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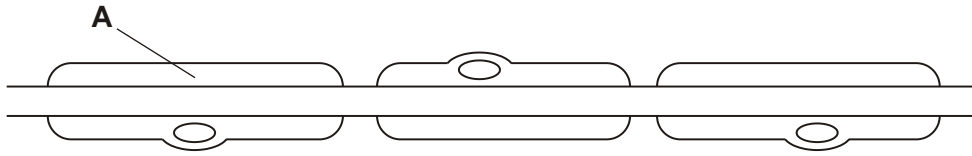
A2 Biology OCR

Unit F214: Communication, Homeostasis and Energy

Module 1.1 – 1.3 Communication, Nerves & Hormones

Questions

1. (a) The figure below represents part of the axon of a neurone.



Describe the **structure** of the feature labelled **A**.

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[2]

The table below shows details of the diameter and speed of conduction of impulse along the neurones of different animal taxa.

type of neurone	axon diameter (μm)	speed of conduction (m s^{-1})	animal taxon
myelinated	4	25	mammal
myelinated	10	30	amphibian
myelinated	14	35	amphibian
unmyelinated	15	3	mammal
unmyelinated	1000	30	mollusc

(b) Using **only the data in the table above**, describe the effect of each of the following on the speed of conduction:

(i) myelination,

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[2]

(ii) axon diameter.

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[2]

(c) The speed of conduction of a nerve impulse is also affected by temperature.

(i) Suggest why an increase in temperature results in an increase in the speed of conduction.

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[1]

(ii) As the temperature continues to increase, it reaches a point at which the conduction of the impulse ceases. Suggest why.

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[1]

[Total 8 marks]

2. (a) Fig. 1 is a diagram of a neurone.

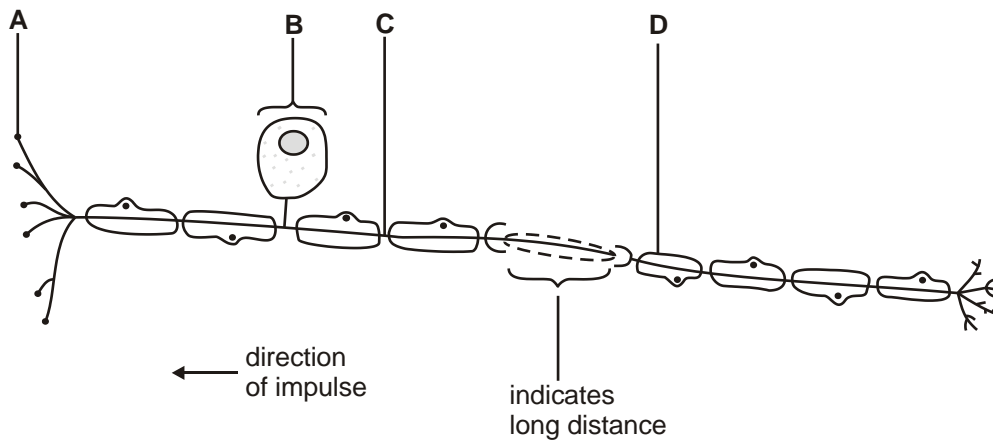


Fig. 1

Name the structures **A** and **B**.

A

B

[2]

Fig. 2 shows a recording of the potential difference across the membrane of an axon as an action potential is transmitted.

