

GCSE Biology (9 – 1)

The Nervous System

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/4
2	/13
3	/8
4	/6
5	/9
6	/17
7	/17
Total	/74
%	
Grade	

Information

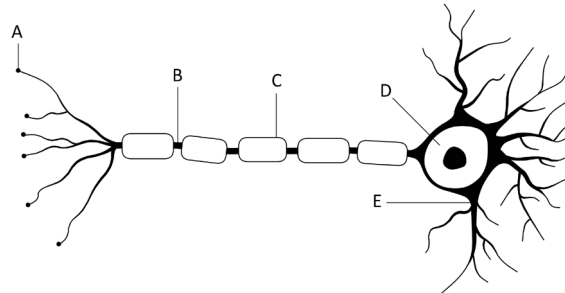
- The maximum mark for this paper is 74 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. The human nervous system allows organisms to react to their surroundings and coordinate their behaviour. Circle the letter of the correct answer for each question below.

a) The figure below shows a motor neurone.

At the junction between a relay neurone and a motor neurone, neurotransmitters are released. To which part of the motor neurone do these neurotransmitters typically bind?



A

B

C

D

E

(1 mark)

b) What is the correct sequence in a reflex arc?

A Motor neurone → sensory neurone → relay neurone → effector → receptor

B Effector → receptor → sensory neurone → relay neurone → motor neurone

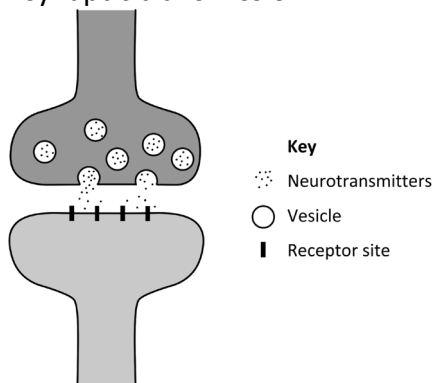
C Receptor → sensory neurone → relay neurone → motor neurone → effector

D Receptor → relay neurone → sensory neurone → effector → motor neurone

(1 mark)

c) The figure below shows a synapse. At this junction, a neurotransmitter chemical diffuses across the gap and binds to receptor sites on the next neurone, allowing an impulse to be generated.

Using the information provided and your own knowledge, describe the role of the neurotransmitter in synaptic transmission.



What happens immediately after the neurotransmitter chemical binds to receptor sites on the second neurone?

A The neurotransmitter diffuses back across the gap.

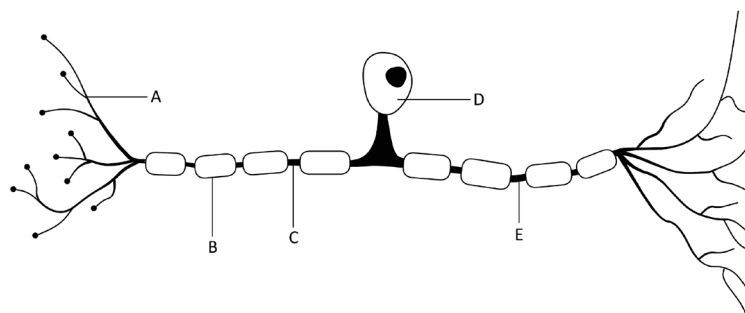
B An electrical impulse is generated in the second neurone.

C The first neurone releases more neurotransmitter.

D The receptor changes shape to release neurotransmitters.

(1 mark)

d) The figure below shows a sensory neurone. Which label shows the myelin sheath?



A

B

C

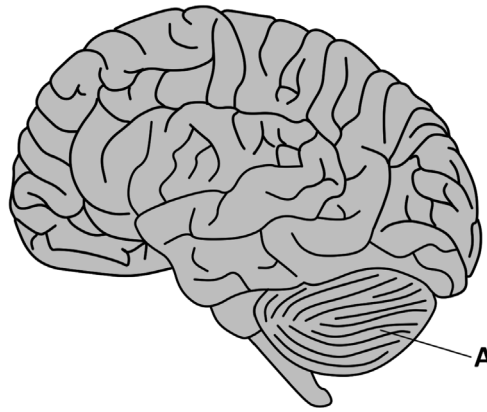
D

E

(1 mark)

(Total for Question 1 is 4 marks)

2. The figure below shows the structure of a human brain.



a) Identify structure A and give its function.

Structure A:

Function:

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.....
.....

(2 marks)

b) In response to a stimulus, nerve impulses are transmitted from the brain to the muscles.

