

1

Outline the structures and processes involved in synaptic transmission.

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(Total 6 marks)

2

Read the following statements and decide whether they are **TRUE** or **FALSE**.

(a) Motor (efferent) neurons carry messages to the central nervous system.  
(Tick the correct box)

TRUE	FALSE

(1)

(b) The nucleus of a neuron is found outside the cell body (soma).  
(Tick the correct box)

TRUE	FALSE

(1)

(Total 2 marks)

**3**

Briefly explain **one** function of the endocrine system.

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**(Total 2 marks)**

**4**

You are just about to cross the road when a car comes speeding round the corner and narrowly misses you. Afterwards, standing safely on the pavement, you notice that your mouth is very dry, your breathing is very fast and your heart is thumping.

Using your knowledge of the body's response to stress, explain why you are likely to have experienced these changes.

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**Extra space** \_\_\_\_\_

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**(Total 4 marks)**

**5**

Martha was telling her friend Sanya about her recent frightening experience.

'I was walking home by myself in the dark. Suddenly, I heard footsteps behind me and I realised that someone was getting closer to me. I saw a bus at the bus stop and decided to run. I don't think I have ever moved with such speed. I leapt on the bus – shaking, sweating and my heart was beating so fast I nearly collapsed.'

Outline the role of the central nervous system **and** autonomic nervous system in behaviour. Refer to Martha's frightening experience in your answer.

**(Total 4 marks)**

**6**

Outline the role of adrenaline in the fight or flight response.

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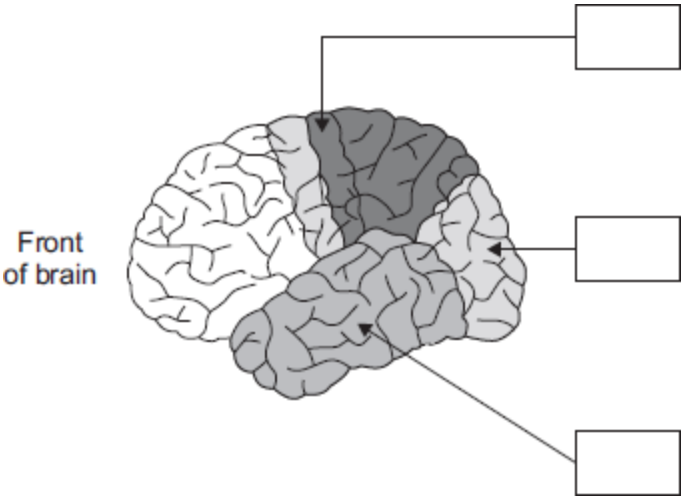
**(Total 4 marks)**

**7**

Psychologists have identified many areas of cortical specialisation in the brain. These include:

- A the motor centre
- B the auditory centre
- C the visual centre
- D the somatosensory centre.

Below is a diagram of the human brain. Identify three areas of cortical specialisation by writing **A**, **B**, **C** or **D** in each of the boxes that are provided. Use a different letter for each box.



**(Total 3 marks)**

**8**

Robert suffered a stroke at the age of 55. After the stroke he was paralysed down his right side, though he could move his left arm and leg easily. Robert could clearly understand what was said to him, but was unable to produce any speech.

Discuss how knowledge of hemispheric lateralisation and language centres in the brain has helped our understanding of cases such as Robert's. Refer to Robert's case in your answer.

**(Total 16 marks)**

**9**

Split brain patients show unusual behaviour when tested in experiments. Briefly explain how unusual behaviour in split brain patients could be tested in an experiment.

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**(Total 2 marks)**

10

Briefly evaluate the use of EEGs as a way of identifying cortical specialisation in the brain.

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(Total 3 marks)

11

Outline **one or more** examples of ultradian rhythms.

(Total 4 marks)

12

Read the item and then answer the question that follows.

Sam is a police officer. She has just started working the night shift and after a week, she finds that she has difficulty sleeping during the day and is becoming tense and irritable. Sam is also worried that she is less alert during the night shift itself.

Using your knowledge of endogenous pacemakers and exogenous zeitgebers, explain Sam's experiences.

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(Total 4 marks)

13

Discuss research into the disruption of biological rhythms (e.g. shift work, jet lag).

