

inkBiology

ANSWER BOOK

Organisation of the nervous system

Nervous coordination, receptors, muscles and behaviour · Unit B14

AQA 3.6.1.3 (context) · OCR A 5.1.3, 5.1.5 · Edexcel A 7.9, 7.12, 8.1, 8.2, 8.7, 8.8
Edexcel B 4.4 iv, 9.4 i, 9.4 iii, 9.4 iv, 9.4 v, 9.5 iv, 9.8 i · CAIE 15.1 (context)

15 questions · 50 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

A1 **B1** the central nervous system is the brain and the spinal cord. **B1** the somatic nervous system carries impulses to skeletal muscle, and its responses are voluntary or reflex. [2]
NSO-Q7

A2 **B1** a nerve is a bundle of the axons and dendrons of many neurones, wrapped together in connective tissue. **B1** a neurone is a single cell, so a nerve is not a neurone but contains the fibres of many of them. [2]
NSO-Q14

A3 **B1** a ganglion, outside the spinal cord. **B1** a sensory neurone. [2]
NSO-Q15

SECTION B · Standard, 3 to 5 marks

B1 **B1** the withdrawal is a reflex carried by the peripheral nervous system: a sensory neurone carries impulses from the receptor into the spinal cord, a relay neurone in the CNS connects the pathway, and a motor neurone carries impulses out to the effector. **B1** the effector is skeletal muscle, which is supplied by the somatic nervous system, and the same motor pathways can be driven voluntarily from the cerebrum, which initiates movement, so the action could also have been performed on purpose. **B1** the faster heartbeat is the work of the autonomic nervous system, whose sympathetic division prepares the body for activity, acting on instruction from the cardiovascular centre in the medulla oblongata. **B1** cardiac muscle is myogenic, so the beat itself originates at the sinoatrial node and the sympathetic impulses only raise its rate, with parasympathetic impulses lowering it again once the danger has passed. **B1** the autonomic system supplies glands, smooth muscle and cardiac muscle, and its pathways are not driven from the conscious cortex, so the change in heart rate happens whether or not the person notices it and cannot be decided on. [5]
NSO-Q1

B2 **B1** the sympathetic system speeds the heart up and the parasympathetic system slows it down. **B1** the sympathetic system dilates the pupils and the parasympathetic system constricts them. **B1** the sympathetic system inhibits movement and secretion in the gut, whereas the parasympathetic system stimulates them. **B1** the sympathetic system dilates the bronchioles and the parasympathetic system constricts them; overall the first prepares the body for activity and the second returns it to rest. [4]
NSO-Q2

- B3** **B1** skeletal muscle is made of long multinucleate striated fibres, involuntary muscle of small spindle-shaped cells with one nucleus and no striations, and cardiac muscle of short branched striated cells joined end to end at intercalated discs so the tissue contracts as a connected sheet. **B1** skeletal muscle takes its orders from the somatic system and involuntary muscle from the autonomic system, whereas cardiac muscle is myogenic: the beat begins in the muscle itself at the sinoatrial node. **B1** the autonomic system only adjusts the heart's rate, sympathetic impulses raising it and parasympathetic impulses lowering it on instruction from the medulla, rather than causing the beat as it causes contraction in the other two tissues. **B1** skeletal muscle contracts rapidly and powerfully and fatigues, whereas involuntary muscle contracts slowly and steadily and cardiac muscle rhythmically and continuously, and neither of these fatigues. [4]
NSO-Q3
- B4** **B1** the medulla oblongata, which holds the cardiovascular centre that sets heart rate and blood vessel diameter and the ventilation centre that sets breathing rhythm. **B1** the cerebrum can be ruled out because the conscious functions of its cortex, language and memory, are intact. **B1** the cerebellum can be ruled out because balance and the coordination of movement, which it handles, are unaffected. **B1** the hypothalamus and pituitary govern thermoregulation, osmoregulation and hormone release rather than heart rate and breathing, and nothing in the symptoms involves them. [4]
NSO-Q4
- B5** **B1** the somatic system supplies skeletal muscle, whereas the autonomic system supplies glands, smooth muscle and cardiac muscle. **B1** somatic responses are voluntary or reflex, whereas autonomic responses are not under conscious control. **B1** the somatic system's effector is exemplified by a skeletal muscle such as the biceps, whereas the autonomic system's effector is exemplified by cardiac muscle or the smooth muscle of the gut. **B1** both are motor divisions of the peripheral nervous system, carrying impulses out from the central nervous system to their own effectors. [4]
NSO-Q8
- B6** **B1** the posterior lobe of the pituitary. **B1** stores and releases hormones made by the hypothalamus. **B1** the anterior lobe of the pituitary. **B1** secretes its own hormones, under the control of the hypothalamus. [4]
NSO-Q9
- B7** **B1** the hypothalamus, because it holds the osmoreceptors that monitor water potential and the centre that regulates temperature. **B1** the cerebrum can be ruled out because the conscious functions of its cortex, speech and voluntary movement, are unaffected. **B1** the medulla oblongata can be ruled out because heart rate and breathing rhythm, which its centres control, are normal. **B1** the cerebellum can be ruled out because balance and the coordination of movement, which it handles, are unaffected. [4]
NSO-Q10

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- B8** [3]
NSO-Q5 **B1** the medulla oblongata contains the cardiovascular centre and the ventilation centre. **B1** the cerebellum coordinates balance and the timing and strength of contractions. **B1** the hypothalamus holds the osmoreceptors that monitor the water potential of the blood.
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- B9** [3]
NSO-Q6 **B1** its cell body lies neither at the start nor at the end of the fibre but on a short side branch part-way along it, housed in a ganglion just outside the spinal cord. **B1** a dendron carries impulses towards a cell body and an axon carries them away from it. **B1** the impulse in the long fibre is travelling from the receptor towards the cell body, so that fibre is a dendron, and only the short fibre running on into the CNS is an axon.
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- B10** [3]
NSO-Q11 **B1** a relay neurone has a cell body with many short processes and no long fibre, because nothing it connects to is far away. **B1** it lies entirely within the central nervous system. **B1** within a reflex arc it links the sensory neurone to the motor neurone.
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- B11** [3]
NSO-Q12 **B1** the two systems act antagonistically on the same organs, one increasing and the other decreasing its activity. **B1** the state of the organ at any moment reflects the balance between the two opposing sets of impulses arriving at it, rather than either system being fully off. **B1** this lets the balance shift smoothly in either direction, for example by raising sympathetic activity, lowering parasympathetic activity, or both together, which a simple on/off switch could not achieve.
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- B12** [3]
NSO-Q13 **B1** the medulla oblongata contains the cardiovascular centre, which sets heart rate and blood vessel diameter, and the ventilation centre, which sets the rhythm of breathing. **B1** these centres are not duplicated anywhere else in the nervous system, so damage to them can stop the heart or breathing directly. **B1** the cerebellum coordinates the timing and strength of movement and balance, so damage there causes clumsy, poorly coordinated movement rather than removing a function needed to stay alive from moment to moment.
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