Describe how impulses are sent from the brain to the muscles.

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(3 marks)

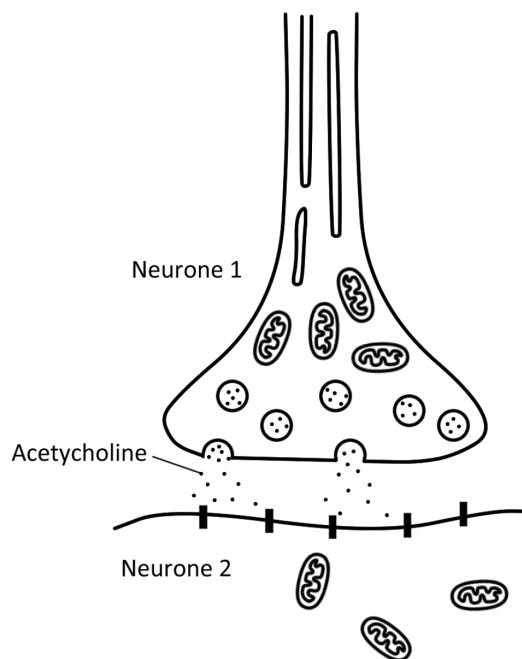
c) Most neurones in the brain are unmyelinated whereas motor neurones are myelinated.

Explain why myelination is needed on motor neurones but not on neurones in the brain.

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(3 marks)

Alzheimer's is a degenerative brain disease that causes brain cells to degenerate and die. Common symptoms include difficulties moving, having a decline in memory, and reduced ability to think. The figure below shows a synapse between two neurones in the brain.



Acetylcholine is a neurotransmitter in the brain. Scientists observe that in a brain affected by Alzheimer's disease, the neurotransmitter acetylcholine requires 6.8×10^{-7} s to diffuse across the 30 nanometre synaptic gap between neurones. 1 metre = 10^9 nanometres

- d) Calculate the speed of the Acetylcholine diffusion across the synapse in a person with Alzheimer's disease. Use this formula: **speed = distance $\div$ time**

Give your answer in metres per second.

Speed of diffusion = ... metres per second
(3 marks)

- e) In a healthy person the speed of diffusion of Acetylcholine is 0.4 metres per second. How does the result in part (d) explain the symptoms of Alzheimer's disease?

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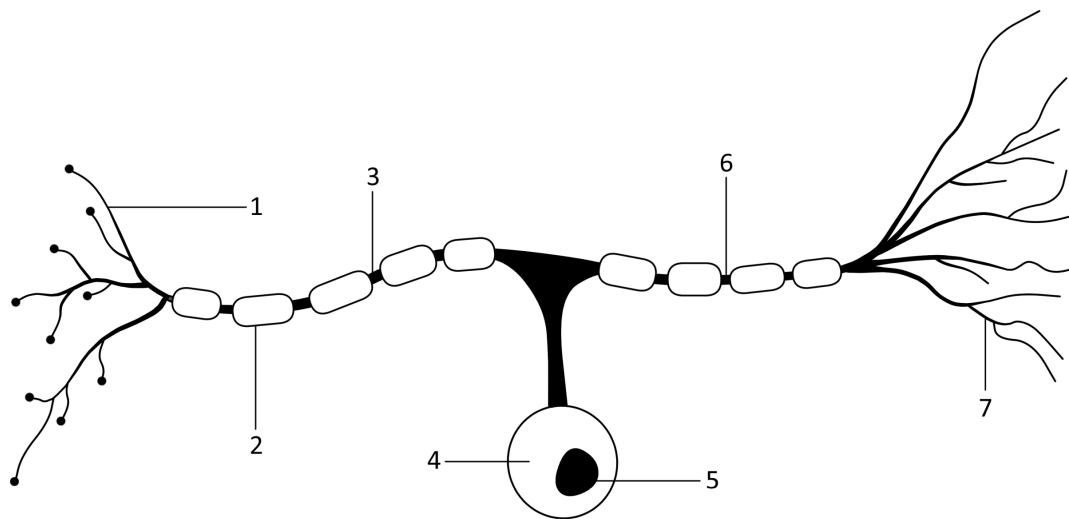
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(2 marks)

(Total for Question 2 is 13 marks)

3. The figure below shows a sensory neurone.



a) Identify the structures labelled 1 to 7 from the figure below.

- | | |
|---------|---------|
| 1. | 2. |
| 3. | 4. |
| 5. | 6. |
| 7. | |

(4 marks)

b) Describe the role of sensory neurones in the nervous system.

