



VCE BIOLOGY 2015

YEAR 12 UNIT 3

Topic Test 2 – Detecting & Responding (1)

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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

Figures

Words

Letter

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Student Name.....

VCE Biology 2015 Year 12 Topic Test 2 Unit 3**Detecting & Responding (1)****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.

Question 1 A B C D

Question 2 A B C D

Question 3 A B C D

Question 4 A B C D

Question 5 A B C D

Question 6 A B C D

Question 7 A B C D

Question 8 A B C D

Question 9 A B C D

Question 10 A B C D

Question 11 A B C D

Question 12 A B C D

Question 13 A B C D

Question 14 A B C D

VCE Biology 2015 Year 12 Topic Test 2 Unit 3

Detecting and Responding (1)

SECTION A – Multiple Choice Questions

Question 1

In plants' growth, development and cell death are regulated by

- A. phytohormones.
- B. neurotransmitters.
- C. potassium ions.
- D. guard cells.

The following information refers to Questions 2 – 4.

The signalling transduction pathway in **Figure 1** is involved in fruit ripening, flowering and cell elongation in the *Arabidopsis thaliana* plant.

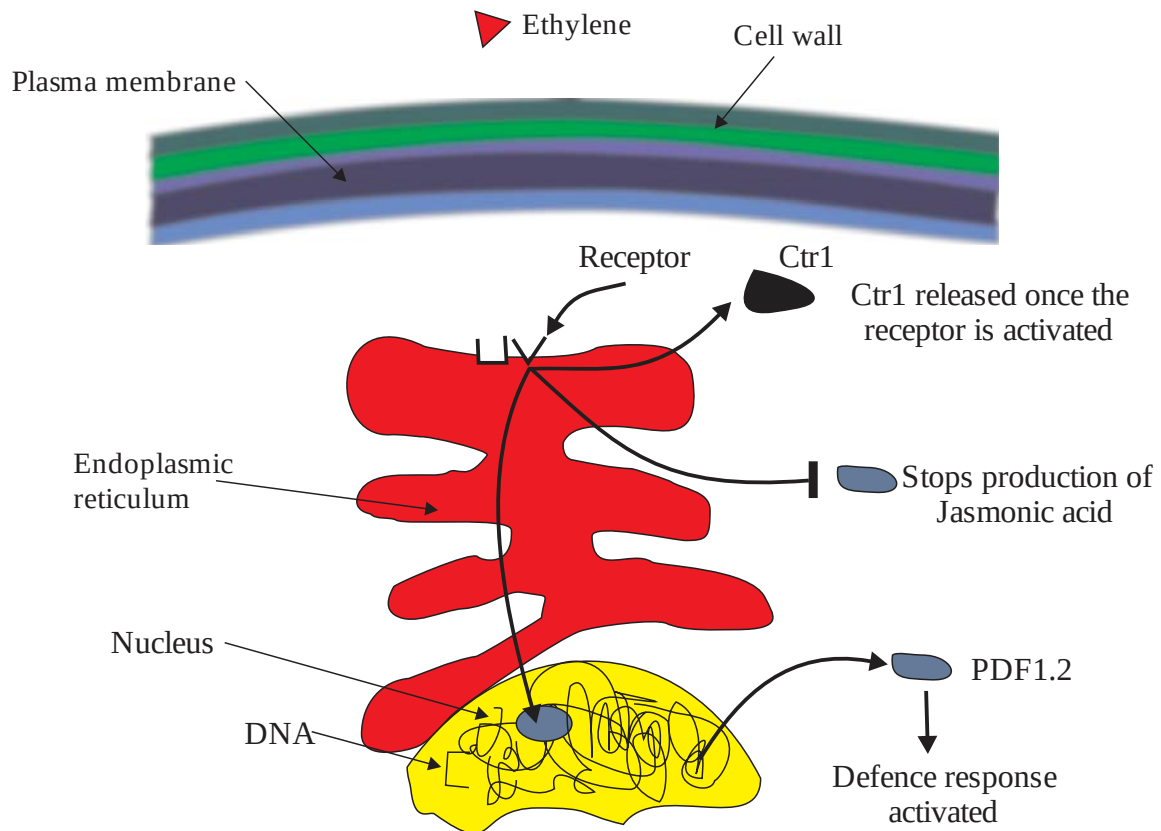


Figure 1: A signalling transduction pathway in *Arabidopsis thaliana*.

