VCE BIOLOGY 2014
YEAR 12 UNIT 3
Topic Test 2 – Detecting & Responding (1)

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
Figures									
Words									

Student Name.....

VCE Biology 2014 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 2014 Year 12 Topic Test 2 Unit 3

Detecting & Responding (1)

SECTION A – Multiple Choice Questions

Question 1
Which structural part of the neurone receives a signal from another neurone?
A. Axon terminal.
B. Myelin sheath.
C. Dendrite.
D. Axon.

Questions 2 and 3 refer to chemical signals that travel across synapses between nerve cells.

Question 2
The chemical signals are
A. pheromones.
B. calcium ions.
C. second messengers.
D. neurotransmitters.

Question 3
These chemical signals are released into the synapse by
A. exocytosis.
B. active transport.
C. diffusion.
D. facilitated diffusion.

Question 4
Which of the following definitions is the **most** accurate with regard to hormones? A hormone is
A. a chemical produced and released by a cell in an organism, which travels to another cell and causes a specific response.
B. a chemical produced and released by a cell in an organism and is then transported through the blood until it reaches another cell, causing a specific response.
C. a chemical produced and released by a cell in an organism, which then travels to another organism of the same species and causes a specific response.
D. any chemical produced by a cell in a ductless gland and released into the blood.

Questions 5, 6 and 7 refer to ***Figure 1.***

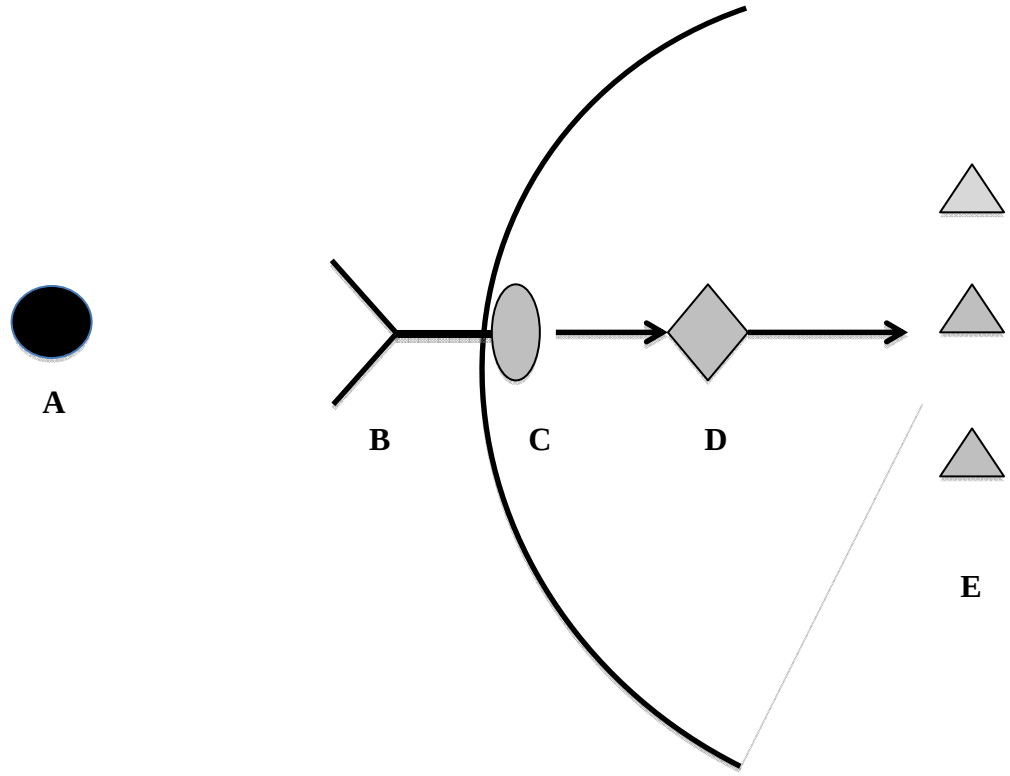

Figure 1

Question 5
In **Figure 1**, the second messenger is represented by molecule
A. A.
B. B.
C. C.
D. D.

Question 6
In **Figure 1**, signal transduction is best represented by the process linking molecule
A. A to B.
B. A to C.
C. C to D.
D. A to E.

Question 7
Molecule A in **Figure 1** would **not** be a/an
A. amino acid derived hormone.
B. neurotransmitter.
C. steroid hormone.
D. peptide hormone.

