



EXAM PAPERS PRACTICE

## Grey Matter -2

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: Grey Matter -2

Type: Topic Question

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful

## Questions

Q1.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Genome sequencing and genetic modification (GM) can be used to develop proteins as personalised medicines.

(i) Which of the following correctly describes the genome of an adult male?

- A** all of his alleles plus all of his genes
- B** all of his exons minus all of his introns
- C** all of his introns minus all of his exons
- D** all of his introns plus all of his exons

(1)

(ii) Which row correctly identifies all the types of organism that can be both genetically modified and be a source of a gene to be used in GM?

(1)

	Animal	Bacterium	Plant
<input type="checkbox"/> <b>A</b>	no	no	yes
<input type="checkbox"/> <b>B</b>	no	yes	yes
<input type="checkbox"/> <b>C</b>	yes	yes	no
<input type="checkbox"/> <b>D</b>	yes	yes	yes

(Total for question = 2 marks)



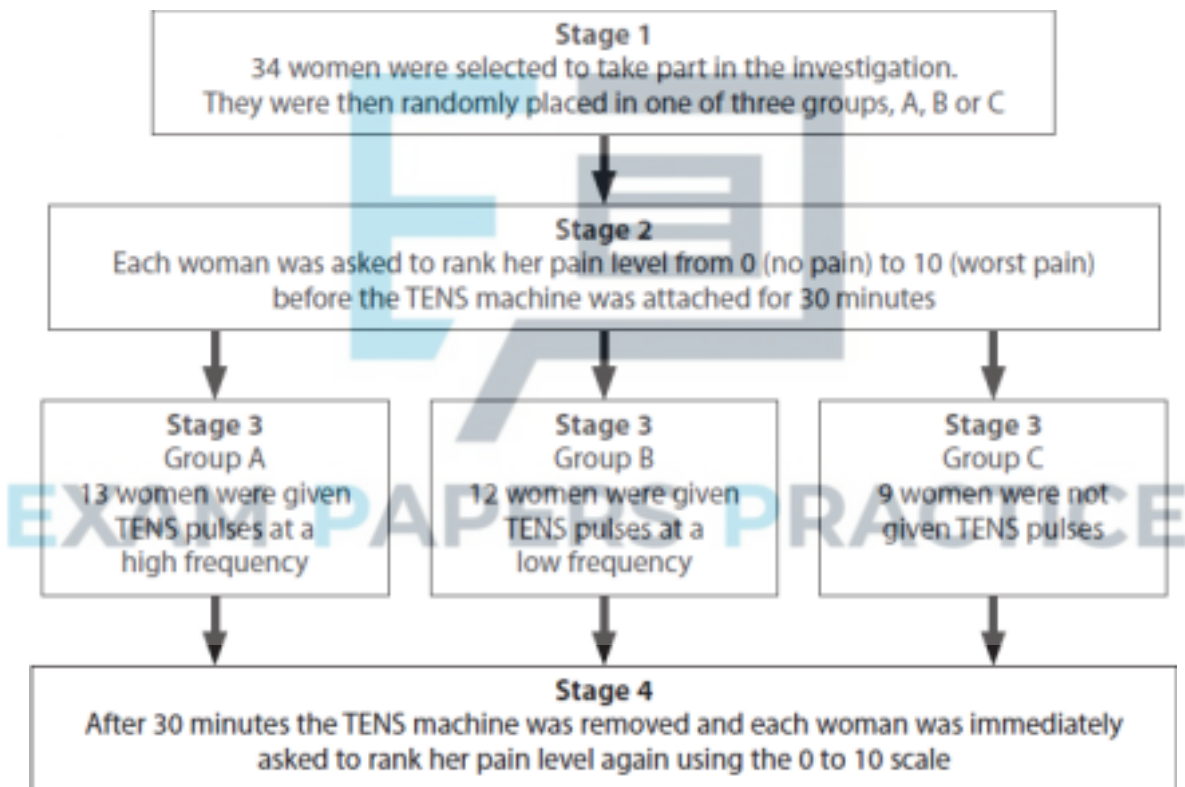
Q2.

Some women need to have surgery to aid childbirth. This can lead to pain after surgery.

A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



This investigation used only one 30-minute session of TENS pulses. This was done to reduce the risk of habituation.

Describe the process that occurs at a synapse that leads to habituation.

(4)

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**(Total for question = 4 marks)**

Q3.

Habituation is a learning response observed in many types of animal.

Explain the importance of the habituation response in an animal.

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**(Total for question = 2 marks)**

Q4.

Plants can respond to environmental cues using IAA (auxin) and photoreceptors.

(a) A plant was kept in a cycle of 12 hours in the light and then 12 hours in the dark. This plant did not flower.



It was then placed in an environment with 15 hours in the light and 9 hours in the dark. The plant then flowered.

Explain how this change in light conditions stimulated this plant to flower.

(3)

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(b) IAA in the stem of the plant is involved in phototropism.