(Total 16 marks)

## Mark schemes

1

[AO1 = 6]

Level	Marks	Description
3	5 – 6	Knowledge of both structures and processes involved in synaptic transmission, including reference to <b>both</b> 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 <b>or</b> 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 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.

2

(a) [AO1 = 1]

False

(b) [AO1 = 1]

False

**3**

[AO1 = 2]

**1 mark** for a correct function of the endocrine system.

- To secrete the hormones which are required to regulate many bodily functions.
- To provide a chemical system of communication via the blood stream.

**1 mark** for elaboration of how the function occurs: such as via release of the required amount of a specific hormone to promote appropriate growth or metabolism or reproduction.

**4**

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.

Although the essential content for this mark scheme remains the same, mark schemes for the new AQA Specification (Sept 2015 onwards) take a different format as follows:

- A single set of numbered levels (formerly bands) to cover all skills
- Content appears as a bulleted list
- No IDA expectation in A Level essays, however, credit for references to issues, debates and approaches where relevant.

**AO2 = 4**

The stem refers to the body responding to a short-term stressor, the release of adrenaline is responsible for increased heart rate and faster breathing and the dry mouth is linked to the digestive system “shutting down”. Students can refer to the pituitary adrenal system and/or the sympathomedullary pathway. They can also refer to the fight-or-flight response. For full marks there must be explicit engagement with the stem.

<b>AO2 Mark bands</b>
<b>4 marks Effective analysis of unfamiliar situation</b> Effective explanation that demonstrates sound knowledge of the body’s response to stress. There is explicit engagement, which relates to either at least two of the specific changes identified in the stem or the car as the stressor.
<b>3 marks Reasonable analysis of unfamiliar situation</b> Reasonable explanation that demonstrates knowledge of the body’s response to stress with reference to one or more of the changes identified in the stem.
<b>2 marks Basic analysis of unfamiliar situation</b> Basic explanation of the body’s response to stress.
<b>1 mark Rudimentary analysis of unfamiliar situation</b> Rudimentary, muddled, explanation of the body’s response to stress demonstrating very limited knowledge.
<b>0 marks</b> No creditworthy material.

**5**

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)
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[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).

**6**

[AO1 = 4]

Level	Marks	Description
2	3 – 4	Knowledge of the role of adrenaline in the fight or flight response is clear and mostly accurate.
1	1 – 2	Knowledge of the role of adrenaline in the fight or flight response is incomplete/partly accurate. For 1 mark there may be some detail of direct or general effects but not explicitly linked to fight or flight.
	0	No relevant content.

**Possible content:**

- Adrenaline is released from the adrenal medulla in response to activation of the sympathomedullary pathway.
- Adrenaline has a range of effects on the body
- Direct effects of adrenaline
  - increase heart rate
  - constricts blood vessels, increasing rate of blood flow and raising blood pressure
  - diverts blood away from the skin, kidneys and digestive system
  - increases blood to brain and skeletal muscle
  - increases respiration and sweating
- The general effects of adrenaline
  - prepare the body for action, fight or flight,
  - increase blood supply/oxygen, to skeletal muscle for physical action
  - increase oxygen to brain for rapid response planning

Up to 2 marks for accurate detail of the effects of adrenaline on the body eg outline of two different effects, or detailed account of one effect. 2 further marks for an account of the role of adrenaline in the fight or flight response ie providing a context for the various effects of adrenaline on the body (eg last two bullets).

7

[AO1 = 3]

One mark each for the correct area of cortical specialisation.

D = Somatosensory centre

C = Visual centre

B = Auditory centre

Level	Marks	Description
4	13 – 16	Knowledge of hemispheric lateralisation and language centres in the brain is accurate and generally well detailed. Discussion is thorough with effective reference to cases of aphasia. Answer is clear, coherent and focused. Specialist terminology is used effectively. Minor detail and/or expansion of argument sometimes lacking.
3	9 – 12	Knowledge of hemispheric lateralisation and language centres in the brain is evident. There are occasional inaccuracies. Discussion is apparent and reference to cases of aphasia is mostly effective. The answer is mostly clear and organised. Specialist terminology mostly used effectively. Lacks focus in places.
2	5 – 8	Some knowledge of hemispheric lateralisation and language centres in the brain is present. Focus is mainly on description. Any discussion and reference to cases of aphasia is only partly effective. The answer lacks clarity, accuracy and organisation in places. Specialist terminology used inappropriately on occasions.
1	1 – 4	Knowledge of biological explanations of offending behaviour is limited. Discussion is limited, poorly focused or absent. The answer as a whole lacks clarity, has many inaccuracies and is poorly organised. Specialist terminology either absent or inappropriately used.
	0	No relevant content.

