Neap:

BIOLOGY VCE UNITS 3&4
DIAGNOSTIC TOPIC TESTS 2017

TEST 4: CELLULAR SIGNALS

SUGGESTED SOLUTIONS AND MARKING SCHEME

SECTION A – MULTIPLE-CHOICE QUESTIONS

Question 1 **D**

The nervous system responds faster than the endocrine system. They do not have the same duration of response. However, they do both release chemical signalling molecules which act on specific tissues.

Question 2 **C**

Structure B is a nucleus; structure A is a Schwann cell forming myelin sheath; structure C is a mitochondrion; structure D is a synaptic vesicle; structure E is the synaptic cleft; structure F is the postsynaptic neuron.

Question 3 **B**

The muscles are producing the response hence they are effectors.

Question 4 **B**

The synapse is part of the nervous system so does not involve endocrine or exocrine signals. Neurotransmitters are chemical messengers released from one neuron. They diffuse across the synapse to bind with receptors on the postsynaptic neuron.

Question 5 **C**

Protein-based signalling molecules cannot cross plasma membranes by themselves; hence, they have receptors on the surface of the cell plasma membrane.

Question 6 **A**

Amplification of the message involves a series of second messenger molecules.

Question 7 **D**

Signalling molecules perform their role by docking with specific receptors either on the cell surface or inside the cell. Once they have docked they elicit a response by the cell.

Question 8 **B**

Hydrophobic signalling molecules cannot move in blood or tissue fluid without a carrier molecule as they are non-polar.

Question 9 **C**

Signal transduction is the process of the cell receiving a signal and responding to the signal.

Question 10 **C**

Cells will only respond to signalling molecules that they have specific receptors for.

Question 11 **D**

Enhancing a message is amplifying the message.

Question 12 **D**

The answers **A**, **B** and **C** walk through the series of steps that occurs to initiate and undergo a signal cascade.

Question 13 **A**

Hormones may be protein based or lipid based signalling molecules.

Question 14 **C**

As erythropoietin is a protein-based hormone, it cannot pass through the plasma membrane. Instead it binds to receptors in the plasma membrane.

Question 15 **B**

Plant hormones tend to cause specific plant growth, flowering and ripening of fruit. These responses are observable.

SECTION B – SHORT-ANSWER QUESTIONS

Question 1 (3 marks)

a. The artificial pheromone could be put in a trap and used to lure the males there to be killed. The females' eggs would not be fertilised, hence less fruit would be destroyed. 1 mark

b. The artificial pheromone is identical to the natural pheromone and would therefore bind with the specific receptors on the male moths. 1 mark

c. No, pheromones have specific shapes and only those organisms with the corresponding receptor would respond. Like other signalling molecules, pheromones are specific. 1 mark

Question 2 (3 marks)

dendrites, cell body/soma, axon, axon terminals 3 marks

Subtract one mark per missing item.

Question 3 (2 marks)

A nerve impulse is a signal transmitted along a nerve fibre, consisting of a wave of electrical depolarisation that reverses the electrical potential difference across the nerve cell membranes. 1 mark

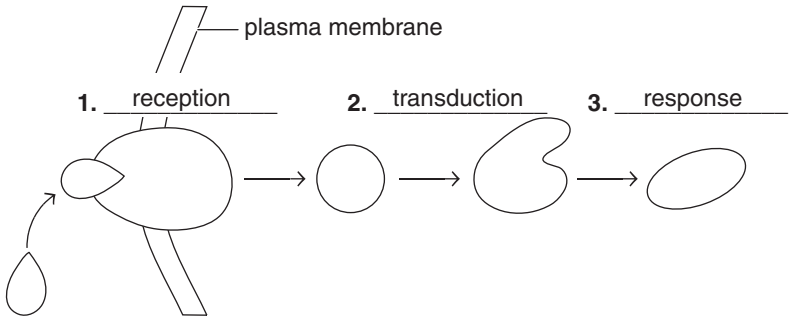
A nerve impulse is transmitted along the axon by movement of sodium and potassium into and out of the axon. 1 mark

Question 4 (1 mark)

A nerve impulse is converted to a chemical-signalling molecule in the form of a neurotransmitter which is released from vesicles in the axon terminal of one nerve. The neurotransmitters diffuse across the synapse to fuse with receptors on the dendrites of the next neuron which causes channels to open, allowing sodium to rush in and initiate an action potential. 1 mark

Question 5 (6 marks)

a.



3 marks

1 mark for each correct label.

b. **1.** The receptor binds to the signalling protein hormone or antigen. 1 mark

2. The receptor then becomes activated which activates the G protein which increases cAMP and a cascade of reactions (second messengers). 1 mark

3. The cellular response is then activated, such as gene expression and protein production. 1 mark

Question 6 (4 marks)

a. The property is that it is hydrophilic; 1 mark
that is, unable to easily diffuse through the lipid bilayer of a plasma membrane. 1 mark

b. A steroid 1 mark
that is lipophilic. 1 mark

Question 7 (6 marks)

a. Intrinsic (within the cell) 1 mark
or extrinsic (outside the cell). 1 mark

b. Apoptosis can occur from within the cell via the mitochondrial pathway where the mitochondria releases caspase enzymes. 1 mark
Apoptosis can occur from signals received outside the outside the cell; this is the death receptor pathway. 1 mark

c. Tumour cells are immortal; they never stop growing and dividing and so do not undergo programmed cell death 1 mark

Normal body cells have a definite life span and break down into fragments as they undergo programmed cell death. 1 mark