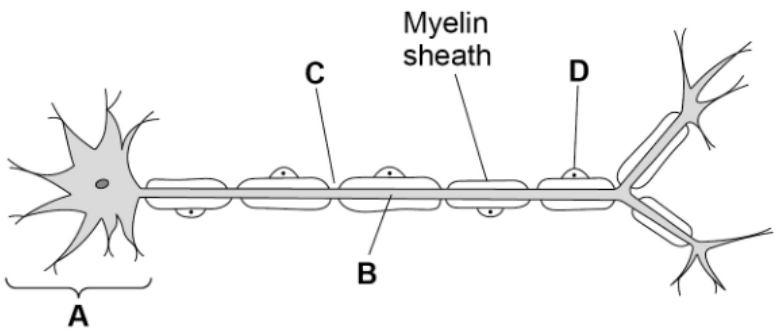
Nervous Coordination: AQA A Level Biology Exam Questions by Topic

18 questions · 48 marks · about 62 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2025 · Q06.1 · 2 marks

0 6 . 1 **Figure 2** shows a drawing of a myelinated motor neurone.

Figure 2



Name the parts labelled **A** to **D**.

[2 marks]

A _____

B _____

C _____

D _____

Question 2 · A level Paper 2 · November 2021 · Q02.1 · 3 marks

0 2 . 1 Explain how a resting potential is maintained across the axon membrane in a neurone.

[3 marks]

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Question 3 · A level Paper 2 · November 2021 · Q02.3 · 3 marks

0 2 . 3 A scientist investigated the effect of inhibitors on neurones. She added a respiratory inhibitor to a neurone. The resting potential of the neurone changed from –70 mV to 0 mV.

Explain why.

[3 marks]

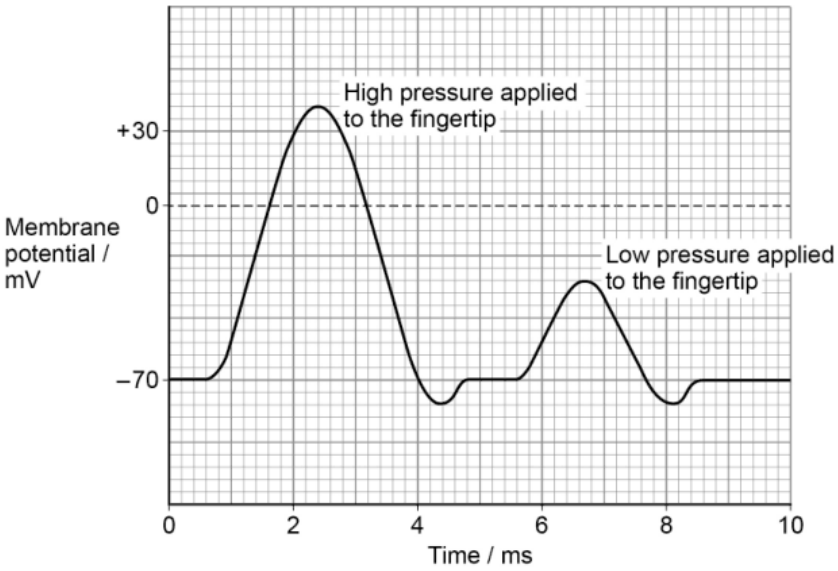
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Question 4 · A level Paper 3 · June 2023 · Q01.2 · 2 marks

Scientists investigated the stimulation of a Pacinian corpuscle in the skin of a fingertip. The scientists applied two different pressures to the fingertip and recorded the changes in membrane potential of the Pacinian corpuscle's sensory neurone.

Figure 1 shows the scientists' results.

Figure 1



0 1 . 2 Use **Figure 1** to describe what is meant by the all-or-nothing principle.

[2 marks]

Question 5 · A level Paper 3 · June 2023 · Q01.3 · 1 mark

0 1 . 3 On **Figure 1**, from 0.6 ms to 4.0 ms, no new generator potential could be produced. What is this time period called?

[1 mark]

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Question 6 · A level Paper 2 · November 2021 · Q02.2 · 3 marks

0 2 . 2 Explain why the speed of transmission of impulses is faster along a myelinated axon than along a non-myelinated axon.

