Mark schemes

Q1.

(a) A = mitochondrion

Accept mitochondria/crista(e).

B = presynaptic membrane/neurone

Accept synaptic knob/bulb or motor neurone.

Accept nerve cell for neurone.

C = (synaptic) vesicle(s)

D = synaptic gap/cleft;;

*4 correct = **2 marks***

*2–3 correct = **1 mark***

*0–1 correct = **0 marks***

2

(b) 1. Acetylcholine/neurotransmitter diffuses (across synaptic cleft);

2. (Acetylcholine/neurotransmitter) attaches to receptors on the sarcolemma;

Accept postsynaptic membrane for sarcolemma.

Accept abbreviations for acetylcholine as term is in the question.

3. Sodium ions enter leading to depolarisation/action potential;

Accept mark points in 'context of a postsynaptic neurone'.

Accept Na^+ for sodium ions.

'Sodium ion channels opening' on its own is not enough.

4. Calcium (ions) released by endoplasmic/sarcoplasmic reticulum;

Accept Ca^{2+} / Ca (ions not required as given in question).

Incorrect sequence, penalise one mark.

4

(c) 1. (Inside postsynaptic neurone/membrane/axon) is more negative

OR

Membrane/neurone/axon) potential is below resting potential

OR

Potential difference (across membrane) is greater;

Accept answers which refer to a numerical decrease in the resting potential.

Accept answers which refer to a 'decrease in the resting potential'.

Accept answers which refer to 'reduces/lowers potential' but not 'reduces potential difference'.

Accept p d for potential difference.

2. More sodium ions (required to enter) for depolarisation

OR

More sodium ions (required to enter) for action potential

OR

Prevents sodium ions causing depolarisation;

Accept to 'reach threshold' or 'generator potential' for 'action potential'.

Accept Na^+ for sodium ions.

2

[8]

Q2.

(a) 1. No/fewer calcium ions enter synaptic knob

OR

No/less calcium enter synaptic knob via calcium ion channels;

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

*Accept 'presynaptic neurone/knob' for synaptic knob but **not** 'presynaptic membrane' on its own.*

2. No/fewer synaptic vesicles move to/fuse with presynaptic membrane **and** no/less glutamate is released;

2, 3 and 4 Accept acetylcholine or neurotransmitter for glutamate.

3. No/less glutamate diffuses across (synaptic cleft);

4. No/less (glutamate attaches) to receptors on the postsynaptic membrane;

5. No/fewer sodium ions enter (postsynaptic neurone) so no/ fewer impulses (sent to brain);

Note: If no/fewer/less is correctly included for any mark point allow for all other mark points.

*A description of synaptic transmission without no/less/fewer gains **four** marks max.*

Accept Na^{+}.

Accept 'no transmission' ('of impulses' is in passage) or 'no depolarisation' or 'no action/generator potentials' for fewer impulses, but reject 'messages' and 'signals'.

Accept 'threshold (potential) not being reached' for fewer impulses.

5

(b) 1. Rapidly/quickly/directly reaches spinal cord;

Accept 'synapses' for spinal cord.

Accept spinal cord and brain but reject brain on its own.

2. Is broken down by enzymes

OR

Is broken down by acid

OR

Is too large to be absorbed;

Accept denatured by acid.

Accept 'not affected by acid/enzymes'

Reject broken down by named enzymes which are not proteases.

Ignore location of enzymes.

Accept description for 'absorption' e.g. 'cross the ileum'.

2

(c) Correct answer of $5/4.7(232) \times 10^{-5}$ = **2 marks**;;

Answer of 5 or 47(232) with incorrect order of magnitude = **1 mark**

OR

Answer of $2/1.9(68) \times 10^{-6}$ (i.e., not multiplied by 24) = **1 mark**

OR

Answer of $6/5.8/5.76 \times 10^{-7}$ (i.e., not multiplied by 82) = **1 mark**

OR

Answer of $2/1.6/1.57(44) \times 10^{-5}$ (i.e., not multiplied by 3) = **1 mark**

OR

Answer of $6/5.9/5.904 \times 10^{-6}$ (i.e., not multiplied by 8) = **1 mark**;

Accept any equivalent numerical representation of the correct answer.

Ignore numbers after 4.7 and 47.

2

(d) 1. (Sensation of) pain is subjective

OR

Pain sensitivity/threshold/tolerance varies;

Accept 'could exaggerate pain'.

2. To ensure that differences (in pain detection) were (statistically) significant

OR

For (valid) comparison;

Accept 'not due to chance' for significant.

Do not credit 'to determine if results are significant.'

2

[11]

Q3.

(a) 1. (There are) stretch-mediated sodium ion channels (in the membrane);

1, 2, 3, 4 Accept Na^+

***Max 2** if only reference to sodium and not sodium ions*

2. (Increased pressure) deforms/changes (sensory neurone/axon) membrane/lamella(e)

OR

(Increased pressure) deforms/changes sodium ion channels;

3. Sodium ion channels open;

4. Sodium ions diffuse in;

Accept sodium ions move in down a concentration gradient

5. Depolarisation (leading to generator potential);

Accept inside becomes positive

3 max

(b) 1. An action potential is only generated/produced when threshold is reached

OR

An action potential is **not** generated/produced until/unless threshold is reached;

Ignore any numbers linked to threshold

1 and 2 Accept impulse for action potential

2. When high pressure was applied (to the fingertip), threshold was reached
OR

High pressure is (an) above threshold (stimulus)
OR

High pressure generates an action potential;

Accept references to 'the first peak' for high pressure

Accept the converse for low pressure

2

(c) (The) refractory (period);

Ignore any reference to absolute or relative

Reject refraction period

1

[6]

Q4.

(a) **Two** marks for **three** correct structures,

one mark for **two** correct structures;;

P = capsule/lamella(e)

Accept connective tissue

Q = Axon (membrane)

Accept (sensory) neurone

Accept nerve cell

Ignore nerve

R = Schwann cell(s)
OR
R = Myelin (sheath)

2

(b) 1.27% (second box) ticked;

1

(c) 1. The student started to move/close her hand before the ruler was released;

Accept any descriptions of a pre-emptive strike

2. The ruler did not fall vertically/was not placed vertically;

3. The ruler stuck to her skin;

4. (Student **B**) held the ruler too high/higher;

*Ignore answers related to student **A** having their eyes open*

*Ignore student **B** misread the ruler*

1 max

(d) Correct answer of 12.9/13 (m s^{-1}) = **2 marks**;;

Use of reaction time of 136 (ms)/0.136 (s) in answer = **1 mark**

OR

$14.583\dot{}$ (answer including Trial 3) = **1 mark**

OR

1.29 = **1 mark**

*For **2 marks** accept any correct rounding of 12.8676471*

2

(e) 1. Synaptic transmission
OR
Transmission at neuromuscular junction;

Accept (involves) synapses

2. Time for muscle contraction;

3. Time taken for (stretch-mediated) sodium ion channels to open (in the Pacinian corpuscle);

4. Student may have been distracted/not concentrating;

5. Time taken for coordination/comprehension (by the brain);

Ignore answers relating to the estimate of the length of the nerve pathway involved

For 1 mark, accept correct reference to student conditions/medication eg tiredness, antidepressants

3 max

[9]