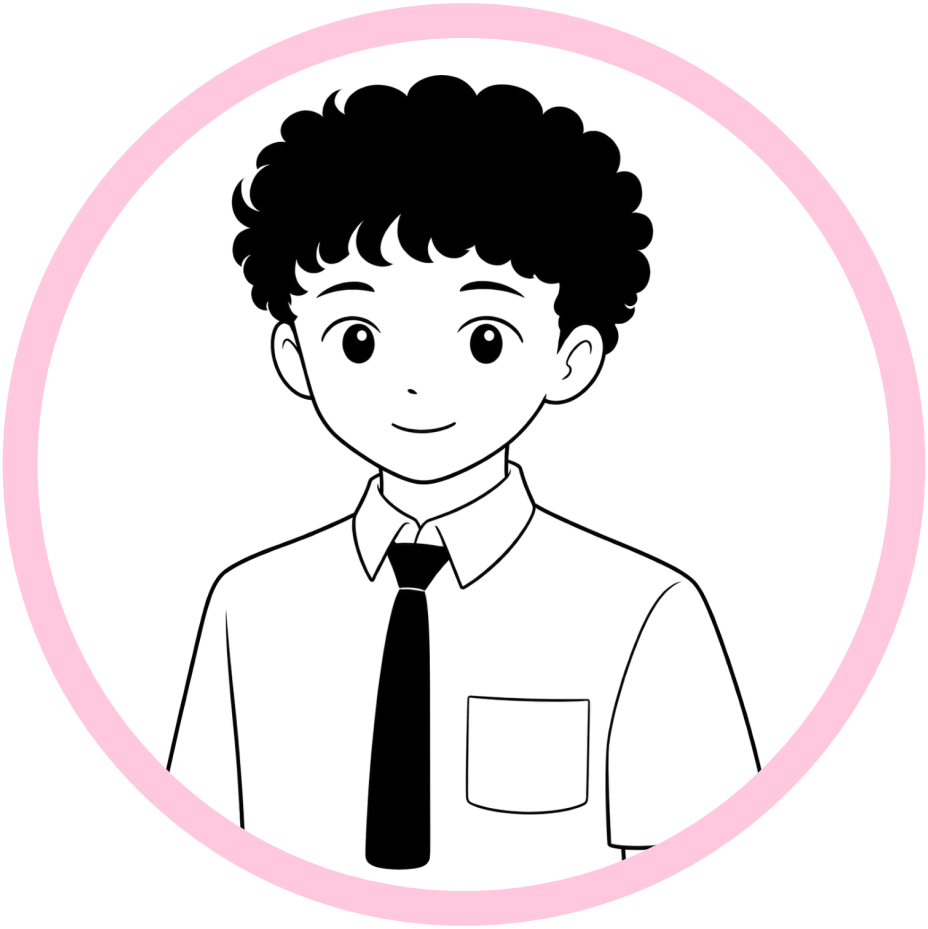
AQA A-LEVEL PSYCHOLOGY · 7182

PSYCHOLOGY



MARK SCHEME

3.2.2 THE NERVOUS SYSTEM AND NEURONS

SCORE	PERCENTAGE
/53	%

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Q1.

[AO1 = 1]

1 mark for any **one** of the following:

- the autonomic nervous system is involuntary whereas the somatic nervous system is under conscious control.
- ANS controls smooth muscles and glands whereas the SNS controls skeletal muscles.

Credit other relevant differences such as structural differences.

[1]

Q2.

[AO1 = 3]

1 mark for each of the following:

A = Sensory Neuron
B = Relay Neuron (accept interneurons / connector neuron)
C = Motor Neuron

[3]

Q3.

[AO1 = 3]

Award **1 mark** for each of the following points (up to 3 marks):

- the synaptic vesicles containing the neurotransmitter are **only** present on / released from the presynaptic membrane
- the receptors for the neurotransmitters are **only** present on the postsynaptic membrane
- it is the binding of the neurotransmitter to the receptor which enables the signal / information to be passed / transmitted on (to the next neuron)
- diffusion of the neurotransmitters mean they can only go from high to low concentration, so can only travel from the presynaptic to the postsynaptic membrane.

[3]

Q4.

[AO1 = 4]

Level	Marks	Description
2	3 – 4	Knowledge of the process of synaptic transmission is detailed, clear and mostly accurate with use of appropriate scientific terminology.

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1	1 – 2	Knowledge of the process of synaptic transmission is incomplete/partly accurate. Scientific terminology is either absent or inappropriately used.
	0	No relevant content.

