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. Calcium ions diffuse into myofibrils from (sarcoplasmic) reticulum;
2. (Calcium ions) cause movement of tropomyosin (on actin);
3. (This movement causes) exposure of the binding sites on the actin;
4. Myosin heads attach to binding sites on actin;
5. Hydrolysis of ATP (on myosin heads) causes myosin heads to bend;
6. (Bending) pulling actin molecules;
7. Attachment of a new ATP molecule to each myosin head causes myosin heads to detach (from actin sites).

5 max

(b) 1. Releases relatively small amount of energy / little energy lost as heat;

Key concept is that little danger of thermal death of cells

2. Releases energy instantaneously;

Key concept is that energy is readily available

3. Phosphorylates other compounds, making them more reactive;
4. Can be rapidly re-synthesised;
5. Is not lost from / does not leave cells.

2 max

[7]

M3.(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]

M4.(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]

M5.(a) (i) 1. Slower <u>diffusion</u>;

Accept description of diffusion eg 'movement down concentration gradient' but concept of slower is required

2. (Of) ions / Na^+ / K^+;

Reference to ions is required. Reject other named ions, eg calcium ions

Ignore references to synaptic transmission or rates of respiration

2

(ii) 1. Myelination / saltatory conduction;

Accept reference to presence of nodes of Ranvier

2. Axon diameter;

2

(b) Keep everything the same but not in bath / at room temperature / same clothing as for immersion / sitting in empty bath / sitting in water at room temperature;

Accept 'normal' or 'comfortable' as equivalent to room temperature

Ignore reference to body temperature

1

(c) (i) (Find) the most common result / time / the result / time that occurs the most;

1

(ii) Highest and lowest result / time;

Accept 'difference between highest and lowest results / times'

1

(d) 1. (Which is based on) <u>mean</u> of 20 people / large (enough) sample;

This point is possible for students that suggest the difference is significant

2. (But) SE bars / confidence limits overlap;

   This point applies whether 1 × SE or 2 × SE is used

3. Reference to 0.297 ± 0.0424 / 0.326 ± 0.0366 / confidence limits = 2 × SE;

   This point rewards knowledge of use of 2 × SE (as per Students' Statistics Sheet)

4. (So) difference is **not** significant;

   This point is only awarded after marking point 2 or marking point 3 has been given

3 max

[10]