[3 marks]

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1 0 Guillain–Barré syndrome is a rare disease in which the immune system damages the myelin sheath of neurones. Myelin sheath damage can cause a range of symptoms, for example numbness, muscular weakness and muscular paralysis. Sometimes, neurones of the autonomic nervous system are affected, causing heart rate irregularities.

Huntington's disease is a disorder caused when a protein called huntingtin damages the brain. Huntingtin is produced because of a dominant, mutant allele.

The first successful drug trial to reduce concentrations of huntingtin in the human brain involved 46 patients. The patients received the drug for 4 months. The concentration of huntingtin was reduced in all the patients. The drug was injected at the base of the spine into the cerebrospinal fluid bathing the brain and spinal cord. The drug contains single-stranded DNA molecules. These single-stranded molecules inhibit the mRNA needed to produce huntingtin.

Symptoms of Huntington's disease can start at any time, but usually develop between 30 and 50 years of age. The likelihood and age when symptoms start are linked to the number of CAG base sequence repeats in the gene for Huntington's disease. However, recent studies have suggested that epigenetics may also affect the age when symptoms first start.

1 0 . 1 Damage to the myelin sheath of neurones can cause muscular paralysis (lines 2–4).

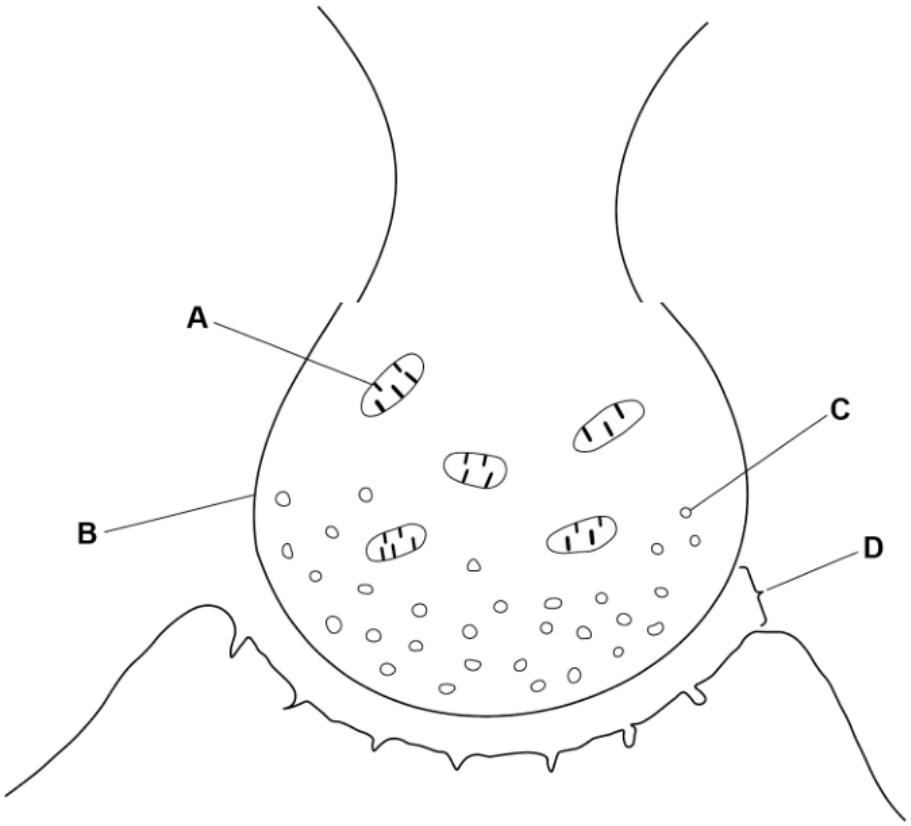
Explain how.

[3 marks]

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0 1 **Figure 1** shows a drawing of a neuromuscular junction.

Figure 1



0 1 . 1 Name the parts labelled **A** to **D**.

[2 marks]

A _____

B _____

C _____

D _____

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Question 9 · A level Paper 2 · November 2020 · Q05 · 5 marks

0 5 Describe the sequence of events involved in transmission across a cholinergic synapse.

Do **not** include details on the breakdown of acetylcholine in your answer.