(i) Give **three** similarities between IAA and animal hormones.

(3)

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(ii) Auxins can be used to kill unwanted plants such as weeds growing in grass. The auxin stimulate the weeds to grow rapidly.

Suggest an explanation for how auxins stimulate the weeds to grow rapidly but not the grass.

(2)



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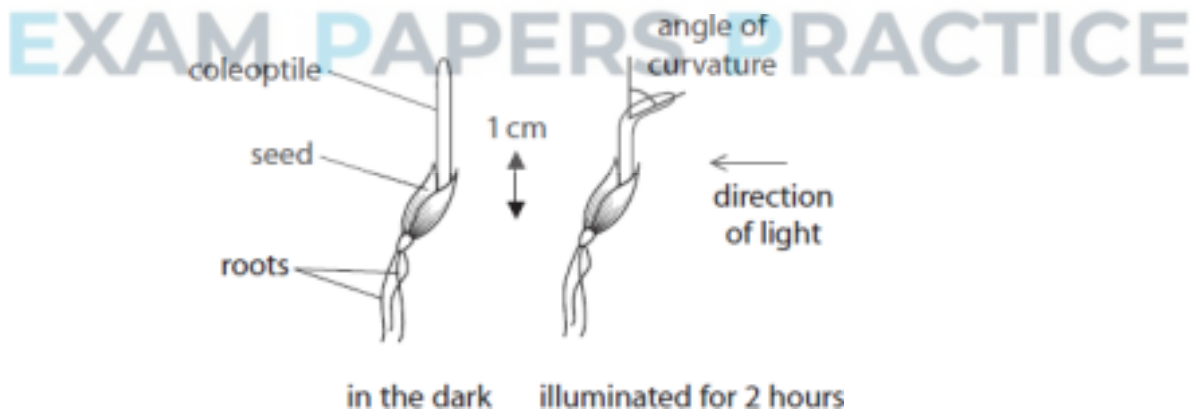
(Total for question = 8 marks)

Q5.

When oat seeds germinate, they produce roots and a coleoptile.

The effect of shading the tip of the coleoptile was investigated.

The diagram shows how the coleoptile of an oat seedling can bend towards light.

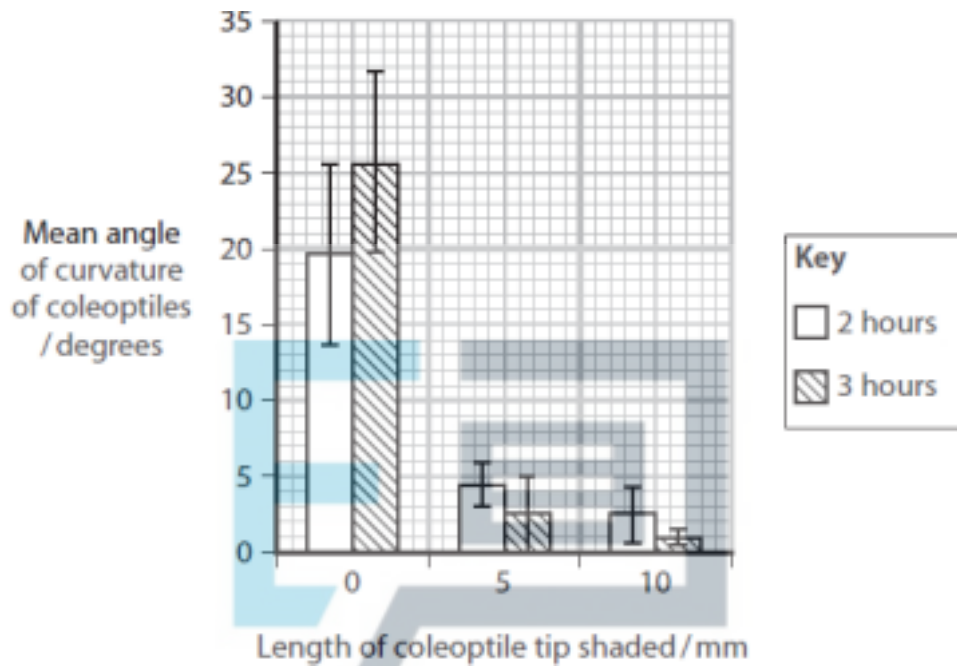


Oat seeds were germinated. When the coleoptiles were 2 cm long the seedlings were split into three groups.

- Group 1 none of the tip of the coleoptile was shaded
- Group 2 5 mm at the tip of the coleoptile was shaded
- Group 3 10 mm at the tip of the coleoptile was shaded

All the coleoptiles were then exposed to light from one side.

The curvature of the coleoptiles was measured after intervals of 2 hours and 3 hours. The results of this investigation are shown in the graph.