Possible content:

- electrical impulses (action potentials) reach the presynaptic terminal
- electrical impulses (action potentials) trigger release of neurotransmitters (or named example)
- neurotransmitters cross the synapse from vesicles
- neurotransmitters combine with receptors on the postsynaptic membrane
- stimulation of postsynaptic receptors by neurotransmitters result in either excitation (depolarisation) or inhibition (hyperpolarisation) of the postsynaptic membrane.

Credit other relevant material (eg labelled diagram – direction of transmission should be made clear).

Note: for 4 marks explanation must describe the complete process (beginning, middle and end).

Q5.

[AO1 = 2]

B the central nervous system consists of the brain and spinal cord.

E the somatic nervous system controls voluntary movements.

Q6.

[AO1 = 4]

Level	Marks	Description
2	3 – 4	Excitation and inhibition are explained clearly with reference to synaptic transmission. The answer is generally coherent with effective use of terminology.
1	1 – 2	There is limited/partial explanation of excitation and inhibition with reference to synaptic transmission or only excitation or inhibition has been outlined. The answer may lack coherence. Use of terminology may be either absent or inappropriate.
	0	No relevant content.

Possible Content:

- Neurotransmitters can be excitatory or inhibitory (most can be both but GABA is purely inhibitory).
- If the neurotransmitter is excitatory then the post synaptic neuron is more likely to fire an impulse.
- If the neurotransmitter is inhibitory then the post synaptic neuron is less likely to fire an impulse.

- The excitatory and inhibitory influences are summed, if the net effect on the post synaptic neuron is inhibitory, the neuron will be less likely to 'fire' and if the net effect is excitatory, the neuron will be more likely to fire.

Students are likely to name neurotransmitters but this is not essential for full credit.

For full credit there should be some understanding of 'summation.'

Q7.

[AO1 = 1]

C

Q8.

[AO1 = 1]

B

Q9.

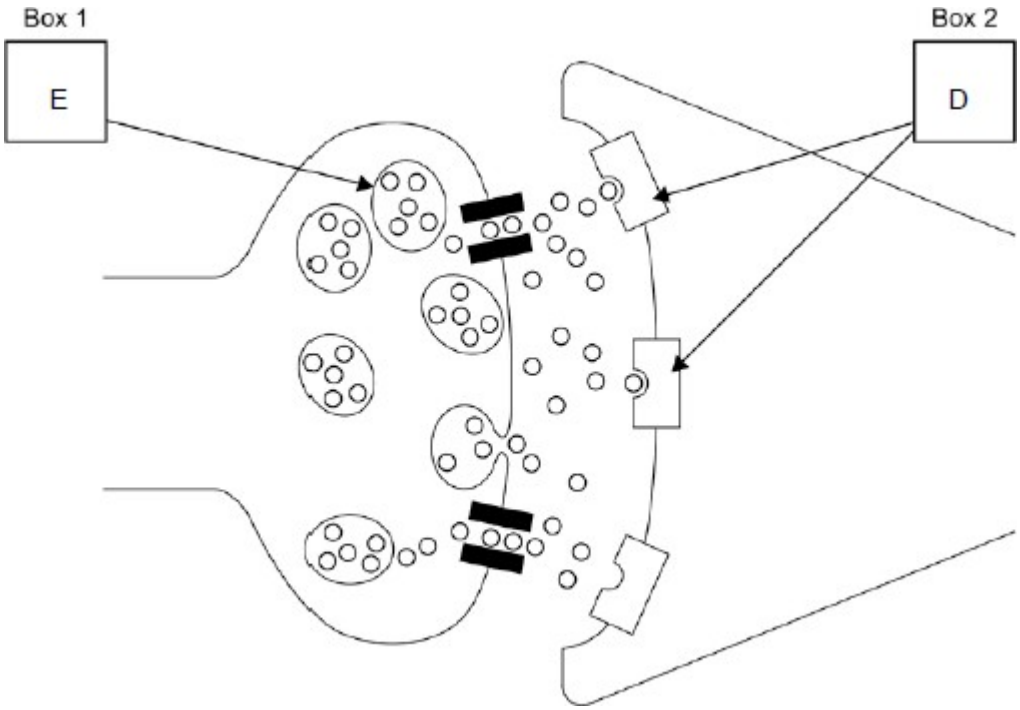
[AO1 = 1]

C

Q10.

[AO1 = 2]

1 mark each for D and E in correct boxes.



Q11.

[AO2 = 6]

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Level	Marks	Description
3	5 – 6	The explanation of how each type of neuron would function in this situation is clear and with effective and generally well-detailed application. The answer is coherent with effective use of terminology.
2	3 – 4	The explanation of how types of neurons would function in this situation is partial. There is partial appropriate application. The answer is generally coherent with some appropriate use of terminology.
1	1 – 2	The explanation of how types of neurons would function in this situation is limited. Application is limited. The answer lacks coherence and/or appropriate use of terminology.
	0	No relevant content.