Question 2

The plant hormone that initiates the signal transduction pathway shown in **Figure 1** is

- A. jasmonic acid.
- B. PDF1.2.
- C. Ctr1.
- D. ethylene.

Question 3

The signal transduction pathway in **Figure 1** involves

- A. only positive regulators.
- B. both positive and negative regulators.
- C. only negative regulators.
- D. no regulators.

Question 4

The signal transduction pathway in **Figure 1**

- A. leads to apoptosis.
- B. affects gene expression.
- C. is dependent on signals from mitochondria.
- D. is prevented by the cell wall.

Question 5

Cancerous cells often arise due to

- A. a higher amount of apoptosis than normal.
- B. the presence of tumour suppressor genes.
- C. a malfunction in the plasma membrane.
- D. incorrect regulation of signal transduction pathways.

The following information refers to Questions 6 – 8.

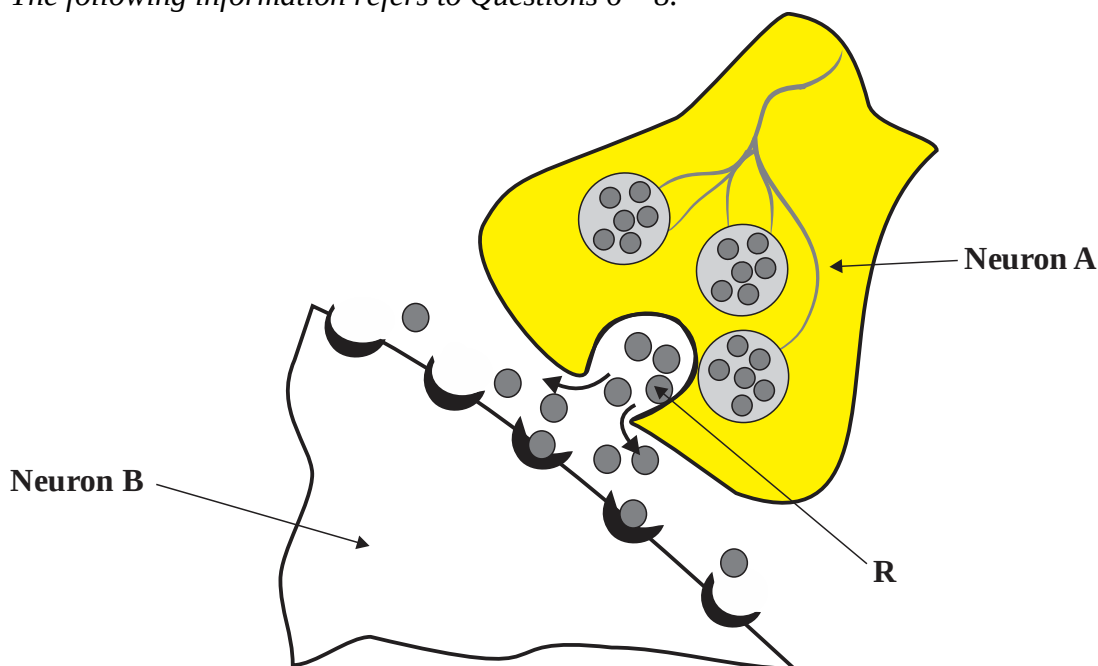


Figure 2: Transmission between neurons

Question 6

Between the axon terminal of Neuron A and the dendrites of Neuron B in **Figure 2**, a chemical transmission occurs where a substance is transported across the

- A. effector.
- B. cell body.
- C. synaptic gap.
- D. myelin sheath.