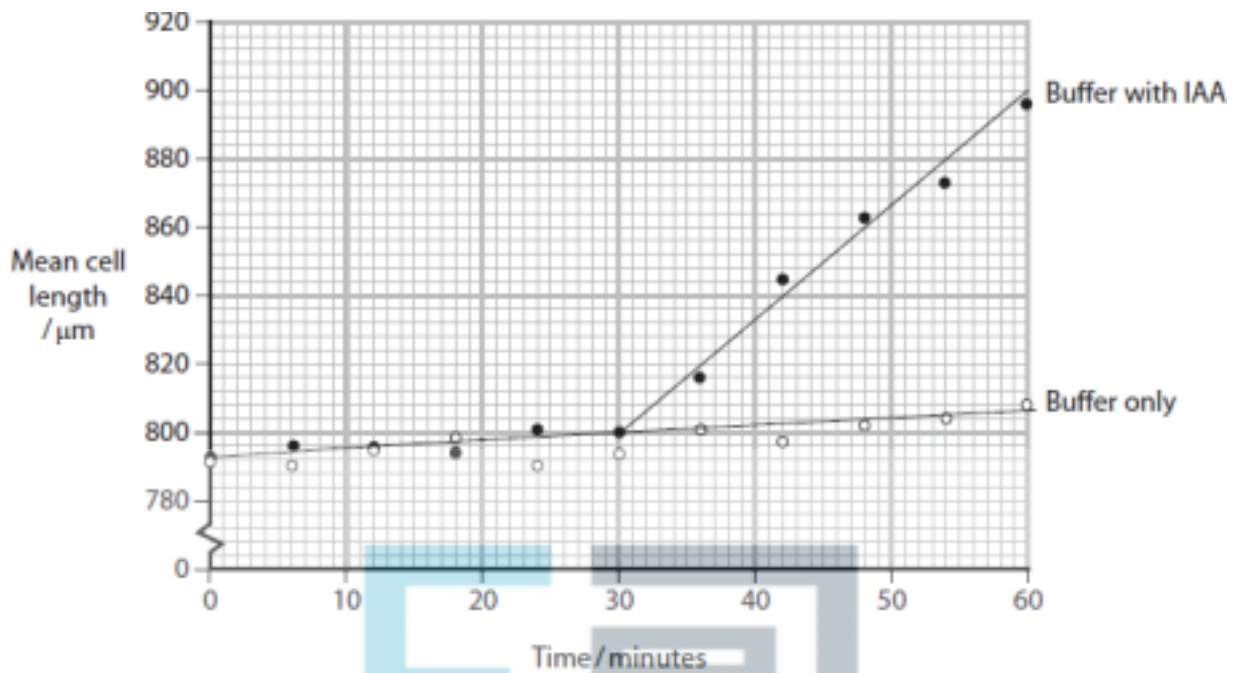


In a second investigation, cells were taken from below the tip of the coleoptile.

These cells were soaked in buffer alone or buffer containing IAA (auxin), for a period of 60 minutes.

The lengths of the cells were measured every six minutes.

The results of this investigation are shown in the graph.



Explain how the evidence from these investigations indicates that plant hormones are involved in the phototropic response of oat coleoptiles.

(3)

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(Total for question = 3 marks)





Q7.

The scientific article you have studied is adapted from *Scientific American*.

Use the information from the scientific article and your own knowledge to answer the following question.

Describe how tumour shrinkage could be observed (paragraph 6).

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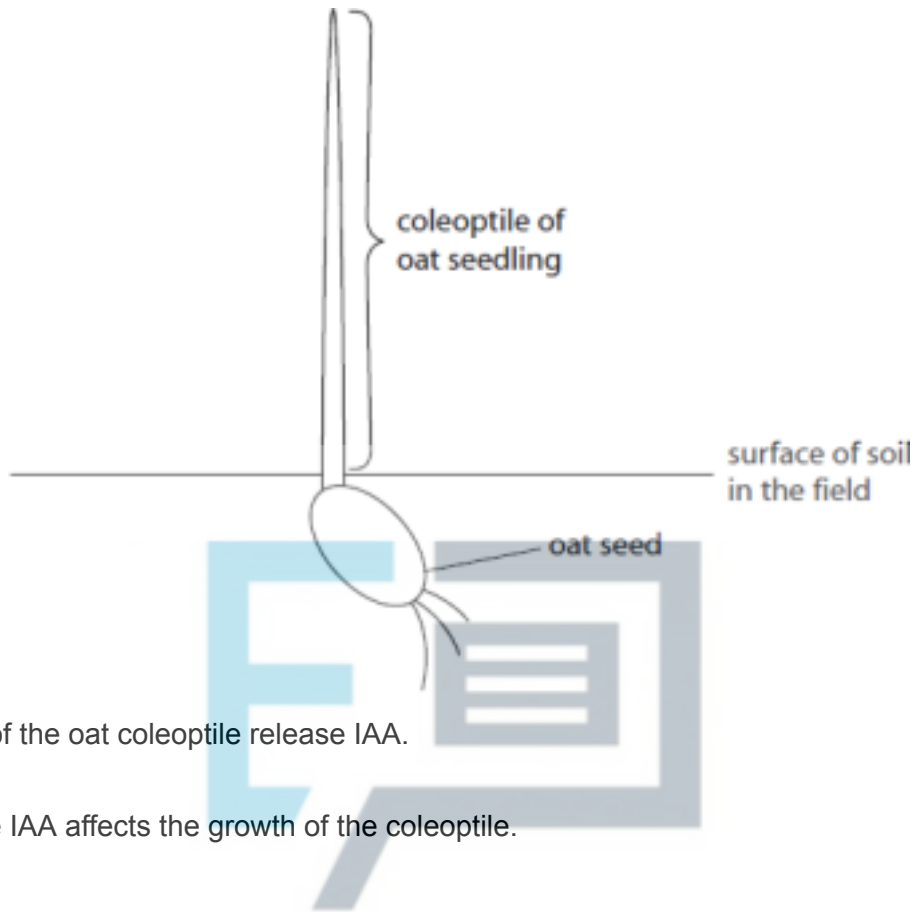
(Total for question = 2 marks)