### Possible content

- Systematic research from Wernicke and Broca onwards has demonstrated that in most people language centres are lateralised to the left hemisphere.
- Wernicke's area seems to be responsible for the interpretation of speech – damage leads to receptive or sensory aphasia
- Broca's area was thought to be responsible for the production of speech this is now thought to involve a wider network than just Broca's area – damage leads to production (expressive) or motor aphasia

### Possible application

- The presence of a right sided paralysis confirms that in cases such as Robert's there is lateralised damage to the left hemisphere
- Robert, can understand speech so we conclude that he does not have Wernicke's, receptive, aphasia; caused by damage to Wernicke's area in the left hemisphere.
- Robert cannot produce speech so we conclude that Broca's area has been damaged leading to Broca's, production or expressive aphasia.

### Possible discussion

- As language centres are lateralised they can be impaired by damage to the left hemisphere, not to the right. The left hemisphere also controls the muscles of the right side of the body therefore, when brain damage leads to speech problems combined with paralysis of body muscles, it is usually a right sided paralysis.
- Damage to Broca's area can lead to production/expressive aphasia combined with right sided paralysis.
- Damage to Broca's and Wernicke's areas may lead to global aphasia (inability to understand or to produce speech), combined with right sided paralysis.
- Use of research evidence to support explanation.
- Problems associated with different types of research evidence.

9

[AO2 = 2]

**2 marks** for a clear, brief explanation including detail of an appropriate experimental procedure and what patients would be required to do.

**1 mark** for a vague explanation which has some detail about an appropriate experimental procedure and what patients would be required to do.

#### Possible suggestions:

- plausible experimental situation / set-up – eg split visual field, dichotic listening
- plausible stimulus – visual, faces, words, auditory, digits, music etc
- plausible task for patient – verbal or visuospatial response, eg drawing, matching etc.

10

[AO3 = 3]

Up to three marks for a brief evaluation of the use of EEGs. Credit up to 3 separate evaluative points or one point fully elaborated or a combination of these.

Likely points: safe way of measuring brain activity; there is no surgery or invasive process; helps to identify activity in various regions of brain; its use as a diagnostic tool eg epilepsy; lacks precision in measuring individual action potential of neurons / electrodes not sensitive enough, etc.

11

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:

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

Although the essential content for this mark scheme remains the same, mark schemes for the new AQA Specification (Sept 2015 onwards) take a different format as follows:

- A single set of numbered levels (formerly bands) to cover all skills
- Content appears as a bulleted list
- No IDA expectation in A Level essays, however, credit for references to issues, debates and approaches where relevant.

**AO1 = 4**

Candidates need to outline an example of one or more examples of ultradian biological rhythms ie rhythms that have a cycle length of more than one cycle every 24 hours. The most accessible example is the alternation between REM and NREM sleep during the night. For marks in the top band candidates should provide some details of this alternation, such as the number of REM episodes per night, the link with stage 2 NREM, or the distinctive characteristics of each sleep type. Other examples of ultradian rhythms include meal patterns in humans and other animals and variations in locomotor activity in rats. Again, for marks in the top band detail beyond a simple outline is necessary.

Description of the stages of sleep without reference to the ultradian rhythm can gain a maximum of 1 mark.

Straightforward definitions are not credit-worthy. However, candidates who provide an incorrect definition of an ultradian rhythm but present an appropriate outline may earn marks across the scale.