Question 7

In **Figure 2**, R refers to a

- A. red blood cell.
- B. neurotransmitter.
- C. hormone.
- D. gland.

Question 8

The release of neurotransmitters from synaptic vesicles in a presynaptic axon terminal is triggered by the rise of

- A. K^+
- B. Na^+
- C. Ca^{2+}
- D. O^{2-}

Question 9

Molecules that are lipid soluble can initiate transduction by

- A. binding to receptors within the cytosol.
- B. binding to receptors on the cell membrane.
- C. activating a second messenger within the cytosol.
- D. binding to a carbohydrate in the extracellular fluid.

Question 10

Hormones can bind to second messengers which can result in the initiation of a signalling cascade. One advantage of this is that the signal is

- A. the same strength as the signal initiated by the first messenger.
- B. lessened and slower acting.
- C. inhibited completely and no response occurs.
- D. amplified in comparison to the signal initiated by the first messenger.

Question 11

In honey bees, the queen bee maintains social order by producing a chemical that is released into the hive. This chemical is an example of a

- A. neurotransmitter.
- B. calcium ion.
- C. pheromone.
- D. growth regulator.

Question 12

There are specific target cells for hormones; however, the way in which a hormone enters a cell differs depending on its structure. Which of the following is true?

- A. Peptide hormones are able to pass into the cell through the cell membrane without first binding to a receptor.
- B. Lipid soluble hormones are able to pass into the cell through the phospholipid bilayer without first binding to a receptor.
- C. Peptide hormones bind to enzymes in the cell membrane.
- D. Lipid soluble hormones bind to receptors on the phospholipid bilayer.

Question 13

Joey has syndactyly, a condition that means that two of his fingers are fused together. During normal embryogenesis, cells between fingers are removed during early development by specific cellular pathways involving targeted cell elimination. During Joey's development, the process that did not occur properly is known as

- A. homeostasis.
- B. signal amplification.
- C. necrosis.
- D. apoptosis.

Question 14

The cell's response to hormones is ultimately controlled by

- A. the genetic code.
- B. second messengers.
- C. G proteins.
- D. Cyclic AMP.

End of Section A

VCE Biology 2015 Year 12 Topic Test 2 Unit 3

Detecting and Responding (1)

SECTION B – Short Answer Questions

Question 1 (7 marks)

Pick's disease, is a neurological disorder that is classified as a type of frontotemporal dementia. Pick's disease is progressively degenerative and is caused by the build-up of a particular protein in the cells of the nervous system, causing the cells to swell and deteriorate in function.

- a.** What is the general term for the cells that are affected by Pick's disease? **1 mark**

- b.** Not much is known about Pick's disease and research into this condition and how it arises is currently being conducted. If Pick's disease also led to the destruction of the myelin sheath of motor neurons, what effect would this have on the individual? In your answer, explain what the myelin sheath is. **2 marks**

- c.** Draw a labelled diagram of a motor neuron in the box below. Include labels for the following: **2 marks**
- myelin sheath
 - axon terminals
 - dendrites
 - cell body



- d. What does it mean if a nerve cell membrane is described as polarised? **1 mark**

- e. What would happen in an individual with Pick's disease if the myelin sheath swelled so greatly that the nodes of Ranvier also became encompassed by the myelin sheath? **1 mark**

Question 2 (7 marks)

Signal transduction pathways in cells involve a sequence of stages.

- a. Define signal transduction. **1 mark**

- b. Complete **Table 1** by stating and explaining what the three general stages of a signal transduction pathway are, as well as the location that they occur in, assuming that the signalling molecule is protein-based and the pathway occurs in an animal cell. **6 marks**

Stage	Location	Description

Table 1

Question 3 (6 marks)

Chronic lymphoblastic leukemia is a type of cancer that occurs when cells that normally die, survive due to the activation of the gene *bcl-2*, which blocks the normal pathway of apoptosis.