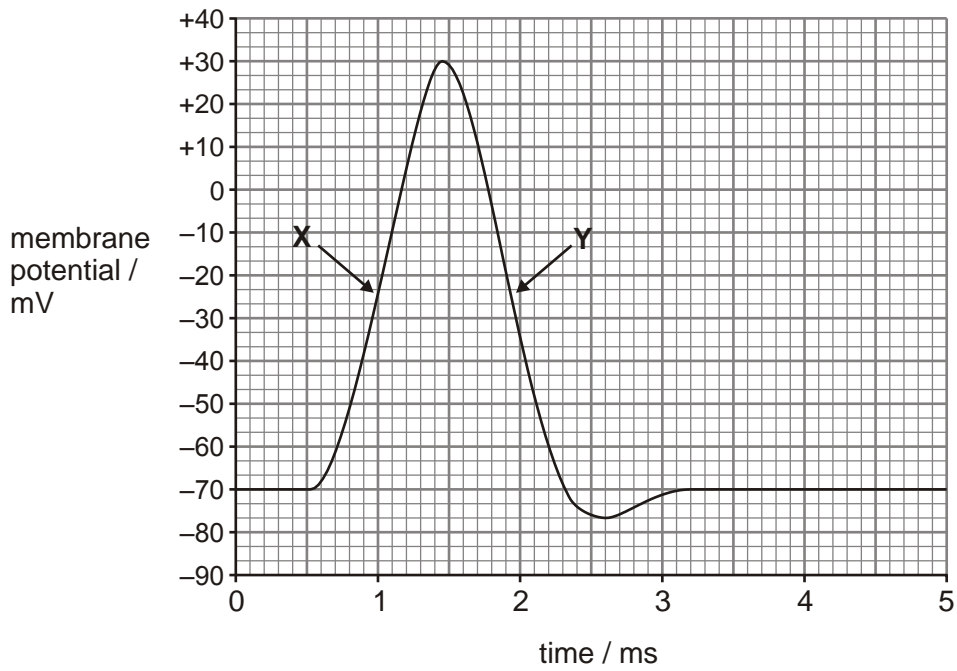


Fig. 2

(b) Describe the events taking place in the neurone during stages X and Y.

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[4]

The table below shows how the speed of conduction of an action potential varies with the diameter of myelinated and non-myelinated axons in different organisms.

organism	type of axon	axon diameter / μm	speed of conduction / ms^{-1}
crab	non-myelinated	30	5
squid	non-myelinated	500	25
cat	myelinated	20	100
frog	myelinated	16	32

- (c) Describe the effect of myelination on the **rate** of conduction of an action potential **and** explain how this effect is achieved.



In your answer, you should use appropriate technical terms, spelled correctly.

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[5]

[Total 11 marks]

3. The table below shows how the speed of nerve impulse conduction varies with the diameter of myelinated and non-myelinated axons in different organisms.

organism	type of axon	axon diameter / μm	speed of impulse / m s^{-1}
crab	non-myelinated	30	5
squid	non-myelinated	500	25
cat	myelinated	20	100
frog	myelinated	16	32

Describe the trends shown in the table above.

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[Total 2 marks]

4. Fig.1 represents **some** of the changes that occur across the membrane of the axon. Three protein complexes are shown to be present in the membrane:

- sodium channels
- potassium channels
- sodium-potassium pumps.