Question 8
The disease multiple sclerosis is caused by the deterioration of the myelin sheaths of nerve cells. What would be the most likely effect this would have on the function of a nerve cell?
A. The movement of neurotransmitters would be less efficient across synapses.
B. The action potential would reach the synapse at a faster rate.
C. The action potential could be less intense and take longer to reach the synapse.
D. The action potential would move in the wrong direction, causing the nerve cell to completely lose its functional ability.

Question 9
Which of the following scenarios involves pheromones?
A. Hyenas secrete chemicals onto a carcass that repel vultures.
B. A crop is sprayed with chemicals resulting in weeds dying.
C. Ants release a chemical that indicates a food trail for other ants to follow.
D. A dog's bark serves as a warning to other dogs not to enter its territory.

Question 10
In which of the following locations would a G protein be found?
A. On the outside surface of the cell membrane.
B. On the inside surface of the cell membrane.
C. Floating in the cytoplasm.
D. In the endoplasmic reticulum.

Question 11
The electrical transmission of a signal through an axon is facilitated by
A. Na^+/K^+ pumps on the membrane.
B. K^+/Ca^+ pumps on the membrane.
C. H^+/electron pumps on the membrane.
D. O_2/CO_2 pumps on the membrane.

Question 12
If a section of the axon is experiencing a refractory period, it will
A. allow an action potential to run through it.
B. not allow an action potential to run through it.
C. change the direction of an action potential.
D. amplify an action potential.

Question 13

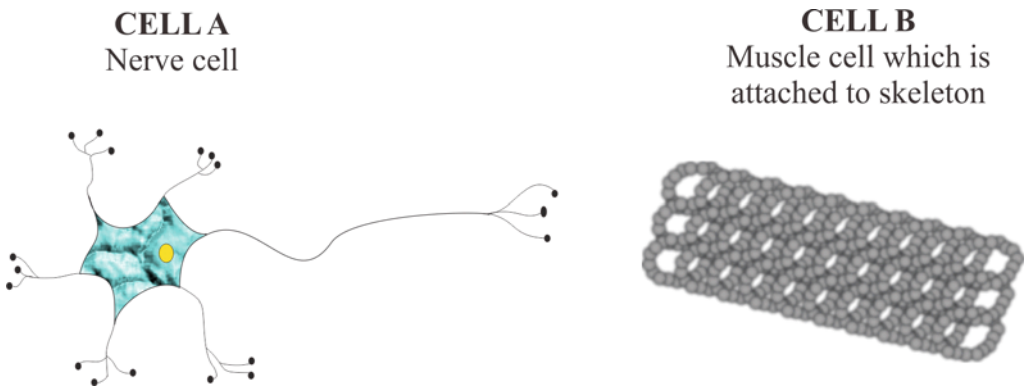

Figure 2

Which of the following statements is correct regarding signalling in **Figure 2**?

A. Cell B would be the original source of the signal.
B. Cell A would be the original source of the signal.
C. Neither cell A nor cell B would be the original source of the signal.
D. The signal cannot cross the gap between the nerve cell and the muscle cells.

Question 14

Which of the following statements concerning hormone receptors is true? They are

A. only found on the outer surface of the cell membrane.
B. also called ligands.
C. made of proteins only.
D. highly specific.

End of Section A

VCE Biology 2014 Year 12 Topic Test 2 Unit 3

Detecting and Responding (1)

SECTION B – Short Answer Questions

Question 1 (7 marks)
A recent study involving brain scans of men and women has supported the hypothesis that there are human pheromones. These compounds are related to hormones and are found in human sweat. Two types of pheromones, detected in human sweat, mimic the reproductive hormones oestrogen and testosterone. The testosterone-like substance is 20 times more concentrated in male sweat than in female sweat, while the oestrogen-like substance is 20 times more concentrated in female sweat than in male sweat. The data in the table below summarise the results of the study.

Human pheromone	Effect on males after smelling substance	Effect on females after smelling substance
Oestrogen-like Substance	Increased blood flow to the hypothalamus.	None
Testosterone-like substance	None	Increased blood flow to the hypothalamus

a. In terms of the hypothesis, what conclusion can be drawn from this study? **1 mark**

_____

_____

b. Define the term pheromone. **1 mark**

_____

_____

_____

c. Explain at the cellular level how the oestrogen-like substance can affect male cells but not female cells. **1 mark**

_____

_____

_____

In **Figure 3**, molecule A represents the oestrogen-like substance and molecule B represents its receptor.