Q8.

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Phytochromes and IAA (indole acetic acid) are important substances that bring about growth responses in plants.

The diagram shows an oat seedling in part of a field.



Cells in the tip of the oat coleoptile release IAA.

Explain how the IAA affects the growth of the coleoptile.

(4)

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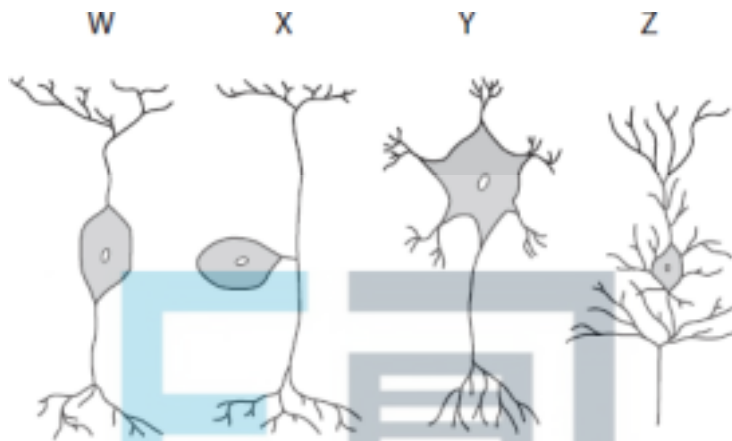
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(Total for question = 4 marks)

Q9.

People with Guillain-Barré syndrome (GBS) suffer from a rapid onset of muscle weakness. It is thought that GBS is caused by damage to the peripheral nervous system.

The diagram shows some typical neurones.



(i) Which of these is a sensory neurone?

(1)

A W

B X

C Y

D Z

(ii) The axons of some neurones are surrounded by a myelin sheath.

The main component of myelin is a glycolipid.


Glycolipids are formed from lipids attached to a chain of

(1)

- A** amino acids which are joined by glycosidic links
- B** amino acids which are joined by peptide bonds
- C** sugar molecules which are joined by ester bonds
- D** sugar molecules which are joined by glycosidic links

(iii) Describe the role of the dendrites in a neurone.

(3)



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**(Total for question = 5 marks)**

Q10.

An investigation was carried out to study the effect of positive and negative physical and emotional experiences on humans.

The positive physical experience was a warm object placed on the arm of a person for five seconds.

The negative physical experience was a hot object placed on the arm of a person for five seconds.

All other variables were kept constant.

Two groups of people were used in this investigation. In the first group, the warm object was used before the hot object. In the second group, the hot object was used before the warm object.

After each experience, the individuals were asked to rate their feelings using the scoring system below.

Feelings	Score
Very bad	1
Bad	2
Neutral	3
Good	4
Very good	5

This investigation then used a scanning technique to study whether the same areas of the brain were involved in both physical experiences and emotional experiences.

(i) Suggest the scanning technique required to study the brain in this investigation. Give reasons for your choice.





A

B

C

D

Q11.

Answer the question with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

There are various ways to scan the brain.

(i) Brain tumours are dense masses of cells. The presence of brain tumours can be detected using several types of scanning method.

The table shows two types of scan. Place a tick [  ] in the box if the scan can identify the size and location of a large brain tumour or a cross [  ] in the box if the scan cannot identify the size and location of a large brain tumour.

(2)

Type of scan	Can be used to identify the tumour
CT	
MRI	

(ii) Functional MRI (fMRI) measures brain activity by detecting changes in

(1)



- A blood flow
- B bone density
- C dopamine release
- D lactic acid production

(iii) Which of the following types of scanner uses X-rays?

(1)

- A CT
- B fMRI
- C MRI
- D PET



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(Total for question = 4 marks)

Q12.

\*Cells use ions in many different processes.