- a. Define apoptosis and explain what purpose it serves to cells.

2 marks

- b. There are **two** apoptotic pathways shown occurring in **Figure 3**. Name these two pathways and in your answer describe the main trigger for each pathway.

2 marks

Pathway A _____

Pathway B _____

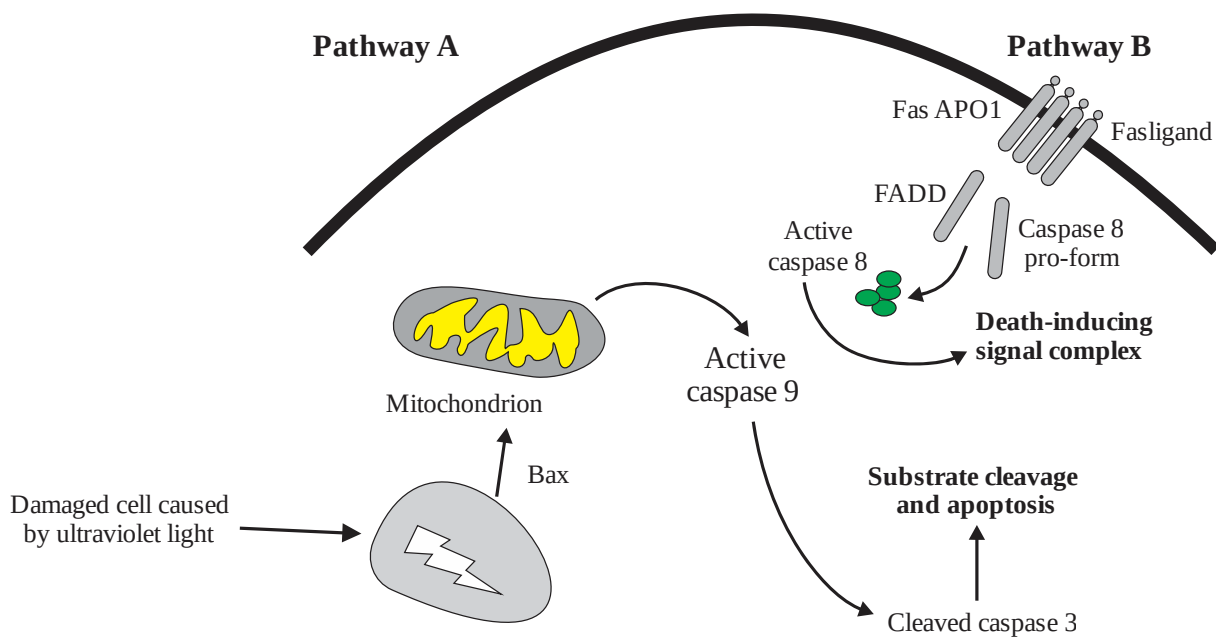


Figure 3: Apoptosis signal transduction.

The following diagram refers to Question 3c.