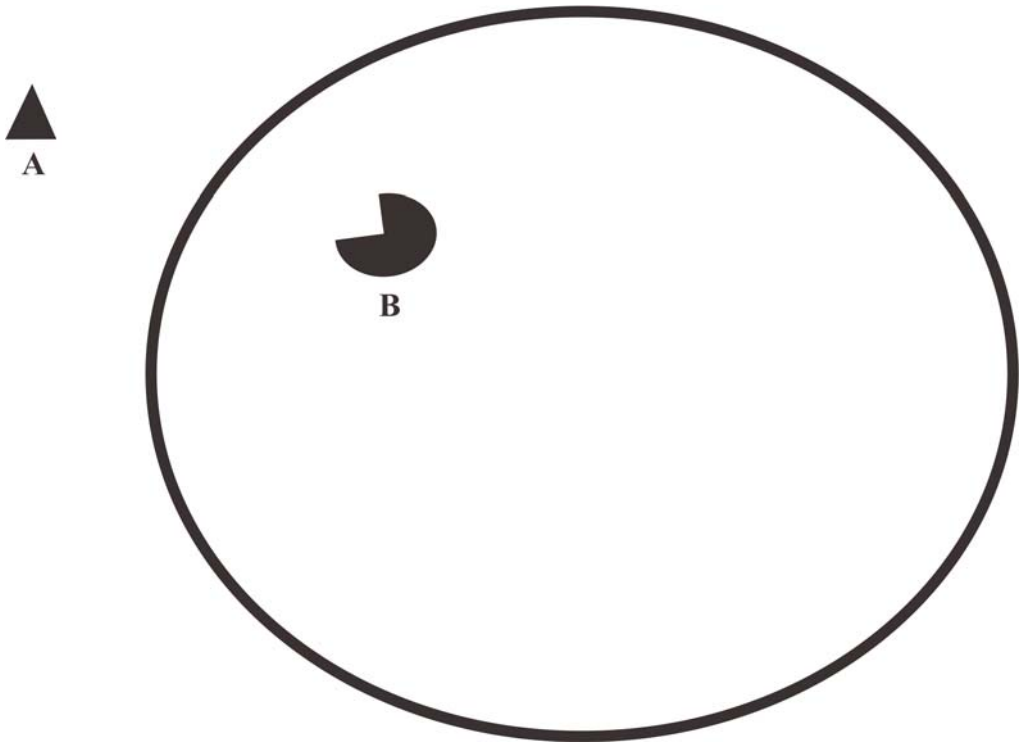

Figure 3

d. Identify a chemical property of molecule A and justify the answer given. **1 mark**

_____

_____

_____

e. What role do pheromones play in other animal species? **1 mark**

_____

_____

In 2008 scientists reported that they had found an orchid that attracted male bees by mimicking the scent of female bees from other areas and not the scent of female bees from the same area. This was due to the fact that the local male bees were more attracted to female bees from other areas. The scientists suggested that the idea of flawed mimicry (the notion of presuming non-exact mimics to be imperfect) needs to be reconsidered by researchers.

f. **i.** Describe how a pheromone mimic could be used in farming to control insect pests. **1 mark**

_____

_____

_____

_____

_____

ii. How might pheromone mimics in farming be improved by the findings from studies on flawed mimicry? **1 mark**

_____

_____

_____

Question 2 (7 marks)

A skin fungus *(Batrachochytrium dendrobatidis)* deadly to frogs has been studied and it appears that it can induce amphibian immune cells to undergo apoptosis, rendering them more susceptible to infection. The fungus exists in two forms during the infection. One form contains a cell wall while the other doesn't. Only the form with the cell wall was seen to cause apoptosis.

a. Define the term apoptosis. In the definition given, compare and contrast it with the process of necrosis. **2 marks**

_____

_____

_____

_____

_____

b. Provide a hypothesis regarding how the fungal cell wall interacts with the immune cells to trigger apoptosis. **1 mark**

_____

_____

_____

c. Broadly speaking, the signal for apoptosis can come from which two general locations? **1 mark**

_____

_____

d. Outline one situation in the human body where apoptosis is necessary. **1 mark**

_____

_____

A study on intestinal cancer has reported that in intestinal endothelial cells, the expression of an enzyme known as cyclooxygenase (COX-2) leads to inhibition of apoptosis in these cells. The study also found that COX-2 production is inactivated by a selective substance called Compound Z.

e. **i.** Explain how the inhibition of apoptosis could lead to cancer in the intestine. **1 mark**

_____

_____

_____

_____

ii. Briefly describe the medical importance of Compound Z. **1 mark**

_____

_____

_____

Question 3 (6 marks)
This question refers to **Figure 4** below.