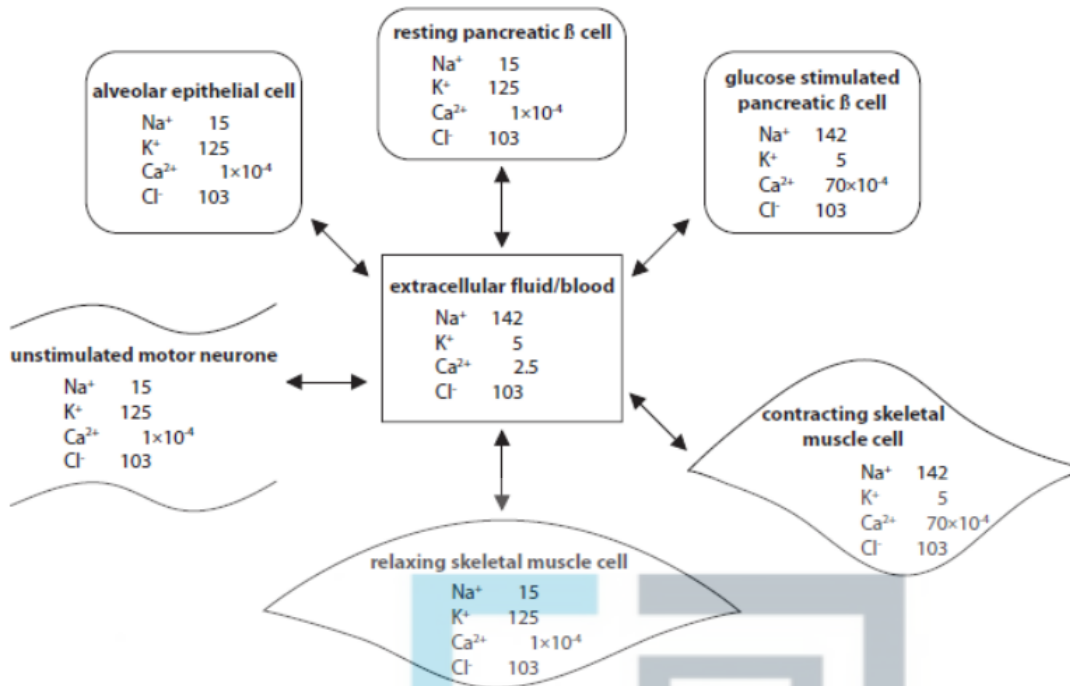
Ion transport across cell membranes is a fundamental property of all living cells.

The diagram shows some typical ion concentrations in healthy human cells and in the extracellular fluid.

All values are in  $\text{mmol dm}^{-3}$ .



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The tables show information about the human genome and types of transport channel in humans.

Some information about the human genome	
Number of genes in the human genome	approximately 20 000
Number of genes coding for membrane proteins	approximately 5 400
Number of genes coding for proteins involved in the transport of ions across cell membranes	more than 350
Number of diseases associated with mutations in genes involved in the transport of ions across cell membranes	more than 28
Organs and systems in which ion channel mutations cause disease	central nervous system, heart, lungs, pancreas and skeletal muscle

Type of transport channel	Number of each type of transport channel
Voltage gated ion channels	147
Chloride channels	17
Active transport	81

Discuss the importance of ion transport across membranes in human health and disease.

(Total for question = 9 marks)

Q13.

The muscles of the earthworm (*Lumbricus terrestris*) contract when it is touched. This is known as the withdrawal response.

Studies were carried out to investigate the withdrawal response in earthworms.

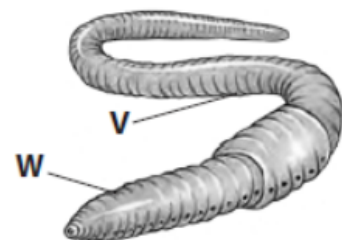
The duration of the withdrawal response is the length of time that the muscles remain contracted. If the stimulus is repeated, the withdrawal response is either reduced in duration or lost.

In one study, an earthworm was touched 20 times in one minute at point **V** as shown in the diagram. The shortening of the earthworm's body was measured after 20 stimuli.

The effect of touching point **W** in the same way was recorded and also the effect of alternating touches between points **V** and **W**.

The results of this study are shown in the table.

