InkBiology

QUESTION WORKBOOK

The action potential: the same size, however hard you push

Nervous coordination, receptors, muscles and behaviour · Unit B14

AQA 3.6.2.1 · OCR A 5.1.3 · Edexcel A Topic 8.8-8.10 · CAIE 15.1.3-15.1.5

7 questions · 25 marks

PRINT EDITION

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SECTION A · Short, 1 to 2 marks

A1 State the resting potential of a typical neurone in millivolts, and state the ratio in which the sodium-potassium pump moves the two ions across the membrane. [2]

SECTION B · Standard, 3 to 5 marks

B1 Explain how the sodium-potassium pump and the permeability of the axon membrane together establish a resting potential of about -70 mV. [4]

B2 Describe the changes in membrane potential during an action potential, from threshold to the recovery of the resting value, in terms of which voltage-gated channels are open at each point. [4]

B3 Explain what is meant by the all-or-nothing principle, and explain how the nervous system distinguishes a light touch from a heavy blow if every action potential is the same size. [4]

B4 Explain what causes the refractory period after an action potential, and explain two consequences it has for the impulses a neurone can carry. [4]

B5 An action potential is recorded 8.4 cm along an axon from the point of stimulation, 1.2 ms after the stimulus was applied. Calculate the conduction velocity of this axon in metres per second, and calculate how long an impulse would take to travel 1.4 m along an unmyelinated axon conducting at 1.0 m s^{-1}. [4]

B6 A local anaesthetic injected at a tooth blocks the voltage-gated sodium channels in the sensory neurones nearby. Suggest why the patient feels no pain from the tooth, and suggest why the sense of touch in the lip on that side is lost as well.

[3]