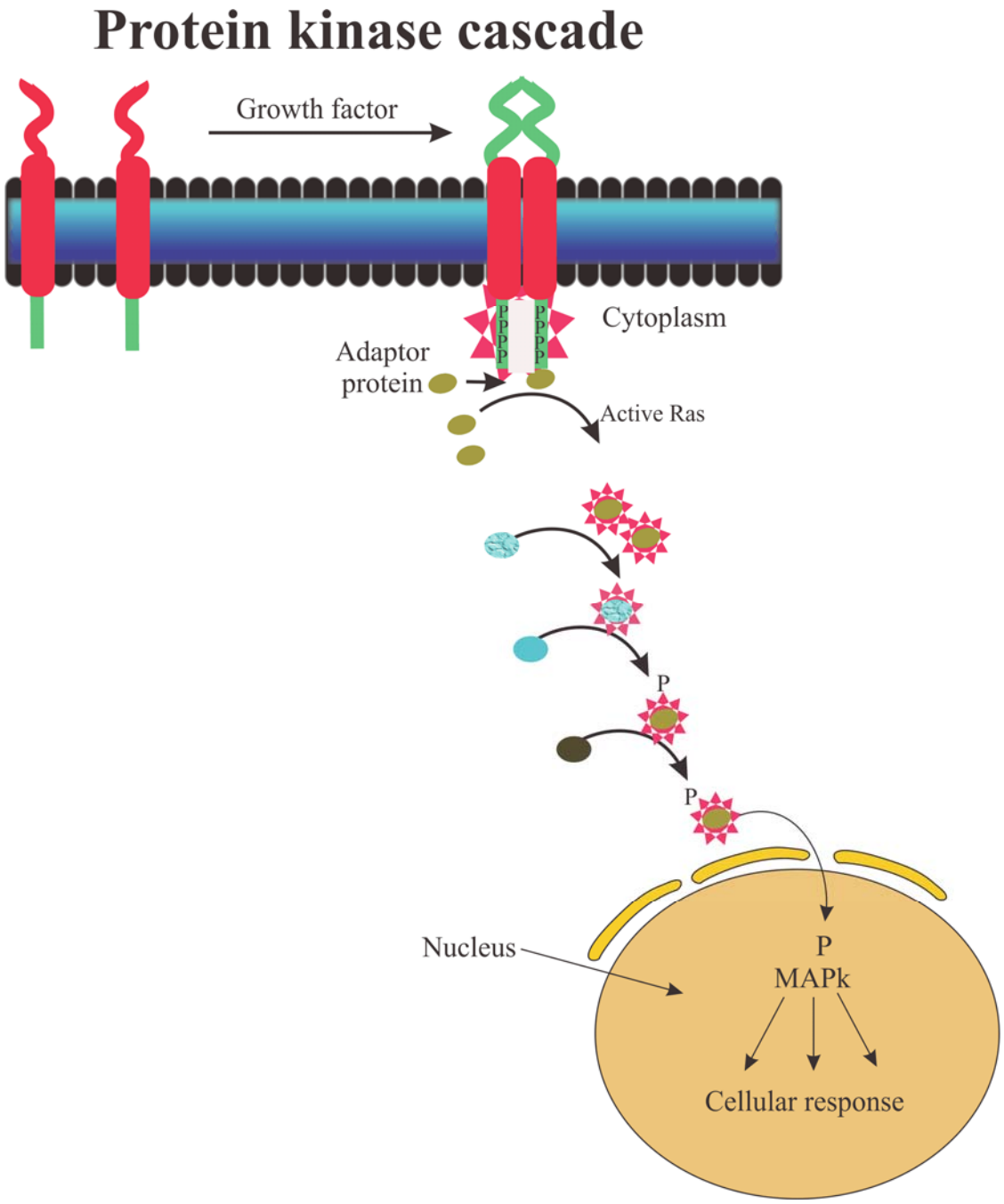

Figure 4

a. Based on the events shown in **Figure 4**, explain whether or not a growth factor molecule should be classified as a hormone. **1 mark**