[5 marks]

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Question 10 · A level Paper 2 · June 2022 · Q07.1 · 2 marks

0 7 . 1 Give **two** reasons why transmission across a cholinergic synapse is unidirectional.

[2 marks]

1 _____

_____

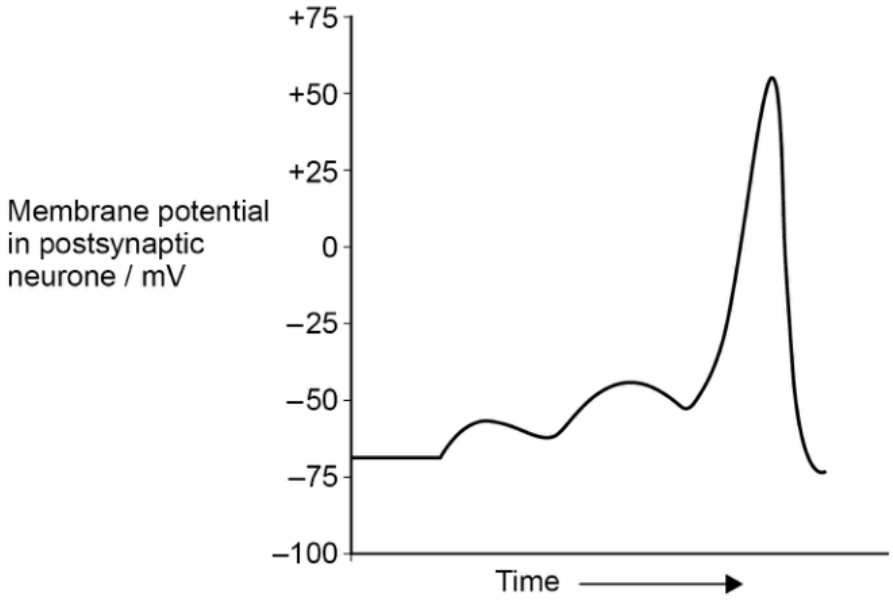
2 _____

_____

Question 11 · A level Paper 2 · June 2022 · Q07.2 · 2 marks

Figure 4 shows the changes in membrane potential in a postsynaptic neurone after repeated stimulation from a single presynaptic neurone.

Figure 4



0 7 . 2 Name and explain the type of summation shown in **Figure 4**.

[2 marks]

Type of summation _____

Explanation _____

_____

_____

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Question 12 · A level Paper 2 · June 2024 · Q01.3 · 2 marks

0 1 . 3 Inhibitory synapses cause hyperpolarisation in postsynaptic neurones.

Explain how this inhibits synaptic transmission.

[2 marks]

Question 13 · A level Paper 2 · June 2024 · Q01.2 · 4 marks

0 1 . 2 Following the release of acetylcholine into a neuromuscular junction, a muscle contraction occurs.

Describe the sequence of events, following the release of acetylcholine, that leads to stimulation of this contraction.

Do **not** include in your answer the events following the release of calcium ions in the myofibril.

[4 marks]

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Question 14 · A level Paper 2 · June 2018 · Q07.2 · 2 marks

0 7 . 2 Dopamine has a role in numerous processes in the brain including pain relief. The release of dopamine can be stimulated by chemicals called endorphins produced in the brain. Endorphins attach to opioid receptors on presynaptic neurones that release dopamine.

Morphine is a drug that has a similar structure to endorphins and can provide pain relief.

Explain how.

[2 marks]

Question 15 · A level Paper 2 · June 2022 · Q07.3 · 2 marks

Myasthenia gravis (MG) is an autoimmune disease caused when antibodies bind to the sarcolemma (postsynaptic membrane) of neuromuscular junctions. This can weaken contraction of muscles.

Mestinon is a drug that inhibits the enzyme acetylcholinesterase. Mestinon can help in the treatment of MG.

0 7 . 3 Suggest and explain how MG can weaken contraction of muscles.

Do **not** include details of myofibril or muscle contraction in your answer.

[2 marks]

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Question 16 · A level Paper 2 · June 2022 · Q07.4 · 3 marks

0 7 . 4 Mestinon can help in the treatment of MG. Explain how.