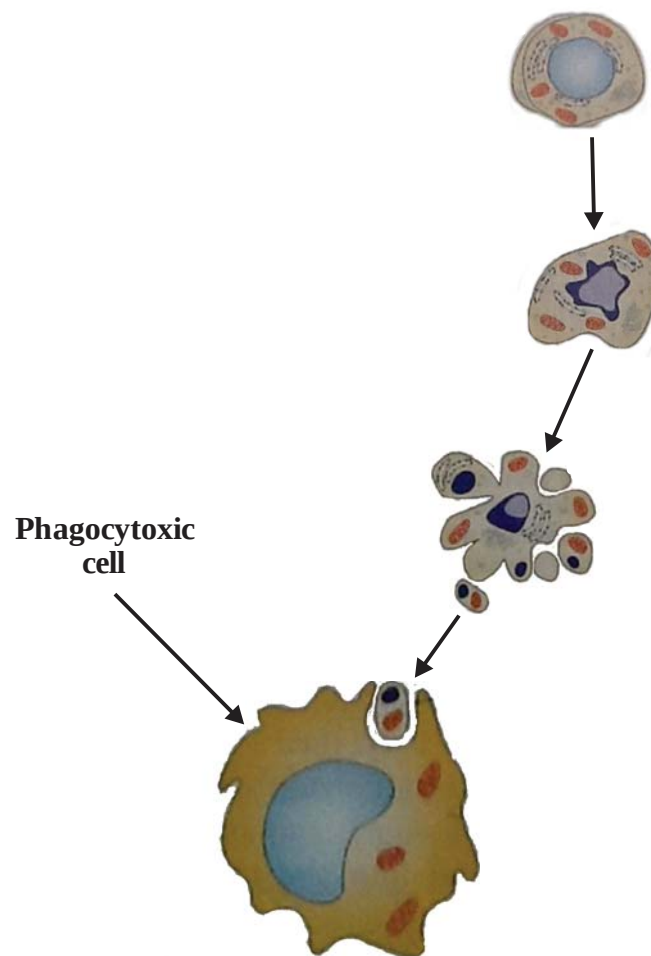


Figure 4: A schematic diagram of a cell undergoing apoptosis.

- c. Label one apoptotic body on **Figure 4** and explain what an apoptotic body is.

2 marks

Question 4 (6 marks)

Research scientists working in one of Melbourne's largest institutes have just discovered a new signal transduction pathway called Malo, in a eukaryotic cell, pictured in **Figure 5**.

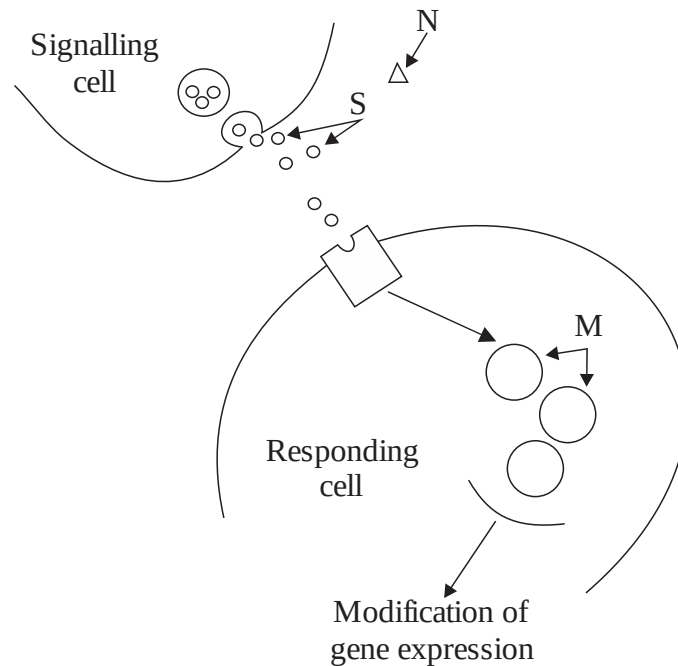


Figure 5: A signal transduction pathway

- a.** In **Figure 5**, which molecule is the first messenger and which molecule is the second messenger? **2 marks**

- b.** Explain whether molecule N in **Figure 5** would have any effect on this pathway. **2 marks**

- c. Is the first messenger molecule lipid soluble? Justify your answer.

2 marks

End of Section B

End of Topic Test 2

Suggested Answers

VCE Biology 2015 Year 12 Topic Test 2 Unit 3

Detecting and Responding (1)