_____

_____

_____

b. Identify the first messenger in this scenario. **1 mark**

_____

_____

c. Explain, with reference to the diagram, what the term 'signal transduction' means. **1 mark**

_____

_____

_____

d. Does the diagram demonstrate that signal amplification is involved? Explain your reasoning. **1 mark**

_____

_____

_____

e. What is a likely cellular response in this scenario? **1 mark**

_____

f. Deregulated (uncontrolled) protein kinase activity is a frequent cause of disease, particularly cancer. What does this suggest about the role of the protein kinase cascade in a cell? **1 mark**

_____

_____

Question 4 (6 marks)

Figure 5 illustrates how a problem with synapses in the nervous system might contribute to Alzheimer's disease.

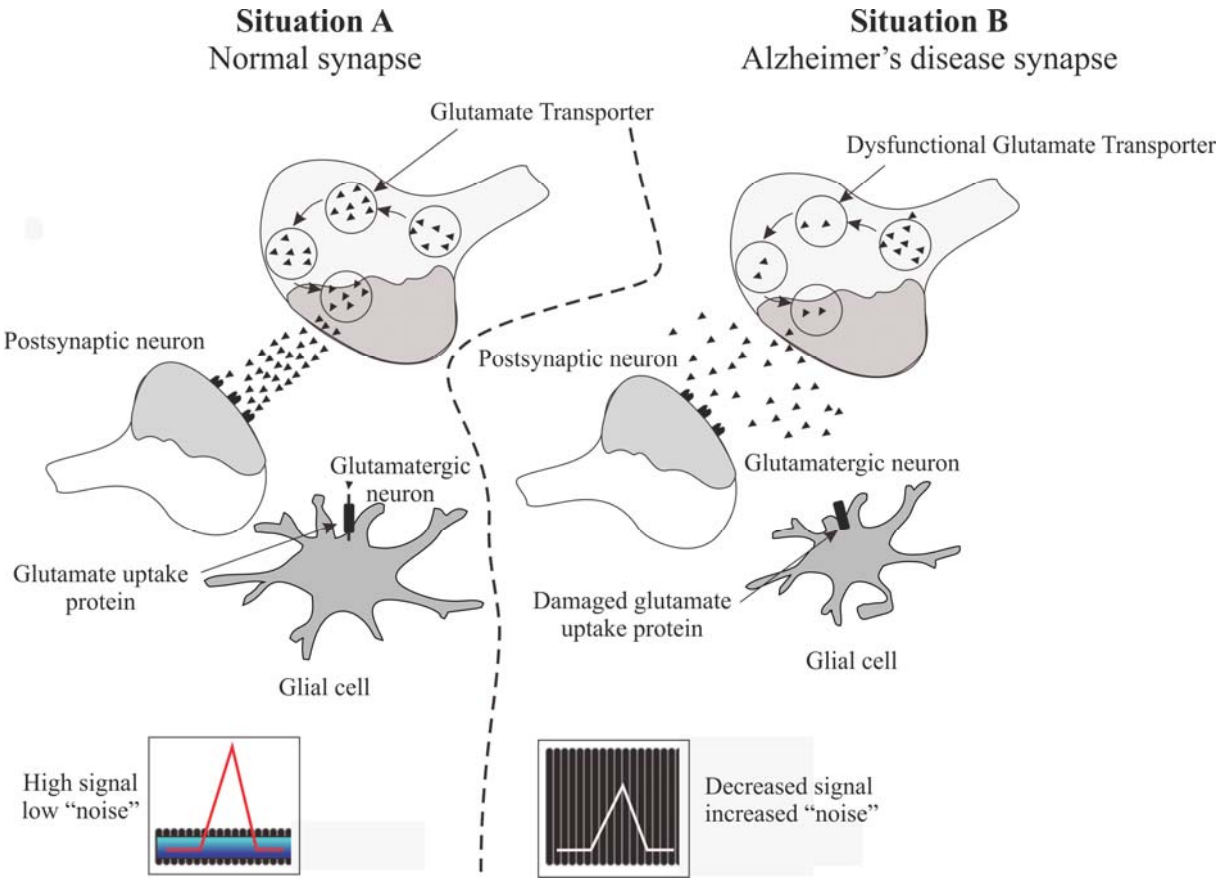

Figure 5

a. In Situation A, what would be the normal cellular response after the neurotransmitters bind to the receptors on the postsynaptic neuron? **1 mark**