[3 marks]

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Question 17 · A level Paper 2 · June 2023 · Q02.1 · 5 marks

0 2 . 1 Glutamate is a neurotransmitter involved in the transmission of nerve impulses from pain receptors to the brain. Ziconotide is a drug that can reduce severe, constant pain. Ziconotide blocks the calcium ion channels at some of the synapses which use glutamate.

The transmission of glutamate at synapses is similar to that of acetylcholine.

Explain how ziconotide reduces severe, constant pain.

[5 marks]

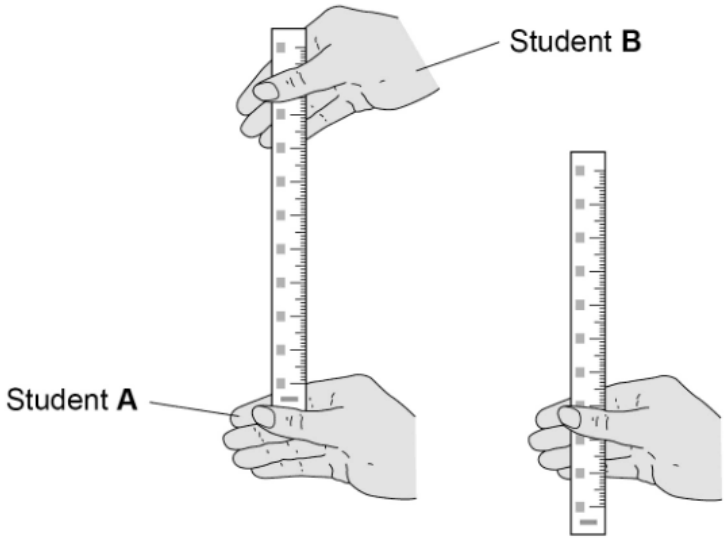
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Question 18 · information from earlier in the question

Two students (**A** and **B**) investigated reaction time in response to touch.

- Student **A** sat with her eyes shut and her forearm resting on a worktop so that her hand was over the edge.
- Student **B** held a ruler vertically between student **A**'s thumb and first finger, with the ruler at 0 mm lightly touching student **A**'s first finger.
- Student **B** released the ruler.
- As soon as student **A** felt the ruler fall, she closed her thumb and first finger to catch the ruler as shown in **Figure 5**.
- Student **B** measured the distance the ruler had fallen to the nearest mm

Figure 5



The test was repeated three more times using the same hand to catch the ruler. **Table 3** shows student **A**'s results.

Table 3

Trial	Distance the ruler has fallen / mm
1	79
2	97
3	10
4	94

The student was able to convert these distances into reaction times using **Table 4**.

Table 4

Distance the ruler fell / mm	Reaction time / ms
10	45
20	64
30	78
40	90
50	101
60	111
70	120
80	128
90	136

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Question 18 · A level Paper 3 · June 2022 · Q02.4 · 2 marks

0 2 . 4 Student **A** estimated that the length of the nerve pathway involved was 175 cm

Use **Table 3** and **Table 4** to calculate the mean speed of nerve impulse transmission.

Do **not** use the value for **Trial 3** in your calculation.

[2 marks]

Answer _____ m s^{-1}

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Mark schemes

Question 1 · A level Paper 2 · June 2025 · Q06.1 · 2 marks

06.1	A. Cell body **OR** Soma **OR** Dendron/dendrite(s) B. Axon **OR** Axoplasm C. Node of Ranvier D. Schwann cell;;	2 (2 x AO1)	4 correct = **2 marks** 2–3 correct = **1 mark** 0–1 correct = **0 marks** For B ignore cytoplasm For D accept shwan(n), scwan(n), scwaan and phonetic spellings of schwann but reject 'swan'

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Question 2 · A level Paper 2 · November 2021 · Q02.1 · 3 marks