Possible application as follows:

- Sensory neurons send information from the senses to the brain – here receptors in Jeremy's hand would sense the jolt of the spade hitting the rock and send that information via the peripheral nervous system to his brain/CNS.
- Relay neurons connect with other neurons, mostly found in the brain/CNS - here they would be involved in analysis of the sensation, what it means, deciding about how to respond to it, thus acting between the sensory and motor neurons.
- Motor neurons send messages via long axons from the brain to the muscles or effectors – here the message from the brain instructs Jeremy's arm muscles to stop working and stop the digging action.

Credit other relevant application.

Q12.

[AO1 = 6]

Level	Marks	Description
3	5 – 6	Knowledge of both structures and processes involved in synaptic transmission, including reference to **both** presynaptic and postsynaptic processes, is generally accurate and mostly well detailed. The answer is clear and coherent. Specialist terminology is used effectively.
2	3 – 4	Knowledge of both the structures and processes involved in synaptic transmission is evident. Focus is on pre **or** postsynaptic processes. There are some inaccuracies. There is some appropriate use of specialist terminology.
1	1 – 2	Knowledge of structures and / or processes involved in synaptic transmission is limited and lacks detail. There are inaccuracies. Specialist terminology is either absent or

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		inappropriately used.
	0	No relevant content.

Content:

The synaptic cleft; pre and postsynaptic membranes; postsynaptic receptor sites, neurotransmitters in vesicles in the presynaptic terminal, release of neurotransmitters into the synaptic cleft when stimulated by nerve impulses (action potentials) arriving at the presynaptic terminal, combination of neurotransmitters with postsynaptic receptors; postsynaptic effects either excitatory (depolarisation) or inhibitory (hyperpolarisation).

Diagrams can describe the structure effectively but text is necessary to explain the processes.

Q13.

[AO1 = 2 AO3 = 2]

One mark each for components of the peripheral nervous system - the somatic nervous system (SNS) and the autonomic nervous system (ANS).

Plus

One mark each for relevant difference explained.

Possible differences

- the SNS has sensory and motor pathways, while the ANS is purely motor;
- the ANS controls internal organs and glands of the body while the SNS controls skeletal muscle, movement etc;
- ANS control centres are in the brain stem whilst SNS carries commands from the motor cortex.

Credit other relevant differences.

There must be explicit focus on ‘differences’ between SNS and ANS for marks to be awarded, rather than independent references to each.

Q14.

[AO2 = 3]

Content:

1 mark for any three of the following points:

- Transmission involves impulses crossing a space or gap between an axon terminus and the adjacent neuron (the synapse/synaptic cleft)
- Neurotransmitters are chemicals released from vesicles on the presynaptic neuron
- They travel/diffuse across the synapse and lock onto receptor sites on

receiving/postsynaptic neuron

- Some neurotransmitters increase the rate of firing in the receiving neurons and others decrease the rate of firing

- Psychoactive drugs work by affecting (increasing or inhibiting) the transmission of neurotransmitters across the synapse

For full marks there must be some reference to drugs affecting synaptic transmission.

Credit diagrams in so far as they contribute to the explanation.

Q15.

(a) **[AO1 = 1]**

False

(b) **[AO1 = 1]**

False

Q16.

[AO1 = 2]

Up to 2 marks for an outline of synaptic transmission.

One mark for reference to the release of neurotransmitter into the synapse.
One mark for reference to neurotransmitter binding with receptors on the dendrite or next neuron to binding another impulse.

Credit a diagram that illustrates the process above.

Q17.

[AO1 = 2, AO2 = 2]

AO1

Up to 2 marks for description of the actions of the autonomic nervous system.
Likely points: one section of the autonomic nervous system (sympathetic nervous system) responds to a perceived threat / it produces physiological changes that prepare the body for fight or flight (the alarm response) (1), and the other section (parasympathetic nervous system) restores normal physiological functioning when the threat has passed (1).
If candidates simply state *flight or flight* and *rest and digest* with no further explanation 1 mark only.

AO2

Up to 2 marks for application to the description. One mark for application to sympathetic activity – breathing quickens, mouth dries, heart pounds. One mark for application to parasympathetic – breathing slows down / becoming calm.

Maximum of 2 marks if ‘sympathetic’ and ‘parasympathetic’ sections are mislabelled in AO1 description

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Q18.

Please note that the AOs for the new AQA Specification (Sept 2015 onwards) have changed. Under the new Specification the following system of AOs applies:

- AO1 knowledge and understanding
- AO2 application (of psychological knowledge)
- AO3 evaluation, analysis, interpretation.