_____

_____

_____

b. Identify the neurotransmitter that crosses this synapse. **1 mark**

_____

_____

c. The packaging and secretion of neurotransmitters in the presynaptic neuron is triggered by the influx of what ion through a protein channel? **1 mark**

_____

_____

d. What role do glial cells appear to play in the normal function of this synapse? **1 mark**

_____

_____

e. Explain why there is a problem with the integrity of the signal in the Alzheimer's disease synapse. **2 marks**

_____

_____

_____

_____

End of Section B

End of Topic Test 2

Suggested Answers

VCE Biology 2014 Year 12 Topic Test 2 Unit 3

Detecting & Responding (1)

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1 (7 marks)

a. These two substances are human pheromones **(1 mark)**.

b. A pheromone is a chemical that, when released by one animal, elicits a response in another animal of the same species **(1 mark).**

c. The male cells have a receptor specific to the oestrogen-like substance while female cells lack this type of receptor **(1 mark)**.

d. Molecule A is lipophilic as it diffuses through the cell membrane to reach its intracellular receptor **(1 mark)**.

e. A female signalling to a male that it is ready to mate **or** another reasonable answer **(1 mark)**.

f. **i.** Traps are baited with scents which mimic the scent of female insects and male insects are lured into them. **(1 mark)**.

ii. The 2008 orchid study suggests that investigations of flawed mimicry could produce more powerful mimics than the exact copies that are traditionally used **(1 mark)**.

Question 2 (7 marks)

a. Apoptosis is defined as programmed cell death and involves a controlled and contained eradication of the cell that has no impact on surrounding tissue **(1 mark)**. Necrosis is cell death resulting from trauma and involves the contents of the cell spreading out into surrounding tissue resulting in inflammation **(1 mark)**.

b. The fungal cell wall contains a protein that is complementary to an apoptosis receptor on the immune cell membrane **(1 mark)**.

c. Inside the cell and outside the cell **(1 mark)**.

d. If severe damage occurs inside a cell **or** if the cell is infected with a virus **or** the cell has outlived its usefulness, such as the webbing between the fingers and toes of a foetus **or** another reasonable answer **(1 mark)**.

e. **i.** Cancer involves the uncontrolled growth of cells. Cell numbers in non-cancerous tissue would usually be kept in check by apoptosis. The inhibition of apoptosis therefore results in cancer causing events in the intestine **(1 mark)**.

ii. Compound Z could be used in cancer treatment because it inactivates COX-2 production and allows apoptosis to occur normally **(1 mark)**.

Question 3 (6 marks)

a. The growth factor molecule should be classified as a hormone because it interacts with a cell receptor which initiates a chemical cascade and results in a cellular response. This process is consistent with the effects of a hormone on a cell **(1 mark)**.

b. The first messenger is the growth factor molecule **(1 mark)**.

c. Signal transduction can be defined as the chain of events linking an external signal to a specific cellular response. This can be seen in the protein kinase cascade diagram as the growth factor molecule binding to the membrane receptor initiates a chain of chemical events, the last of which is a cellular response **(1 mark)**.

d. There is no clear indication that signal amplification is occurring as only one new substance is activated at each step of the chemical cascade **(1 mark)**.

e. As the first messenger is the growth factor molecule, it would be reasonable to assume that the protein kinase cascade has a role in cell growth **(1 mark)**.

f. It suggests that the protein kinase cascade has a role in cell growth or cell division **(1 mark)**.

Question 4 (6 marks)

a. Na^+ ion membrane channels would open and an influx of Na^+ would occur, generating an action potential in the postsynaptic neuron **(1 mark)**.

b. The neurotransmitter is glutamate **(1 mark)**.

c. Ca^+ **(1 mark)**.

d. Glial cells appear to have a role in the removal of neurotransmitters from the synapse once the impulse has passed through **(1 mark)**.

e. The glial cells in the Alzheimer's synapse are defective and do not remove the neurotransmitters from the synapse **(1 mark)**. This means that there are too many neurotransmitters remaining in the synapse, resulting in too many action potentials generated in the postsynaptic neuron **(1 mark)**.

End of Suggested Answers