

Central and Peripheral Nervous System

Section One: Multiple-choice

1. Parasympathetic action
 - a) is described as 'fight or flight'.
 - b) acts to produce the same effects as the sympathetic division.
 - c) increases overall vasotone.
 - d) has no effect on blood flow to the skeletal muscle.
2. The somatic and autonomic divisions
 - a) use the same neurotransmitter, if referring only to the sympathetic innervation of sweat glands.
 - b) have opposing effects (act in antagonism).
 - c) use the same neurotransmitter, if referring only to the sympathetic division of the autonomic system.
 - d) both supply voluntary muscles, such as skeletal muscle.
3. Which of the following is **incorrect**?
 - a) afferent information is transferred towards the spinal cord.
 - b) efferent information leaves the spinal cord.
 - c) efferent information originates from the receptors and spindle fibres.
 - d) afferent information enters the spinal cord at the dorsal root.
7. A sensory or afferent neuron is capable of
 - a) receiving sensory information and carrying it out of the spinal cord, via the ventral root.
 - b) receiving sensory information and carrying it into the spinal cord, via the ventral root.
 - c) receiving sensory information and carrying it out of the spinal cord, via the dorsal root.
 - d) receiving sensory information and carrying it into the spinal cord, via the dorsal root.
8. Which is **incorrect** about interneurons? An interneuron
 - a) is also known as a connector neuron.
 - b) can connect a sensory neuron to a motor neuron in a monosynaptic reflex arc.
 - c) can connect a sensory neuron to a motor neuron in a polysynaptic reflex arc.
 - d) exists in both divisions of the central nervous system.
9. Which of the following **best** describes the actions of acetylcholine. Acetylcholine is
 - a) the neurotransmitter used by both divisions of the autonomic nervous system.
 - b) the neurotransmitter used by the autonomic division and not the somatic division.
 - c) pumped out of the synapse by the acetylcholine transporter.
 - d) degraded by acetylcholinesterase.
10. Hormones, rather than action potentials,
 - a) have a much faster speed of action, in the order of milliseconds.
 - b) are more specific.
 - c) are electrochemical messengers, as opposed to chemical messengers.
 - d) have a greater duration of action.
11. Hyperpolarisation
 - a) is when the membrane potential increases above -70mV .
 - b) is when the membrane potential increases above -55mV .
 - c) is when the membrane potential decreases below 30mV .
 - d) is when the membrane potential decreases below -70mV .

12. In repolarisation
- a) sodium moves into the cell, from high concentration to low concentration.
 - b) sodium moves out of the cell, from high concentration to low concentration.
 - c) potassium moves into the cell, from high concentration to low concentration.
 - d) potassium moves out of the cell, from high concentration to low concentration.

13. The central nervous system
- a) is composed of the peripheral and autonomic systems.
 - b) sends information to the periphery.
 - c) is responsible for the initiation of reflexes.
 - d) none of the above are correct.

15. Which component of the nervous system is the umbrella term grouping the sympathetic and parasympathetic divisions?
- a) afferent nervous system.
 - b) somatic nervous system.
 - c) central nervous system.
 - d) autonomic nervous system.

16. In typical cells, the resting potential is a result of the
- a) diffusion of potassium ions out of the cell.
 - b) diffusion of chloride ions into the cell.
 - c) diffusion of sodium ions out of the cell.
 - d) active transport of sodium and potassium ions out of the cell.

17. Which statement characterises parasympathetic activity?
- a) bronchioles dilate.
 - b) pupils dilate.
 - c) secretion of sweat glands.
 - d) urinary bladder contracts to eliminate urine.

18. Sympathetic innervation of the heart will result in
- a) reduced heart rate.
 - b) reduced stroke volume.
 - c) increased heart rate.
 - d) increased heart rate but with no effect on stroke volume.

