M1.(a) One suitable suggestion; explained;

E.g.

1. Action potentials travel more slowly / don't travel;

   Accept: fewer / no saltatory movement of potentials

2. So delay in muscle contraction / muscles don't contract / muscles contract slow(er);

OR

3. Action potentials / depolarisation 'leaks' to adjacent neurones;

   Accept: neurones not insulated

4. So wrong muscle (fibres) contract.

2 max

(b) Lipid-soluble / pass through phospholipid bilayer.

Not just 'pass through membranes'

1

(c) 1. Prevents influx of calcium ions (into pre-synaptic membrane);

Need idea of moving into pre-synaptic membrane / synaptic knob

Accept Ca^{++} / Ca^{2+}

2. (Synaptic) vesicles don't fuse with membrane / vesicles don't release neurotransmitter;

Accept vesicles don't release acetylcholine

3. Neurotransmitter does not diffuse across synapse / does not bind to receptors (on post-synaptic membrane);

Accept: sarcolemma / muscle membrane for post-synaptic membrane

4. No action potential / depolarisation (of post-synaptic membrane) / sodium (ion) channels do not open / prevents influx of sodium ions.

Accept Na^{+}

Accept prevents depolarisation of muscle cell

Ignore: descriptions of events at post-synaptic membrane involving calcium ions and muscle contraction

4

(d) 1. They won't affect synapses in brain;

2. They won't cause problems with the brain's function / won't damage brain;

Accept: suitable named problem e.g. hallucination

Ignore: unqualified references to 'side effects'

Accept: reference to addiction / harm of smoking (cannabis)

3. (So only the) muscle / neuromuscular junctions treated / affected.

2 max

[9]

M2.(a) 1. Membrane more permeable to potassium ions and less permeable to sodium ions;

2. Sodium ions actively transported / pumped out and potassium ions in.

2

(b) 1. (Pressure causes) membrane / lamellae to become deformed / stretched;

2. Sodium ion channels in membrane open and sodium ions move in;

3. Greater pressure more channels open / sodium ions enter.

3

(c) 1. Threshold has been reached;

2. (Threshold or above) causes maximal response / all or nothing principle.

2

(d) 1. Less / no saltatory conduction / action potential / impulse unable to 'jump' from node to node;

2. More depolarisation over length / area of membranes.

2

[9]

M3.(a) 0.32.

Correct answer = 2 marks

Accept 32% for 1 mark max

Incorrect answer but identifying 2pq as heterozygous = 1 mark

2

(b) 1. Mutation produced *KDR minus* / resistance allele;
2. DDT use provides selection pressure;
3. Mosquitoes with *KDR minus* allele more likely (to survive) to reproduce;
4. Leading to increase in *KDR minus* allele in population.

4

(c) 1. Neurones remain depolarised;
2. So no action potentials / no impulse transmission.

2

(d) 1. (Mutation) changes shape of sodium ion channel (protein) / of receptor (protein);
2. DDT no longer complementary / no longer able to bind.

2

[10]

M4.(a) 1. (In myelinated) action potential / depolarisation only at node(s);

2. (In myelinated, nerve impulse) jumps from node to node / saltatory;

3. (In myelinated) action potential / impulse does not travel along whole length;

The question is about speed of transmission, not repolarisation or related matters

Accept converse for non-myelinated

3

(b) 1. Probability of obtaining this difference by chance;

Reject 'results' once only

This statement often split round 2.

2. Is less than 5% / less than 0.05 / less than one in twenty;

Accept is 4.7% / 0.047 but reject less than 4.7% / 0.047

Accept correct greater than 95% / greater than 0.95 arguments

3. Difference is significant;

Reject 'results' once only

2 max

(c) 1. (All) dementia results lower (than control group) / non-dementia result higher;

2. Error bars do not overlap so differences are (possibly) significant;

Neutral results

Accept not due to chance / statistically significant

In this context, accept references to standard deviation

3. Dementia may be due to other factors / not only due to a lack of myelin;

Accept suitable named factor e.g. genetic

4. (Because) big / significant differences in myelin in different dementia;

Not just 'different'

5. Only small sample sizes / only one study / more data required;

4 max

[9]

M5.(a) 1. Causes sodium ion channels to open;

1. Reject if wrong sequence of events

2. Sodium ions enter (cell and cause depolarisation);

Reject sodium on its own only once

2

(b) 1. (If not removed) keeps binding (to receptors);

Accept answers based on what happens if it is transported out − ie what should happen

2. Keeps causing action potentials / depolarisation (in post-synaptic membrane);

2. Accept keeps Na^+ channels open(ing)

2

(c) 1. Movement in all groups (about) same before MDMA;

Q

2. MDMA increases movement in Group **L**;

*2. Accept normal mice for **L***

3. Group **K** shows MDMA causes movement;
*3. Accept **K** is a control*

4. No / little increase in mice without receptor / Group **M**;

3 max

[7]