<b>AO1 Mark Bands</b>
<b>4 marks Sound</b> Knowledge and understanding are accurate and well detailed. Organisation and structure of the answer are coherent.
<b>3 marks Reasonable</b> Knowledge and understanding are generally accurate and reasonably detailed. Organisation and structure of the answer are reasonably coherent.
<b>2 marks Basic</b> Knowledge and understanding are basic/relatively superficial. Organisation and structure of the answer are basic.
<b>1 mark Rudimentary</b> Knowledge and understanding are rudimentary and may be very brief, muddled and/or inaccurate. Lacks organisation and structure.
<b>0 marks</b> No creditworthy material.

Level	Marks	Description
2	3 – 4	Knowledge of the role of endogenous pacemakers and exogenous zeitgebers and how they interact to affect the normal sleep-wake cycle is clear and mostly accurate. The material is used appropriately to explain Sam's experiences / symptoms. The answer is generally coherent with effective use of specialist terminology.
1	1 – 2	Some knowledge of the role of endogenous pacemakers and exogenous zeitgebers in the sleep-wake cycle is evident. The material is not always linked explicitly or effectively to Sam's experiences / symptoms. The answer lacks accuracy and detail. Use of specialist terminology is either absent or inappropriate.
	0	No relevant content.

**Content:**

- endogenous pacemakers – internal biological rhythms
- exogenous zeitgebers – external factors, eg light
- moving to night shift means pacemakers try to impose inbuilt rhythm of sleep, but are now out of synchrony with the zeitgeber of light
- disruption of biological rhythms has been shown to lead to disrupted sleep patterns, increased anxiety and decreased alertness and vigilance.

**13****Marks for this question: AO1 = 6, AO3 = 10**

<b>Level</b>	<b>Marks</b>	<b>Description</b>
4	13 – 16	Knowledge is accurate and generally well detailed. Discussion / evaluation / application is thorough and effective. The answer is clear, coherent and focused. Specialist terminology is used effectively. Minor detail and / or expansion of argument sometimes lacking.
3	9 – 12	Knowledge is evident. There are occasional inaccuracies. Discussion / evaluation / application is apparent and mostly effective. The answer is mostly clear and organised. Specialist terminology is mostly used effectively. Lacks focus in places.
2	5 – 8	Some knowledge is present. Focus is mainly on description. Any discussion / evaluation / application is only partly effective. The answer lacks clarity, accuracy and organisation in places. Specialist terminology is used inappropriately on occasions.
1	1 – 4	Knowledge is limited. Discussion / evaluation / application is limited, poorly focused or absent. The answer as a whole lacks clarity, has many inaccuracies and is poorly organised. Specialist terminology either absent or inappropriately used.
	0	No relevant content.

Please note that although the content for this mark scheme remains the same, on most mark schemes for the new AQA Specification (Sept 2015 onwards) content appears as a bulleted list.

## **AO1**

The term 'research' refers to both theory / explanations and studies.

Students are likely to focus on research studies into shift work and jet lag, although other examples, such as seasonal affective disorder, could also be relevant if presented in the context of the disruption of biological rhythms. Effects of disrupting biological rhythms through shift work and jet lag can be behavioural (e.g. lowered productivity), psychological (e.g. tiredness, depression, anxiety), or physiological (e.g. increased vulnerability to heart disease and cancer). For each of these and for both shift work and jet lag there are many accessible research studies.

More anecdotal answers that simply describe effects of disrupting biological rhythms without reference to research studies may earn very limited credit as the description is based on research. This includes reference to real world events such as Chernobyl and Three Mile Island.

Some candidates may begin by outlining the mechanisms behind the disruptive effects, such as the dislocation of endogenous pacemakers and external zeitgebers i.e. outlining an *explanation* for the effects of disrupting biological rhythms.

## **AO3**

Commentary might include the implications of findings for our understanding of the mechanisms of the effects of disruption, and application of findings to reduce the impact of disruption e.g. by changes to shift work patterns, or by adjusting behaviour when crossing time zones. For full credit such applications should be linked to mechanisms / explanations. Treatments for jet lag e.g. melatonin, would be creditable as long as there is an explicit link to biological rhythms e.g. via the role of melatonin in biological clocks.

Use of the findings of relevant research studies is an accessible source of credit, where used to support or contradict our understanding of the mechanisms.

Credit also discussion of practical applications of findings. Some convincing studies show that modifying shift work patterns can have significant beneficial effects on behaviour and health. Other relevant discussion may include reductionism and the nature / nurture debate.