02.1	1. Higher concentration of potassium ions inside **and** higher concentration of sodium ions outside (the neurone) **OR** potassium ions <u>diffuse</u> out **OR** sodium ions <u>diffuse</u> in; 2. (Membrane) more permeable to potassium ions (leaving than sodium ions entering) **OR** (Membrane) less permeable to sodium ions (entering than potassium ions leaving); 3. Sodium ions (actively) transported out and potassium ions in;	3	1. Accept 'more' for 'higher concentration'. 1. Accept 'sodium ions can't <u>diffuse</u> in (due to alternative explanation). 2. Accept for 'less permeable to sodium ions' is 'impermeable to sodium ions' or 'sodium gates/channels are closed' (alternative explanation). 1, 2 and 3 reference to <u>ions</u> or Na^+ and K^+ is required. If mentioned once allow for all mark points. 1, 2 and 3. If an answer provides two or three of these mark points **without** any reference to <u>ions</u> – award **one** maximum mark. 3. Accept 3 Na^+ out and 2 K^+ in but reject if numbers used are incorrect.

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Question 3 · A level Paper 2 · November 2021 · Q02.3 · 3 marks

02.3	1. No/less ATP produced; 2. No/less <u>active</u> transport **OR** Sodium/potassium pump inhibited; 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;	3	2. Accept Na^+ not/fewer moved out **and** K^+ not/fewer moved in. 3. Accept reaches electrical equilibrium/balance. 3. Accept concentration gradient of sodium and potassium ions not maintained.

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01.2	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; 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;

2 (1 x AO1, 1 x AO3)	1. Ignore any numbers linked to threshold 1. and 2 Accept impulse for action potential 2. Accept references to 'the first peak' for high pressure 2. Accept the converse for low pressure

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Question 5 · A level Paper 3 · June 2023 · Q01.3 · 1 mark

01.3	(The) refractory (period);	1 (AO1)	Ignore any reference to absolute or relative Reject refraction period

Question 6 · A level Paper 2 · November 2021 · Q02.2 · 3 marks

02.2	1. Myelination provides (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);	3

1. Reject thermal insulation.

1. Accept description of (electrical) insulation.

3. Accept action potentials for depolarisation.

2 and 3. 'Messages' or 'signals' disqualifies first of these marks credited.

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Question 7 · A level Paper 2 · June 2019 · Q10.1 · 3 marks

10.1	1. (Refers to) saltatory conduction **OR** (Nerve) impulses/depolarisation/ions pass to other neurones **OR** Depolarisation occurs along whole length (of axon); 2. (Nerve) impulses slowed/stopped; 3. (Refers to) <u>neuromuscular</u> junction **OR** (Refers to) <u>sarcolemma</u>;	3	1. Accept suitable description that refers to (transmission) from node to node (of Ranvier). 1 and 2. Accept action potentials for impulses. 1. Accept action potential for depolarisation. 1, 2 and 3. Reject first mark awarded if answer refers to messages/signals for impulses. Reject even if impulse/s also referred to.

Question 8 · A level Paper 2 · June 2024 · Q01.1 · 2 marks

01.1	A = mitochondrion B = presynaptic membrane/neurone C = (synaptic) vesicle(s) D = synaptic gap/cleft;;	2 (2 x AO1)	4 correct = **2 marks** 2–3 correct = **1 mark** 0–1 correct = **0 marks** A. Accept mitochondria/crista(e). B. Accept synaptic knob/bulb or motor neurone. B. Accept nerve cell for neurone.

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Question 9 · A level Paper 2 · November 2020 · Q05 · 5 marks

05	1. Depolarisation of presynaptic membrane; 2. Calcium channels open and calcium ions enter (synaptic knob); 3 (Calcium ions cause) synaptic vesicles move to/fuse with presynaptic membrane **and** release acetylcholine/neurotransmitter; 4 Acetylcholine/neurotransmitter diffuses across (synaptic cleft); 5. (Acetylcholine attaches) to receptors on the postsynaptic membrane; 6. Sodium ions enter (postsynaptic neurone) leading to depolarisation;	5 max

1. Accept action potential for depolarisation.

2. Accept Ca^{2+}.

3 and 4. Accept abbreviations for acetylcholine as term is in the question.

6. Accept Na^{+}.

6. Accept 'action potential' or 'generator potential' for depolarisation.

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Question 10 · A level Paper 2 · June 2022 · Q07.1 · 2 marks

07.1	1. (Only) the presynaptic neurone/knob/membrane releases/has neurotransmitter/acetylcholine; 2.(Only) the postsynaptic neurone/membrane has receptors **OR** No receptors in the presynaptic neurone/membrane;	2 (2 x AO1)	1. Accept abbreviations for acetylcholine e.g., ACh, Ach, AChol. 1. Ignore has/releases 'transmitter'.