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(2 marks)

c) Describe **two** distinct structural features of a sensory neurone that differ from those of a motor neurone.

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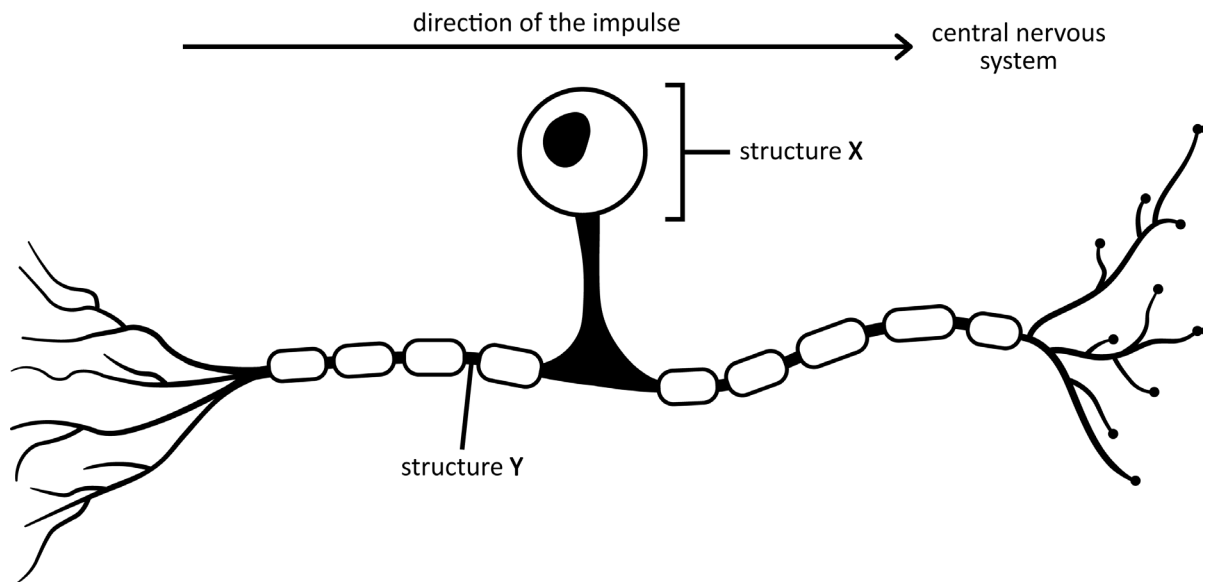
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(2 marks)

(Total for Question 3 is 8 marks)

5. The figure below shows a sensory neurone.



a) Identify the structures labelled in the figure above.

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(2 marks)

b) To what do sensory neurones carry impulses to?

.....
(1 mark)

c) What is the function of the myelin sheath?

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(2 marks)

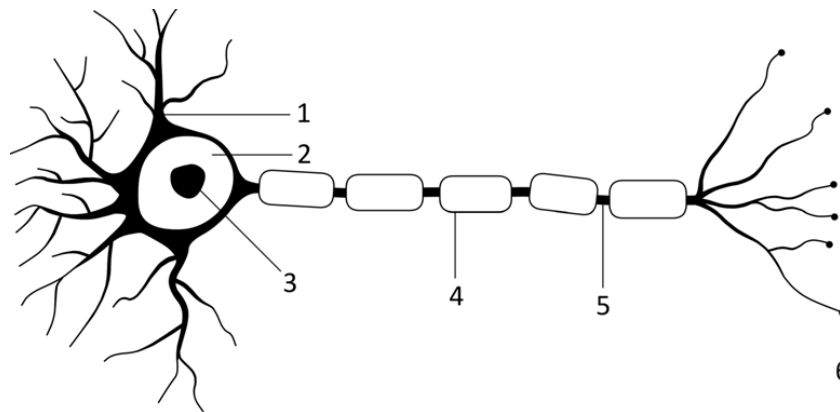
d) Explain how impulses are transmitted at synapses.

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(4 marks)

(Total for Question 5 is 9 marks)

6. Motor Neurone Disease (MND) is a rare, progressive condition that attacks and destroys the motor neurones. MND badly affects the speed of nerve impulse in motor neurones.

The figure below shows a motor neurone.



- a) Identify the structures labelled 1 to 6 from the figure below.

- | | |
|---------|---------|
| 1. | 2. |
| 3. | 4. |
| 5. | 6. |

(3 marks)

- b) Describe the specific role of motor neurones in enabling an organism to respond to a stimulus.