19. Parasympathetic stimulation will _____ heart rate and _____ digestive tract motility.
- a) increase, decrease.
 - b) decrease, increase.
 - c) decrease, decrease.
 - d) not affect, increase.

20. All of the following typically release the neurotransmitter, acetylcholine, **except**
- a) somatic neurons.
 - b) parasympathetic preganglionic fibres.
 - c) parasympathetic postganglionic fibres.
 - d) sympathetic postganglionic fibres.

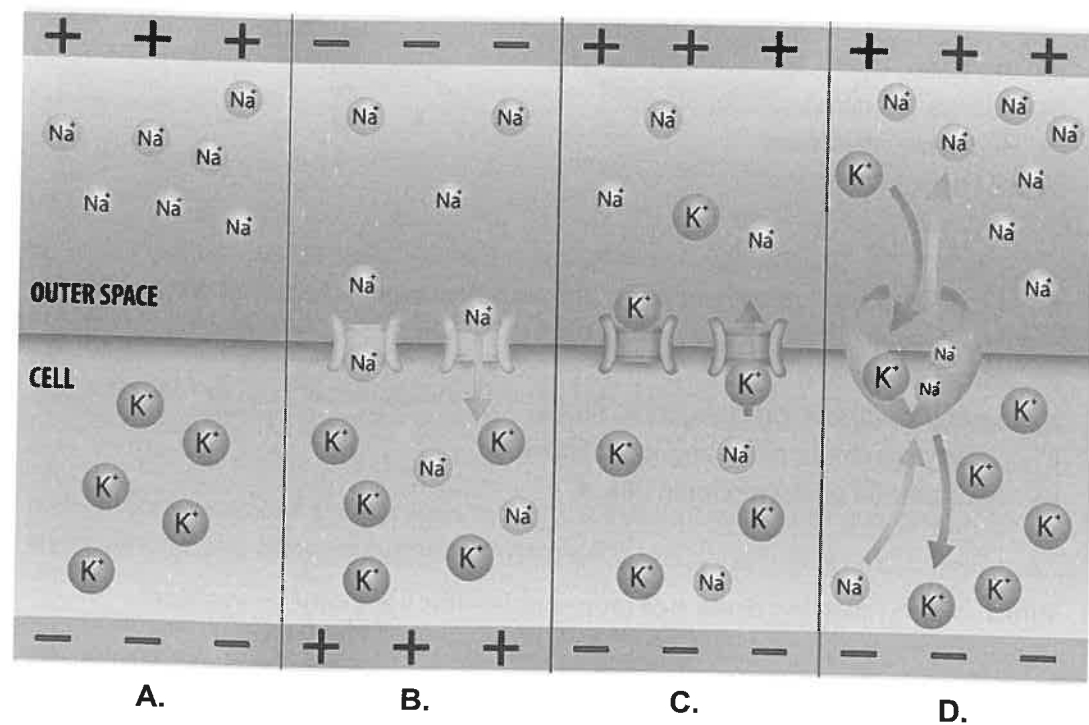
21. Which of the following **does not** characterise the sympathetic system?
- a) it is generally antagonistic to the parasympathetic division.
 - b) it is always excitatory.
 - c) it is involved in activating the body for strenuous activity.
 - d) noradrenaline is generally the postganglionic neurotransmitter.

22. The resting membrane potential

- i) Is created by the selective permeability of specific ions.
 - ii) Is in the order of +55mV, inside relative to the outside of the cell.
 - iii) Is created by an unequal distribution of electrically charged ions.
 - iv) Is a result of a higher cation concentration inside the cell compared to the outside of the cell.
- a) all of the statements are correct.
 - b) statements i, iii, iv are correct.
 - c) statements i and iii are correct.
 - d) statements i, ii and iii are correct.

23. ~

24. The below diagram illustrates sections of the axon upon electrical stimulation. Which section indicates the active transport of ions across the axon membrane?



- a) A.
- b) B.
- c) C.
- d) D.

Question 26.