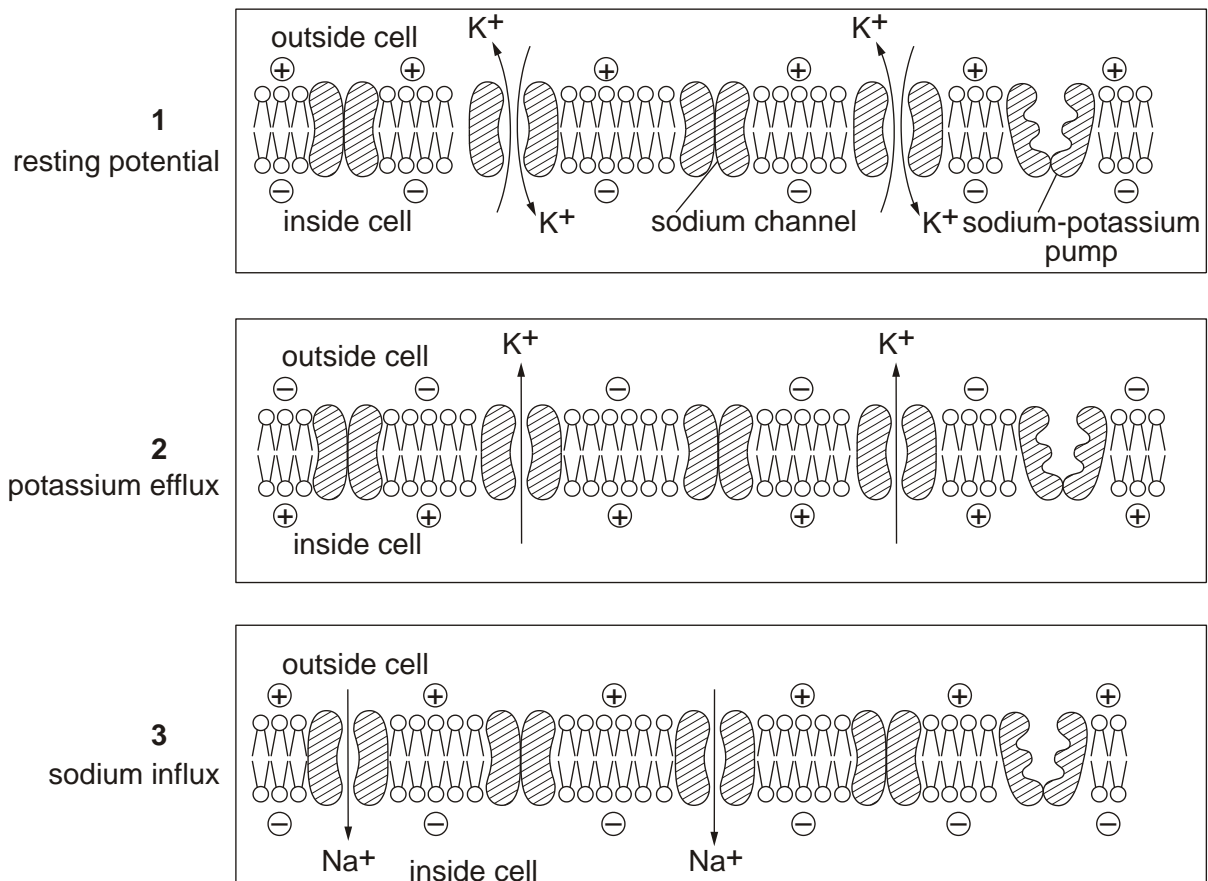


Fig. 1

Fig. 2 shows the change of membrane potential associated with an action potential.

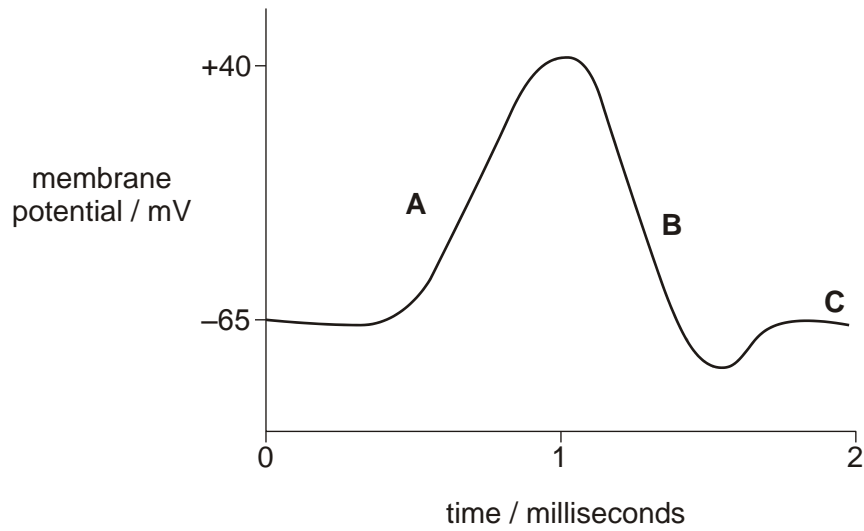


Fig. 2

- (i) State which of the three diagrams of the axon membrane in Fig. 1 match up to the phases labelled in Fig. 2. Write your answers in the table below.

phase	number
A	
B	
C	

[1]

- (ii) With reference to Fig. 1, explain the changes in membrane potential in Fig. 2.

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[5]
[Total 6 marks]

- 5. In this question, one mark is available for the quality of spelling, punctuation and grammar.

In order to transfer information from one point to another in the nervous system, it is necessary that action potentials be transmitted along axons. In humans, the rate of transmission is 0.5 m s^{-1} in a nonmyelinated neurone, increasing to 100 m s^{-1} in a myelinated neurone.

Explain how action potentials are transmitted along a nonmyelinated neurone **and** describe which parts of this process are different in myelinated neurones.

No credit will be given for reference to events at the synapse.