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(3 marks)

- c) Motor neurones have an axon. State the function of the axon in a motor neurone.

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(2 marks)

- d) The nervous system also makes use of sensory neurones.

Describe the role of sensory neurons in enabling an organism to respond to a stimulus.

[illegible]

(3 marks)

- e) Some painkillers prevent neurotransmitters binding to receptors in a synapse.

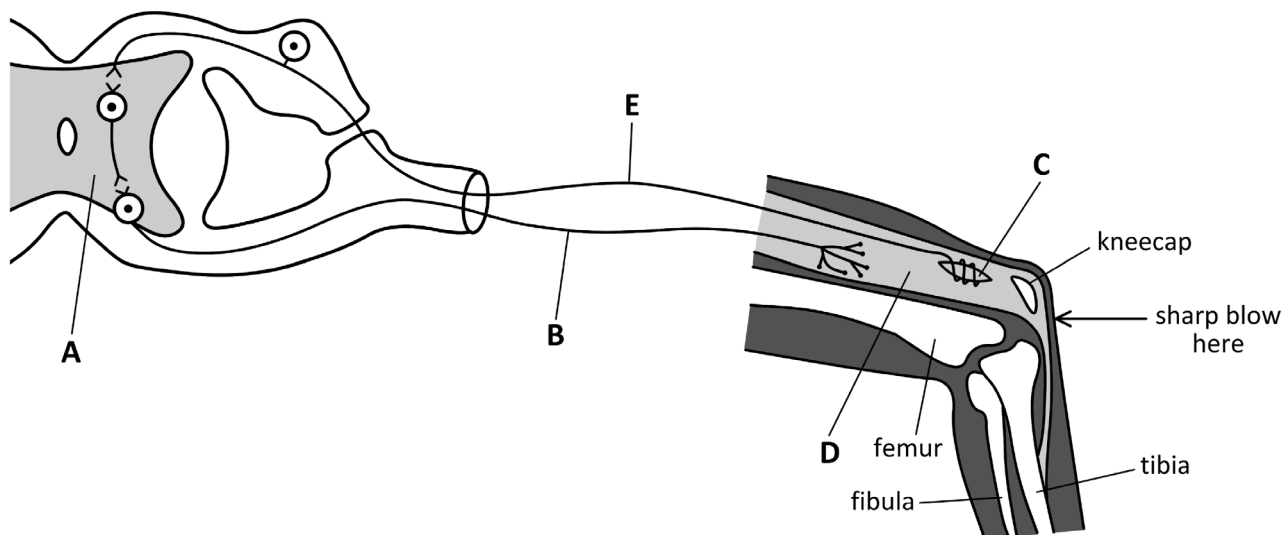
Explain how a signal is transmitted at a synapse and how the painkillers reduce the pain felt by the person.

[illegible]

(6 marks)

(Total for Question 6 is 17 marks)

7. The figure below shows a simplified reflex arc for the knee.



a) Identify the structures labelled **A**, **B**, **C** and **D** from the figure above.

A = ...

B = ...

C = ...

D = ...

(4 marks)

b) Explain **two** ways in which reflex arcs are beneficial to the survival of an organism.

.....

(2 marks)

c) Identify the structure labelled **E** and explain its function in the nervous system.

Identity of E:

Function:

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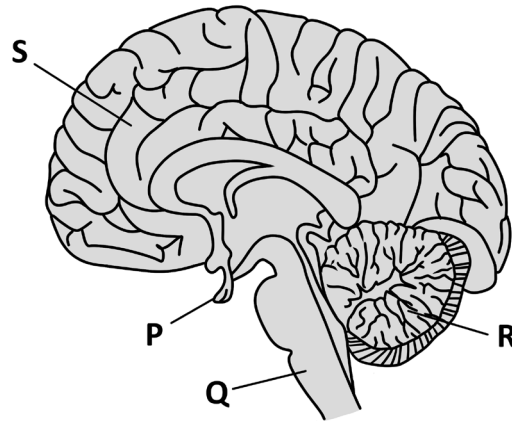
(3 marks)

d) State the **two** parts of the central nervous system.

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.....

(2 marks)

The figure below shows a section through a human brain.



e) Identify the structures labelled **S**, **P**, **Q** and **R** from the figure above.

S = ...

P = ...

Q = ...

R = ...

(4 marks)

f) Describe the function of structure S.

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(2 marks)

(Total for Question 7 is 17 marks)