(14 marks)

a) Which division of the peripheral nervous system operates outside conscious control?
(1 mark)

b) The sensory nervous system is able to detect stimuli inside and outside of the body. Provide **one example** of an external stimulus and **one example** of an internal stimulus.
(2 marks)

An acetylcholinesterase inhibitor is given to a series of patients. This means the usual function of acetylcholinesterase is blocked, and the effects of acetylcholine are enhanced.

e) One patient with paralytic ileus and another patient with glaucoma are administered with an acetylcholinesterase inhibitor. Using your knowledge of acetylcholine and the specific neural division that relies on this neurotransmitter, complete the table below. (4 marks)

Condition	Target organ	Effect of acetylcholinesterase inhibitor
Paralytic ileus – intestinal obstruction due to paralysis of intestinal muscles		
Open-angle glaucoma – increased intraocular pressure		

f) The doctor accidentally gives both patients too high a dose of the inhibitor, resulting in acute poisoning with cholinesterase inhibitors. This means that at the synapse, acetylcholine will remain present for longer. Complete the table below. (4 marks)

Organ	Effect
Heart	
Lungs	
Sweat glands	
Salivary glands	

Review Page 36 of the Coursebook.

Parasympathetic nerve stimulation is said to act in opposition to the sympathetic division of the nervous system.

d)

i) Provide **two differences** between the sympathetic and parasympathetic divisions. (2 marks)

ii) What is the effect of the parasympathetic system on **three exocrine glands**? (3 marks)

Question 28.

(8 marks)

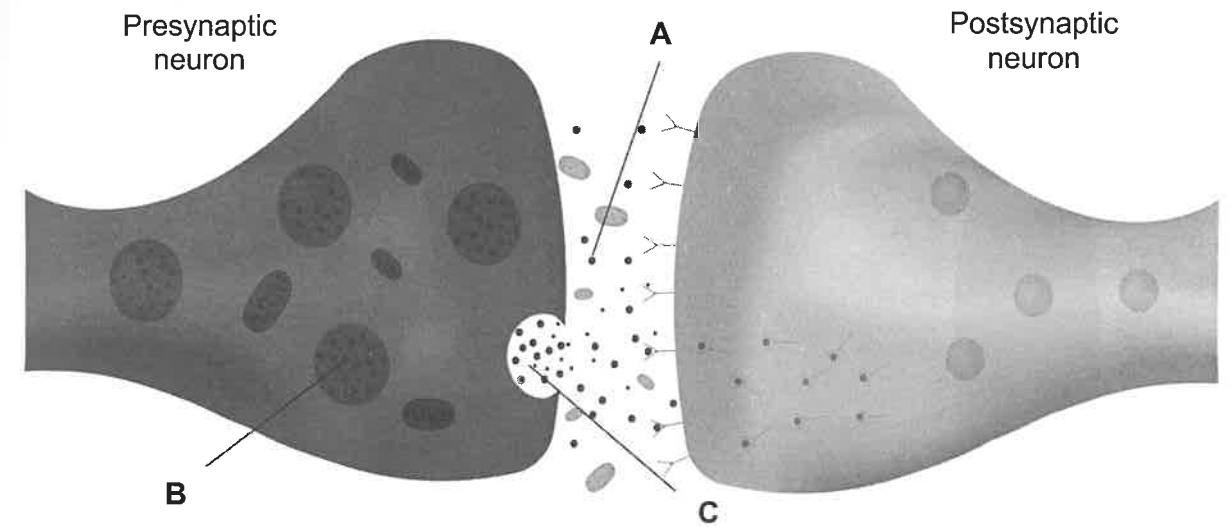
In Multiple Sclerosis, the immune system attacks the myelin sheath.

a) Which structure in the peripheral nervous system manufactures myelin? (1 mark)

b) What would be the effect of reduced myelin coverage on a neuron's conduction velocity? (1 mark)

c) Explain how a nerve impulse conducts along myelinated neurons. (3 marks)

Once a nerve impulse reaches a synapse, it must be conducted along to the postsynaptic neuron. The diagram below illustrates this process.