Nature of stimulus	Change in body length after 20 stimuli / mm
All stimuli at point <b>V</b>	0
Stimuli alternating between points <b>V</b> and <b>W</b>	17
All stimuli at point <b>W</b>	0

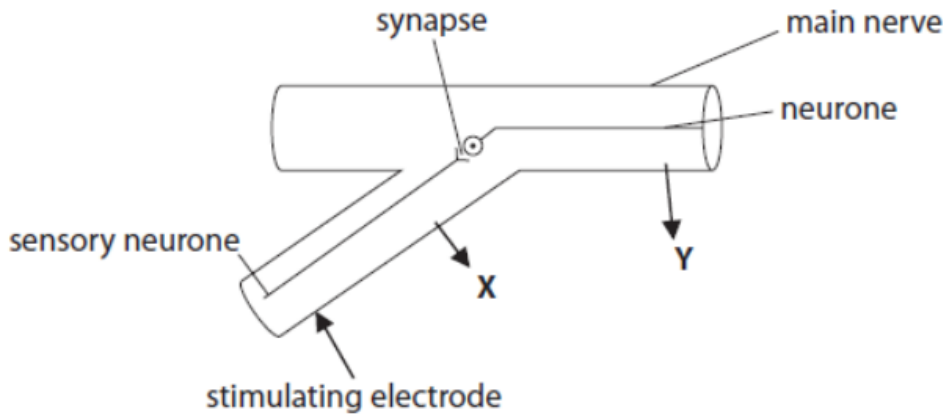


In another study, sensory neurones of an earthworm were stimulated by an electrode six times.

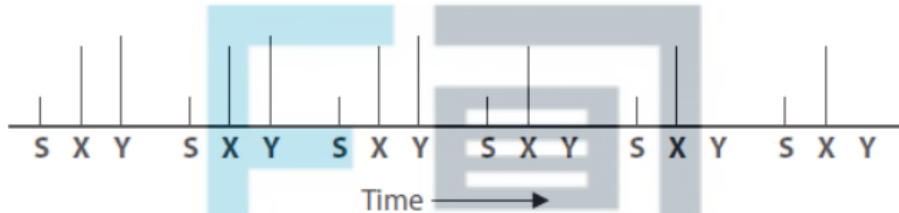
Nerve impulses were recorded at positions **X** and **Y** as shown in the diagram.



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Nerve impulses recorded at **X** and **Y** are shown in the diagram below. The presence of a line indicates that an impulse was detected. **S** shows the stimulus.



\* (i) Analyse the data from these two studies to evaluate the most likely cause of the loss of the withdrawal response.

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wiring of the immune response into the brain (paragraphs 22 and 23).

Explain how this critical period could be investigated using animal experiments.

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(Total for question = 2 marks)

Q15.

When scientists visit Antarctica, they need appropriate clothing to help with thermoregulation.



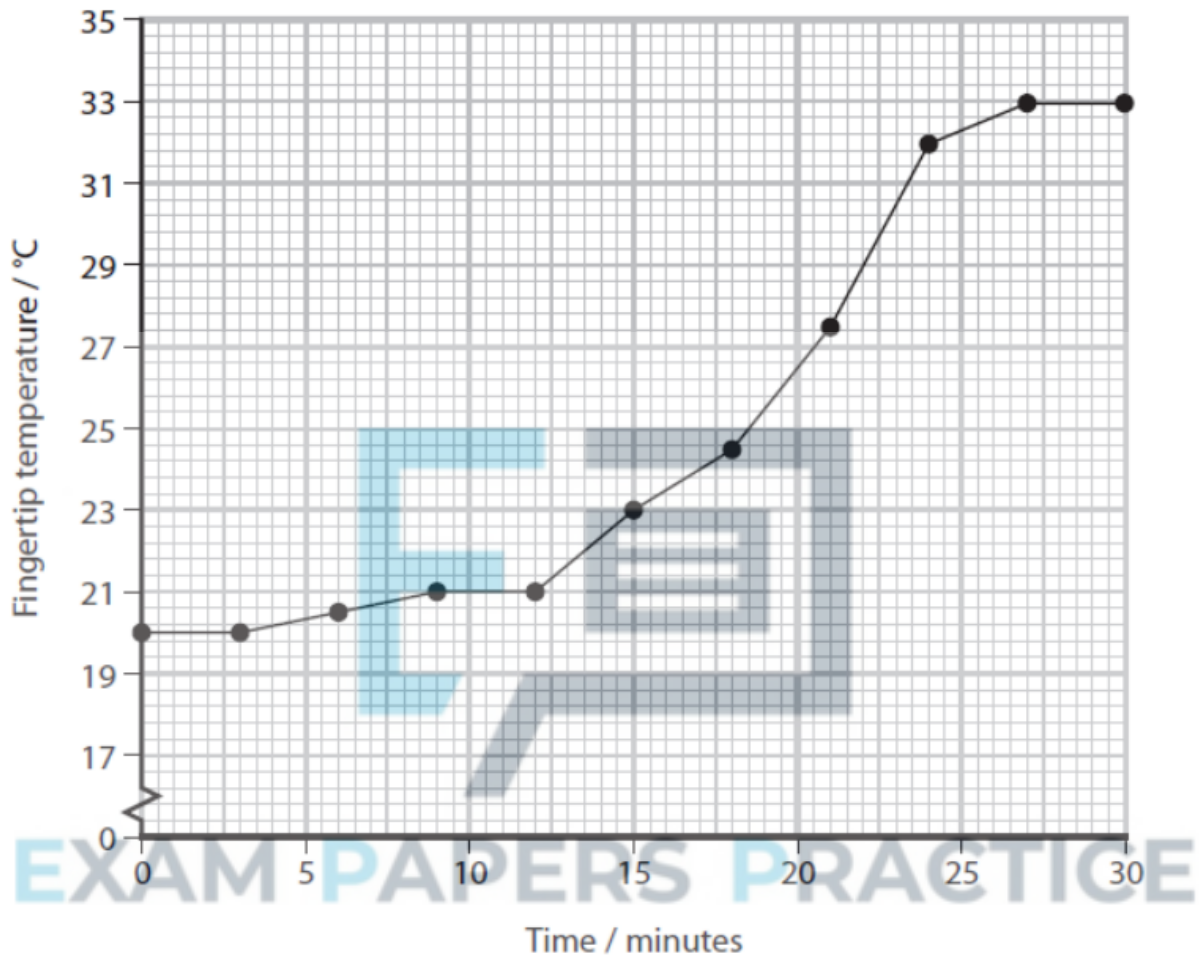
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An investigation was carried out to study thermoregulation in humans.

