+</sup> **(1 mark)**.
- c.** An individual does not have a mature immune system when he or she is a foetus or a baby, so it is necessary for the mother to provide immunological support **(1 mark)**.
- d.** After the initial pregnancy, immediately after birth, the mother is injected with anti-Rh<sup>+</sup> antibodies **(1 mark)**. This neutralises the presence of the Rh<sup>+</sup> antigen before the mother's immune system has a chance to mount a specific response against it and thus leaves the mother without an immune memory that will cause problems in subsequent pregnancies **(1 mark)**.

**End of Suggested Answers**