[AO1 = 2, AO2 = 2]

AO1

Up to two marks for outlining the role of the CNS and the ANS in behaviour. One mark for each. This will probably be embedded in the application to Martha.
For CNS, possible points might include brain and role in life functions / psychological processes / higher mental functions and spinal cord and its role in transmitting information to and from the brain. Controls reflex behaviours.
For ANS, possible points might cover that it controls life-maintaining processes such as heart rate; transmits information to and from internal organs; sympathetic division of ANS prepares body for action; parasympathetic division conserves / stores energy.

AO2

Up to two marks for application of the role of the CNS and the ANS to Martha. One mark for each.

Likely answers for CNS:
Brain / cerebral cortex in higher mental functions / conscious awareness (I realised that...); decision making (...I decided to run.); auditory cortex / temporal lobe in processing auditory information (... I heard footsteps behind me...); visual cortex / occipital lobe in processing visual information (I saw a bus...).

Less likely but accept:
Cerebellum in regulating movement and sense of balance - ‘walking’ and ‘...leapt on the bus’.

Likely answers for ANS will relate to the sympathetic division of ANS and to fight / flight response: increased heart rate in emergency action (...my heart was beating so fast...);
increased action of adrenal glands and energising effect (...moved with such speed / shaking); blood vessels to limbs dilate (... sweating).

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Q1.

This question provided another opportunity to distinguish understanding as opposed to rote learning with just over half of students achieving the mark. There was generally little understanding of the divisions of the nervous system, with many relying on structural differences or muddling functional differences.

Q2.

This question was generally well answered with over 80% of students achieving full marks.

Q3.

This question provided an excellent discriminator between students who could recall the process of synaptic transmission and those who genuinely understood the process. A very small number of clear and detailed responses demonstrated sound understanding, but too many students simply explained synaptic transmission instead of using their knowledge to answer the question. Many attempted to address the question but muddled terminology, such as the pre- and post-synaptic membrane, preventing them from achieving the marks. Overall, it appeared that students are learning the required knowledge and terminology but do not understand it well enough to be able to use their knowledge flexibly. Some students gave a biological explanation of why information passes in one direction within a neuron rather than between neurons, focusing on why action potentials are unidirectional, with reference to refractory periods, voltage-gated ion channels and hyperpolarisation. Understanding of the process of synaptic transmission is an area that perhaps teachers need to look at more in the classroom and students should always be prepared to apply their knowledge to explain unfamiliar contexts.

Q4.

This question offered good discrimination. There were some very complex and detailed responses that went beyond the requirements of the specification, although these were not always well focussed. Weaker students mainly struggled with either poor focus on the process of synaptic transmission or a lack of specific detail or inaccuracies, especially regarding the use of scientific terminology. Common misunderstandings included vesicles crossing the synaptic gap, action potentials being excitatory/inhibitory, neurotransmitters being ‘fired’ across the gap and confusion between chemical and electrical transmission. Few made use of a diagram and those that did generally were ineffective in explaining the process.

Q5.

This was answered quite well although a significant number of students struggled with the instructions about how to indicate their choice of response in the appropriate mark box and even more with how to amend their choices correctly.

Q6.

There were some issues with the accuracy of knowledge here and many students produced answers that were very confused. There was only a superficial/limited understanding of how excitation and inhibition are involved in synaptic transmission. Often there was no knowledge that excitation and inhibition occur at the post synaptic

membrane and some students suggested that synapses were firing or that excitation caused more neurotransmitter and inhibition caused less. Other responses suggested that excitation referred to more firing and inhibition to less firing but an understanding of the summation of excitatory and inhibitory influences was rare, even in knowledgeable answers. At the simplest level students should be aware of the general idea that transmission is halted if there are more inhibitory effects in total and proceeds if there are more excitatory effects overall.

Q15.

(a) The majority of answers were incorrect. Many students seemed to miss the crucial word, 'to' in the description.

(b) This was answered well.

Q16.

More than half the answers to this question gained no credit. Many students did not appreciate the change that takes place from an electrical to a chemical signal and referred to 'jumping across.' A few students mentioned neurotransmitters then completed their answers with reference to binding on the post-synaptic membrane.

Q17.

Many answers to this question were quite good, although some did muddle the sympathetic and parasympathetic sections of the ANS.

Q18.

Students were familiar with the role of the Autonomic Nervous System (ANS) and most were able to apply this to the source material. Few students, however, accessed full marks for this question due to limited knowledge of the role of the Central Nervous System (CNS), often referring to the structure of the CNS (the brain and spinal cord) rather than the role of the CNS and consequently were unable to link Martha's experience to the CNS. Several students unnecessarily provided two links to the ANS (parasympathetic and sympathetic nervous systems). Examiners also noted that a substantial number of students believed that '... the CNS is part of the brain...'; others did not separate the ANS from the CNS.

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