A woman was wrapped in blankets and her feet were put in hot water for 30 minutes. During this time, the temperature of the skin at the end of one of her fingertips was recorded.



The graph shows the results of this investigation.



(i) Explain why there was no change in fingertip temperature between 0 and 3 minutes.

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(ii) Calculate the greatest rate of increase in fingertip temperature.

(2)

Answer .....



(iii) Explain the role of the nervous system in bringing about the increase in temperature of the fingertip as shown in this investigation.

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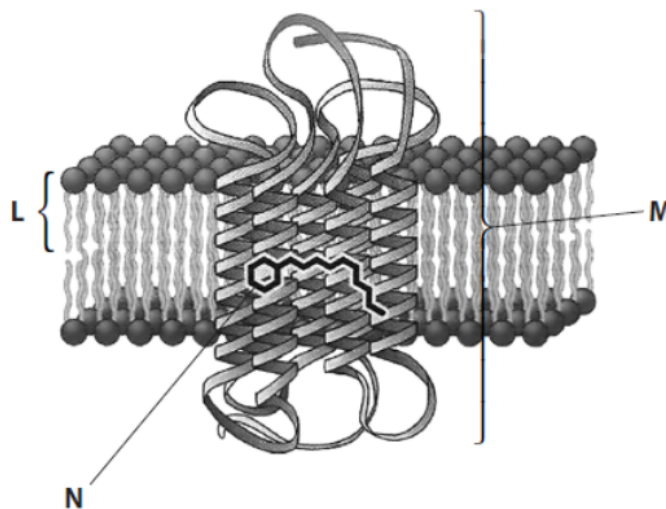
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(Total for question = 9 marks)

Q16.

The diagram shows part of the membrane of the outer segment of a rod cell.





(a) Which of the following is the part labelled **L**?

(1)

- A** fatty acid tail
- B** phosphate head
- C** phospholipid
- D** phospholipid bilayer

(b) (i) Give the name of the visual pigment labelled **M**.

(1)

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(ii) Give the name of the light-absorbing part of the visual pigment labelled **N**.

(1)

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(c) Describe how the absorption of light by the part labelled **N** results in an action potential in the optic nerve.

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**(Total for question = 6 marks)**

Q17.

Serotonin is found in the brain and is important in health and wellbeing.

An imbalance of serotonin can lead to problems such as depression. An individual with symptoms of depression may have low serotonin levels in the brain.

Describe how low serotonin levels in an individual can affect the transmission of impulses in their brain.

(2)

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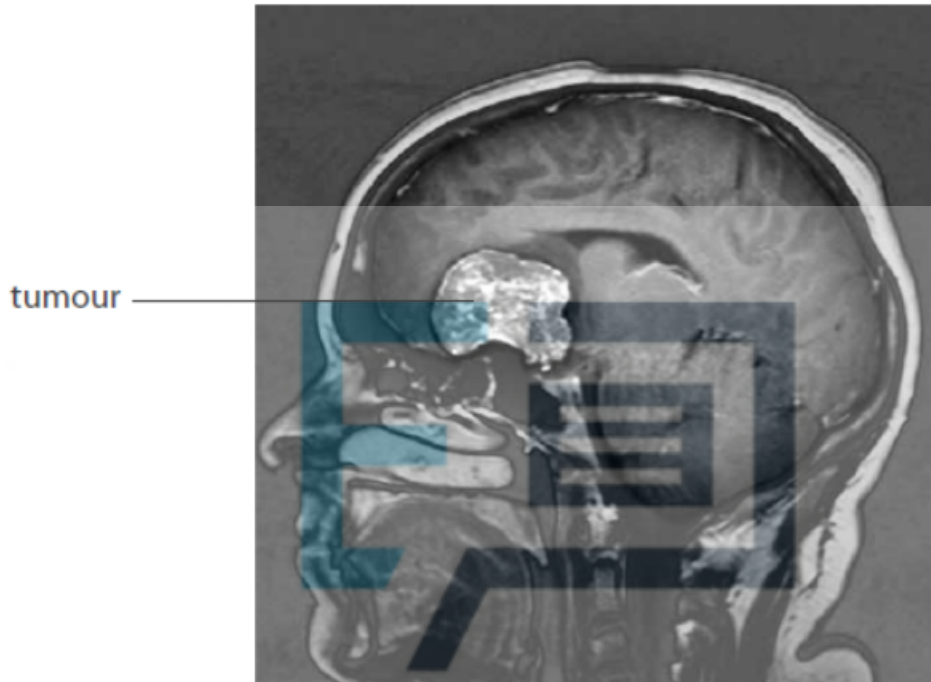
**(Total for question = 2 marks)**