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[7]
Quality of Written Communication [1]
[Total 8 marks]

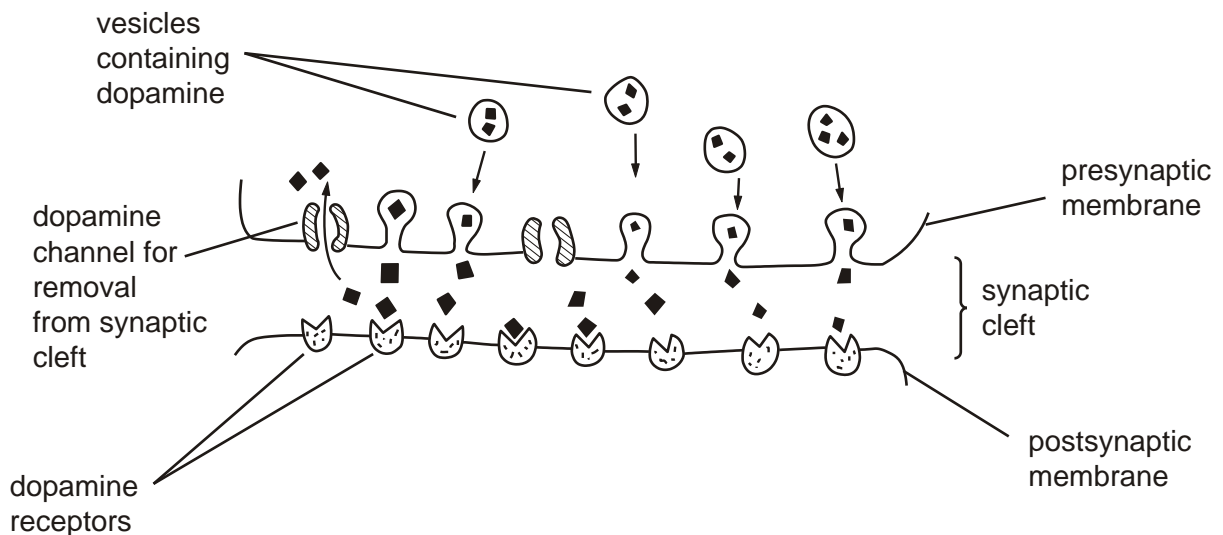
6. Parkinson's disease is a disorder of the nervous system. People with this condition are unable to produce enough of the neurotransmitter substance dopamine. This chemical is required in neurone circuits in the brain that control movement.

(a) Outline **two** roles of synapses in the nervous system.

- 1
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- 2
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[2]

The figure below illustrates the events at a synapse where the neurotransmitter is dopamine.



(b) Using **only** the information above, list **three** ways in which the events occurring at this synapse are the same as at a cholinergic synapse.

- 1
- 2
- 3

[3]

- (c) For the proper functioning of neurone circuits, neurotransmitters have to be removed from the receptors in the postsynaptic membrane and from the synaptic cleft. Explain why this is so.

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[2]
[Total 7 marks]

- 7. Alzheimer’s disease is a complex, degenerative disease that affects the brain. The risk of developing this disease increases with age, particularly over the age of 65. Symptoms include a gradual loss of memory, disorientation, difficulty with learning, loss of language skills and a decline in the ability to perform routine tasks. The areas of the brain that control memory and thinking skills are affected first.

State the functions of acetylcholine and acetylcholinesterase in synapses in the brain.

acetylcholine
.....
acetylcholinesterase
.....

[Total 2 marks]

8. In this question, one mark is available for the quality of spelling, punctuation and grammar.

The autonomic nervous system contains neurones that carry impulses to the internal organs.

Describe the role of the autonomic nervous system in the control of the heart beat.

[7]

Quality of Written Communication [1]

[Total 8 marks]

