

Mark schemes

Q1.

- (a) 1. Higher concentration of potassium ions inside **and** higher concentration of sodium ions outside (the neurone)

OR

potassium ions diffuse out

OR

sodium ions diffuse in;

Accept 'more' for 'higher concentration'.

Accept 'sodium ions can't diffuse in (due to alternative explanation).'

2. (Membrane) more permeable to potassium ions (leaving than sodium ions entering)

OR

(Membrane) less permeable to sodium ions (entering than potassium ions leaving);

Accept for 'less permeable to sodium ions' is 'impermeable to sodium ions' or 'sodium gates/channels are closed' (alternative explanation).

3. Sodium ions (actively) transported out and potassium ions in;
reference to ions or Na^+ and K^+ is required. If mentioned once allow for all mark points.
*If an answer provides two or three of these mark points **without** any reference to ions – award **one** maximum mark.*
Accept 3 Na^+ out and 2 K^+ in but reject if numbers used are incorrect.

3

- (b) 1. Myelination provides (electrical) insulation;

Reject thermal insulation.

Accept description of (electrical) insulation.

2. (In myelinated) saltatory (conduction)

OR

(In myelinated) depolarisation at nodes (of Ranvier);

3. In non-myelinated depolarisation occurs along whole/length (of axon);
Accept action potentials for depolarisation.

'Messages' or 'signals' disqualifies first of these marks credited.

3

- (c) 1. No/less ATP produced;
2. No/less active transport

OR

Sodium/potassium pump inhibited;

*Accept Na⁺ not/fewer moved out **and** K⁺ not/fewer moved in.*

3. Electrochemical gradient not maintained

OR

(Facilitated) diffusion of ions causes change to 0 mV

OR

(Results in) same concentration of (sodium and potassium) ions (either side of membrane)

OR

No net movement of (sodium and potassium) ions;

*Accept reaches electrical equilibrium/balance.
Accept concentration gradient of sodium and potassium ions not maintained.*

3

[9]

Q2.

1. Depolarisation of presynaptic membrane;
Accept action potential for depolarisation.
2. Calcium channels open and calcium ions enter (synaptic knob);
Accept Ca²⁺.
3. (Calcium ions cause) synaptic vesicles move to/fuse with presynaptic membrane **and** release acetylcholine/neurotransmitter;
Accept abbreviations for acetylcholine as term is in the question.
4. Acetylcholine/neurotransmitter diffuses across (synaptic cleft);
Accept abbreviations for acetylcholine as term is in the question.
5. (Acetylcholine attaches) to receptors on the postsynaptic membrane;

6. Sodium ions enter (postsynaptic neurone) leading to depolarisation;
Accept Na⁺.
Accept 'action potential' or 'generator potential' for depolarisation.

5 max

[5]

Q3.

- (a) 1. (Dopamine) diffuses across (synapse);
 2. Attaches to receptors on postsynaptic membrane;
Ignore name/nature of receptor e.g. cholinergic
 3. Stimulates entry of sodium ions **and** depolarisation/action potential;
Accept Na⁺ for sodium ions
Accept generator potential for action potential

3

- (b) 1. Morphine attaches to opioid receptors;
Reject reference to active site
 2. (More) dopamine released (to provide pain relief);
Reject receptors release dopamine

2

- (c) 1. (Inside of postsynaptic) neurone becomes more negative/hyperpolarisation/inhibitory postsynaptic potential;
Ignore K⁺
Accept -75mV or any value below this as equivalent to more negative
Accept 'decrease in charge'

2. More sodium ions required (to reach threshold)
OR
 Not enough sodium ions enter (to reach threshold);
Accept Na⁺ for sodium ions

3. For depolarisation/action potential;
Context must convey idea that depolarisation / action potential is less likely

3

[8]

Q4.

- (a) 1. Correct answer of 19.4 / 19.41%
OR
 19.47 / 19.5% = **2 marks**;
 2. Incorrect answer but shows increase of 1,048,320 **OR** 1,051,200 = one mark;

Accept: 19.46% for one mark.

2

- (b) 1. Less / no acetylcholine broken down;
 2. Acetylcholine attaches to receptors;
 3. (More) Na⁺ enter to reach threshold / for depolarisation / action potential / impulse;
1. *Accept: more acetylcholine present / remains.*
 1 and 2. *Accept: remains attached for longer = 2 marks.*
 3. *Must be sodium ions.*

3

Q5.

- (a) 1. (Nerve impulse / depolarisation of membrane) causes Ca²⁺ channel (proteins) to open;
 2. Ca²⁺ enter by (facilitated) diffusion;
 3. Causes (synaptic) vesicles to fuse with (presynaptic) membrane;

Accept single reference to ions to cover 1 and 2

Penalise once for no reference to ions

1. *Reject carrier proteins*
 3. *Reject ref to release of vesicles*
 3. *Ignore vesicles bind to membrane (but accept merge with)*

3

- (b) 1. Myosin head attaches to actin **and** bends / performs powerstroke;
 2. (This) pulls mitochondria past / along the actin;
 3. Other / next myosin head attaches to actin (and bends / performs powerstroke);

1. *Accept change shape / change angle*

2. *Ignore pulls actin along*

2. *Ignore refs to cytoskeleton*

Accept plural or singular statements

2 max

- (c) 1. (Mitochondria) supply (additional) ATP / energy;
 2. To move vesicles / for active transport of ions / for myosin to move past actin

OR

Re-synthesis / reabsorption of neurotransmitter / named neurotransmitter;

1. *Reject produces energy*

2. *Ignore ref. to ATP for opening calcium ion channels/making vesicles fuse with membrane*

2

[7]

Q6.

A Vesicle;

B Neurotransmitter;

C Synaptic cleft;

B *Accept named neurotransmitter*

[3]