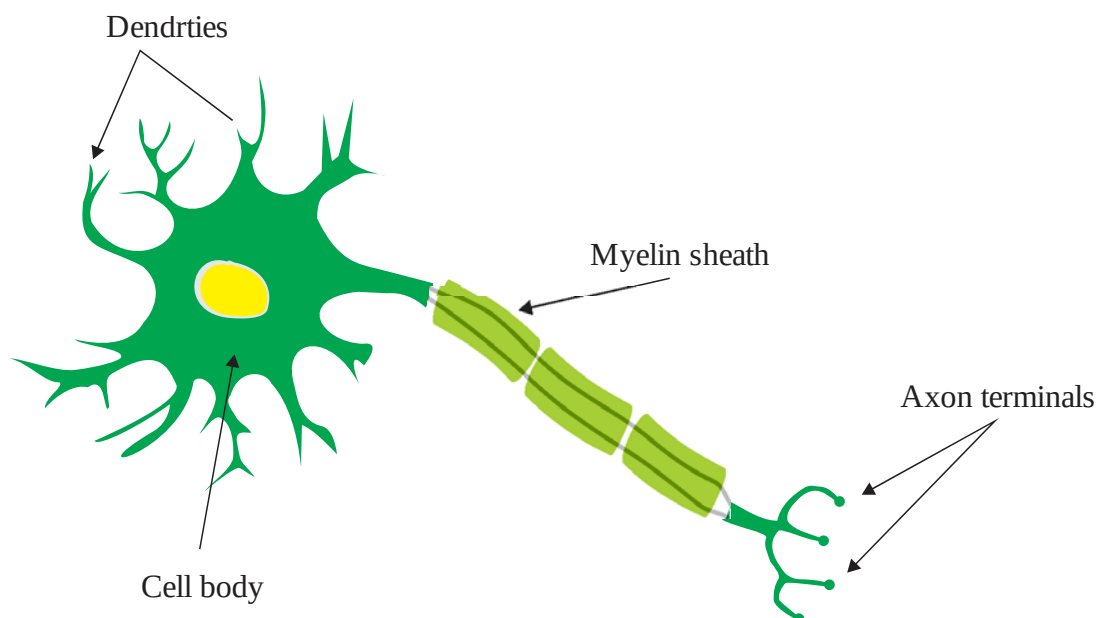
SECTION A – Multiple Choice Questions

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

SECTION B – Short Answer (Answers)

Question 1 (7 marks)

- Neuron or nerve cell **(1 mark)**.
- Myelin sheath is a fatty substance that acts as insulating material, surrounding the neuron's axon **(1 mark)**. If the myelin sheath is damaged, electrical impulses travelling through neurons would become slower because the myelin sheath increases the speed of electrical impulses. In turn, this could lead to decreased reaction times and lack of controlled movements in individuals with Pick's disease **(1 mark)**.
- Students should sketch a similar diagram and correctly label myelin sheath and cell body **(1 mark)**, axon terminals and dendrites **(1 mark)**.



- An inactive or resting neuron **(1 mark)** OR There is a potential (charge) difference between the outside of the cell membrane and the inside of the cell membrane **(1 mark)**.
- If the nodes of Ranvier were not exposed, there would not be a nerve impulse. **(1 mark)**.

Question 2 (7 marks)