9. Excretion and secretion are two processes that take place in the body of a mammal.

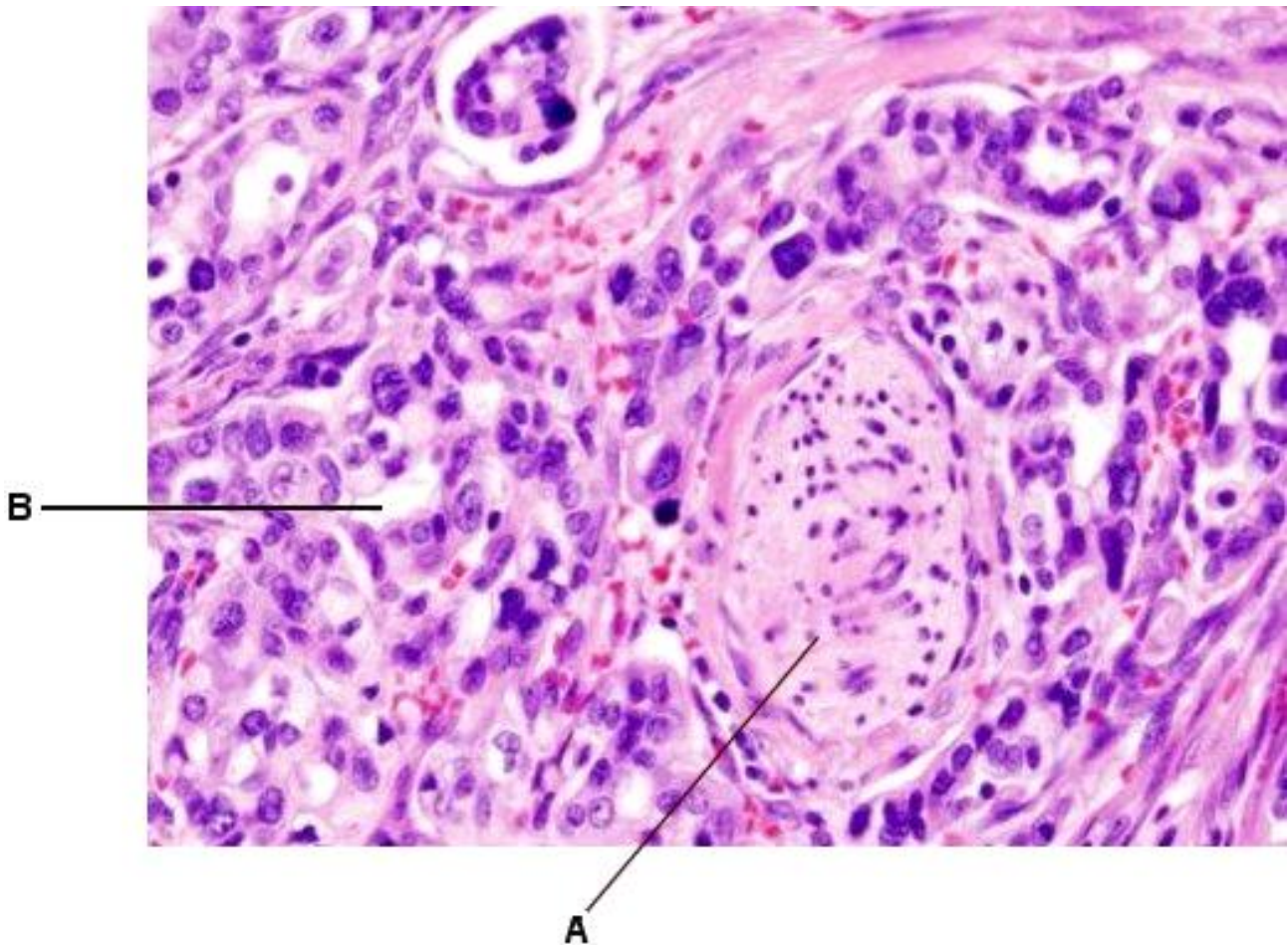
Complete the table below to compare the processes of excretion and secretion.

	excretion	secretion
one difference		
one example of a product		
one similarity		

[Total 3 marks]

10. The pancreas is a gland that has both endocrine and exocrine functions.

The figure below shows a section through part of the pancreas.



magnification × 400

(i) Name **A** and **B**.

A

B

[2]

(ii) Explain the difference between the terms *endocrine* and *exocrine* with regard to the pancreas.

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[4]

[Total 6 marks]

11. Following a meal rich in carbohydrates, the plasma glucose concentration rises.

Describe the homeostatic mechanisms that would normally prevent glucose appearing in the urine.

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[Total 5 marks]

12. Over 2.3 million people in the UK are known to have diabetes. It is also estimated that a further 0.5 million people have the condition but are unaware of it.

(i) Explain how **Type 1** diabetes is caused.

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[2]

(ii) Describe **three** factors that increase a person's risk of developing **Type 2** diabetes.

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[3]

[Total 5 marks]