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Question 11 · A level Paper 2 · June 2022 · Q07.2 · 2 marks

07.2	1. Temporal; 2. (Several/repeated impulses in short time) provide (enough) neurotransmitter/acetylcholine to reach threshold **OR** (Several/repeated impulses in short time) so (enough) sodium ions enter to reach threshold **OR** (Several/repeated impulses in short time) increases membrane potential to reach threshold;

2 (2 x AO2)	2. Accept abbreviations for acetylcholine e.g., ACh, Ach, AChol. 2. Accept 'to cause depolarisation' or 'to produce 'action/generator potential' for 'to reach threshold'. 2. Accept Na^+ for sodium ions.

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Question 12 · A level Paper 2 · June 2024 · Q01.3 · 2 marks

01.3	1. (Inside postsynaptic neurone/membrane/axon) is more negative **OR** Membrane/neurone/axon) potential is below resting potential	2 (2 x AO1)
	OR Potential difference (across membrane) is greater; 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;	

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

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

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

1. Accept p d for potential difference.

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01.2	1. Acetylcholine/neurotransmitter <u>diffuses</u> (across synaptic cleft); 2. (Acetylcholine/neurotransmitter) attaches to <u>receptors</u> on the sarcolemma; 3. Sodium <u>ions</u> enter leading to depolarisation/action potential; 4. Calcium (ions) released by endoplasmic/sarcoplasmic reticulum;	4 (4 x AO1)

Incorrect sequence, penalise one mark.

1 and 2. Accept abbreviations for acetylcholine as term is in the question.

1, 2 and 3. Accept mark points in 'context of a postsynaptic neurone'.

2. Accept postsynaptic <u>membrane</u> for sarcolemma.

3. Accept Na^+ for sodium ions.

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

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

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Question 14 · A level Paper 2 · June 2018 · Q07.2 · 2 marks

07.2	1. Morphine attaches to <u>opioid</u> receptors; 2. (More) dopamine released (to provide pain relief);	2	1. Reject reference to active site 2. Reject receptors release dopamine

Question 15 · A level Paper 2 · June 2022 · Q07.3 · 2 marks

07.3	1. Less/no acetylcholine/neurotransmitter binds to <u>receptor/s</u>; 2. Less/no depolarisation **OR** Fewer/no action potential(s) **OR** Fewer/no sodium <u>ions</u> enter to reach threshold;	2 (2 x AO2)	1. Accept abbreviations for acetylcholine e.g., ACh, Ach, AChol 1. Ignore competitive inhibition but reject ''active site'. 2. Accept 'takes longer for depolarisation or action/generator potential to be produced'. 2. Ignore 'weaker action potential/depolarisation'. 2. Accept Na^+ for sodium ions.

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07.4	1. Less/no acetylcholine/neurotransmitter broken down; 2. (More) acetylcholine attaches to receptors; 3. Depolarisation (of sarcolemma) occurs **OR** Action potential(s) produced **OR** (Enough) sodium ions enter to reach threshold **OR** Fewer/no antibodies attach;

3 (1 x AO1, 2 x AO2)	1. Accept (more) acetylcholine/neurotransmitter present/remains. 1 and 2. Accept acetylcholine/neurotransmitter remains attached to receptors (for longer) = 2 marks. 1 and 2. Accept ACh or other abbreviations e.g. AChol for acetylcholine. 3. Accept Na^+ for sodium

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02.1	1. No/fewer calcium ions enter synaptic knob **OR** No/less calcium enter synaptic knob via calcium ion channels; 2. No/fewer synaptic vesicles move to/fuse with presynaptic membrane **and** no/less glutamate is released; 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);	5 (2 x AO1, 3 x AO2)

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.

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

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

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Question 18 · A level Paper 3 · June 2022 · Q02.4 · 2 marks

02.4	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** $14.58\dot{3}$ (answer including Trial 3) = **1 mark** **OR** 1.29 = **1 mark**	2 (2 x AO2)

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

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