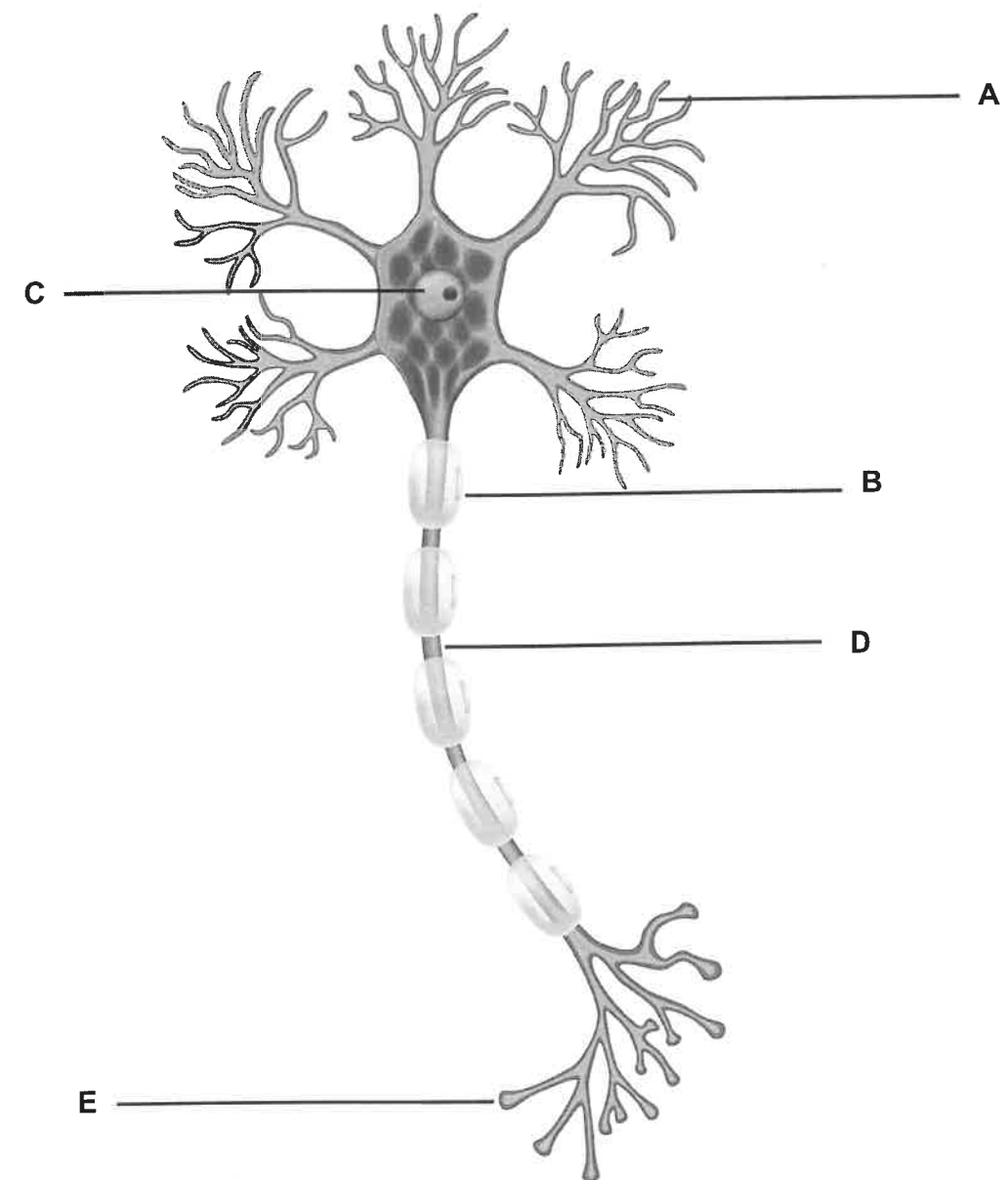


d) i) What is located within B? (1 mark)

ii) What is the process occurring at C called? (1 mark)

iii) The overall process displayed in the diagram above is best known as? (1 mark)

The following diagram is of a myelinated motor neuron.