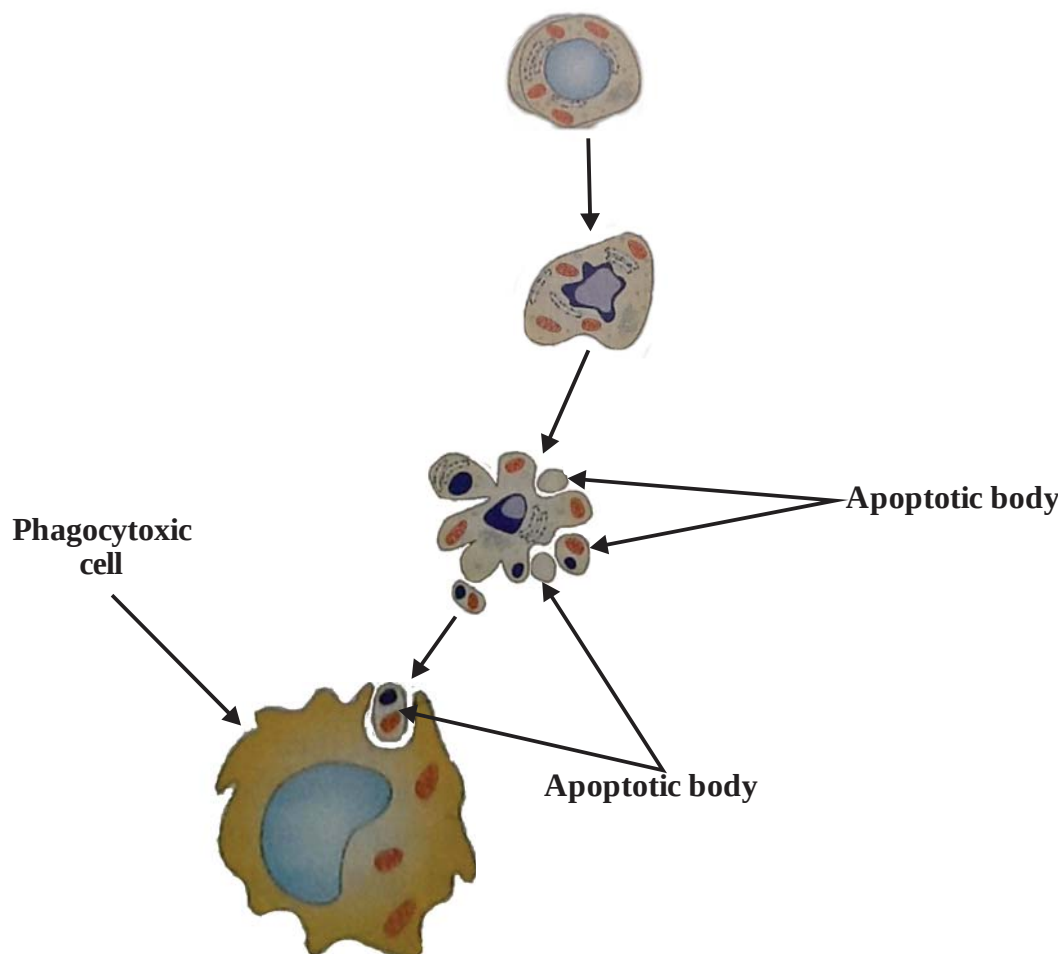
- a. The conversion of an extracellular stimulus, by the cell, that results in a functional change or specific cellular response (**1 mark**).
- b. Students should complete **Table 1** so that it appears similar to the table below with the respective stage, location and description. Students are awarded **1 mark** for the correct stage name and corresponding location and **1 mark** for the corresponding description.

Total = 6 marks

Stage	Location	Description
Reception	Plasma membrane	The protein-based signal molecule binds to the specific receptor.
Transduction	Cytosol	The second messenger is formed or released into the cytosol which then amplifies the signal.
Induction	Cytosol	A cellular response is activated.

Question 3 (6 marks)

- a. Genetically programmed cell death (**1 mark**) with the purpose of tissue and cell population maintenance and removal of damaged cells (**1 mark**).
- b. **Pathway A:** An intrinsic pathway which is triggered by cellular or mitochondrial stress (**1 mark**). **Pathway B:** An extrinsic pathway which is triggered by ligands binding to receptors on the cell membrane (**1 mark**).
- c. Correctly labelling **one** of the possible apoptotic bodies as shown on the diagram (**1 mark**).



An apoptotic body is a sealed membrane vesicle formed during nuclear or cytoplasm fragmentation (**1 mark**).

Question 4 (6 marks)

- a. Molecule S is the first messenger **(1 mark)** and Molecule M is the second messenger **(1 mark)**.
- b. Molecule N would not have any effect on the cell **(1 mark)** because it would not fit the specific receptor on the membrane of the responding cell **(1 mark)**.
- c. No, it is a peptide molecule **(1 mark)** because it cannot pass directly through the phospholipid bilayer but must bind to a receptor embedded in the cell membrane **(1 mark)**.

End of Suggested Answers