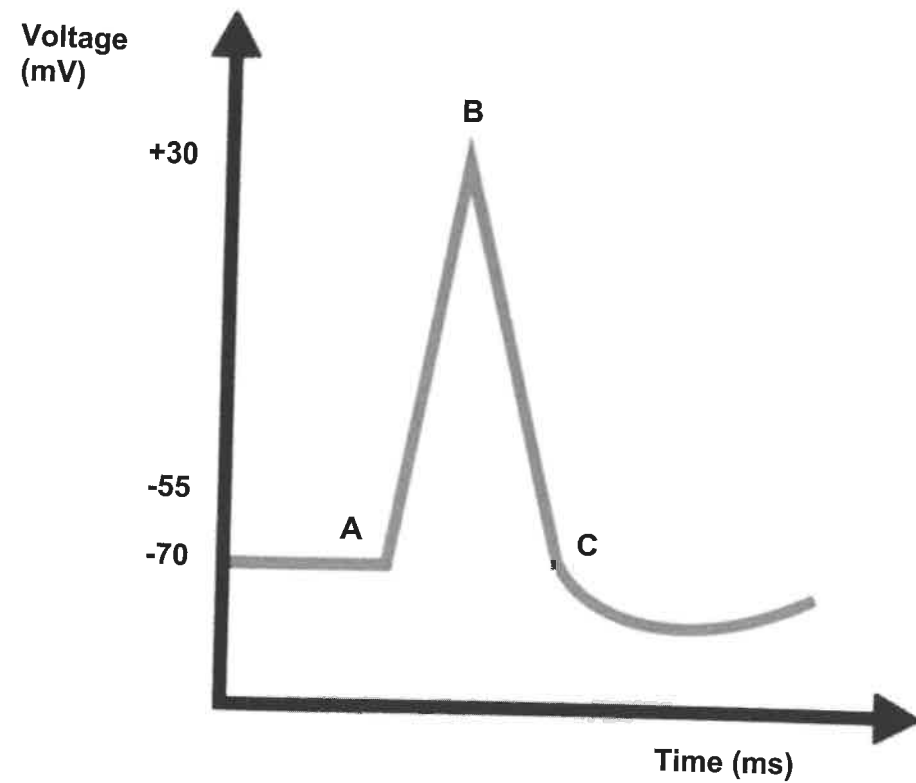


- f)
- i) The axon terminal is Structure _____ (1 mark)
 - ii) The structure that manufactures myelin is Structure _____ (1 mark)
 - iii) The region along which action potentials are generated is Structure _____ (1 mark)

Question 30.

(10 marks)

Refer to the following action potential chart to answer this question.



a) At C the membrane potential falls below A. Why does this happen? (2 marks)

b) Explain the significance of a membrane potential of -55mV. (2 marks)

c) Action potentials are often regarded as 'all or none' responses. What does this mean? (1 mark)

d) What processes occur at B? (2 marks)

e) Eventually, the membrane potential is re-established. Which ions migrate to reverse the hyperpolarised membrane potential? (2 marks)

f) On the diagram, annotate the location of the refractory period. (1 mark)

Section Three: Extended Answer

Question 31.

(20 marks)

- a) Explain the sequence of events that occur to generate and propagate action potentials along an unmyelinated neuron. (10 marks)

- b) How does nerve impulse propagation differ in myelinated neurons? (3 marks)

- c) With the aid of a diagram, explain the sequence of events that occur at the axon terminal of a neuron. (7 marks)

*Review Page 38-40
of the Coursebook.*