Q18.

Magnetic resonance imaging (MRI) can be used to study brain structure.

The MRI scan shows a human brain with a tumour.



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Magnification  $\times 0.3$

(a) The part of the brain in which the tumour has grown is the

(1)

- A** cerebellum
- B** cerebral hemisphere
- C** hypothalamus
- D** medulla oblongata



(b) Explain the advantages of using MRI scanning to identify tumours compared to using CT scanning.

(3)

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(c) fMRI scanning is another way of collecting information about the brain.  
Explain how fMRI scanning would help neuroscientists to identify the part of the brain involved in controlling a voluntary action such as picking up a pen to write on paper.

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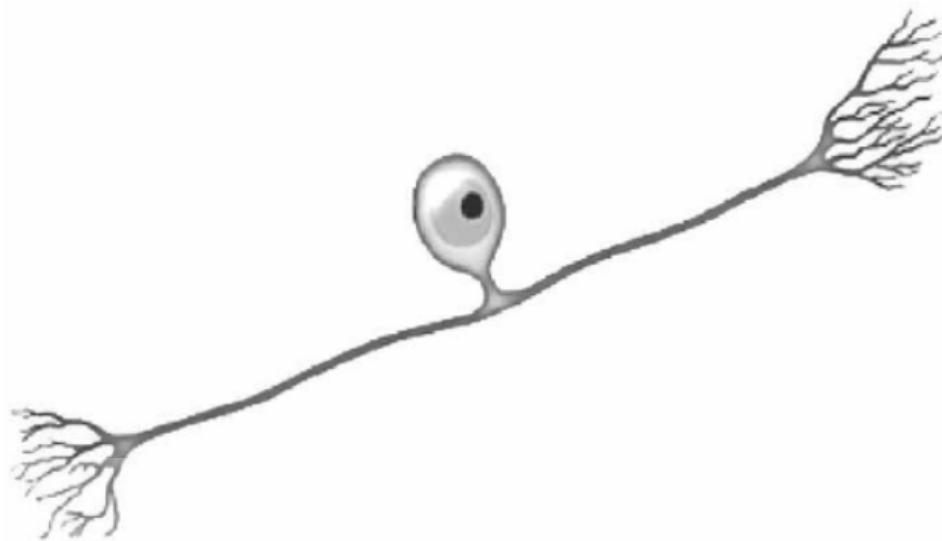
**(Total for question = 7 marks)**

Q19.

The neurones of the central nervous system contain TAU proteins. These proteins help to maintain cell structure.

In humans, six different TAU proteins can be produced from a single gene.





(a) Give **one** feature, shown in the diagram, that identifies this cell as a sensory neurone.

(1)

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(b) The table shows the conduction velocity of a nerve impulse along a myelinated and an unmyelinated neurone, each with a diameter of 5  $\mu\text{m}$ .

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Conduction velocity / $\text{ms}^{-1}$	
Myelinated neurone	Unmyelinated neurone
24.9	5.1

Explain why there is a difference in the conduction velocity of these neurones.

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**(Total for question = 6 marks)**

Q21.

Scientists have investigated the influence of both nature and nurture on brain development. They used several pairs of identical twins and several pairs of non-identical twins.

(a) In one investigation, each twin was shown a number of human faces and then asked to identify them amongst a group of unfamiliar faces.

The agreement in face identification between each pair of twins was recorded.

The results were used to calculate the mean percentage agreement in face identification for the two types of twin. This is shown in the table below.

Mean percentage agreement in face identification (%)	
identical twins	non-identical twins
70	29

(i) From these results, the scientists concluded that face identification has a genetic component. Explain how these results support this conclusion.

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(ii) This investigation was repeated using written words rather than faces. The mean percentage agreement in word identification for the two types of twin suggested that this involved an environmental component.

Suggest how the results of this investigation might differ from the results shown in the table.

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(b) Functional magnetic resonance imaging (fMRI) was used in another investigation. Brain activity was recorded whilst carrying out face identification. Suggest why fMRI was used in this investigation.

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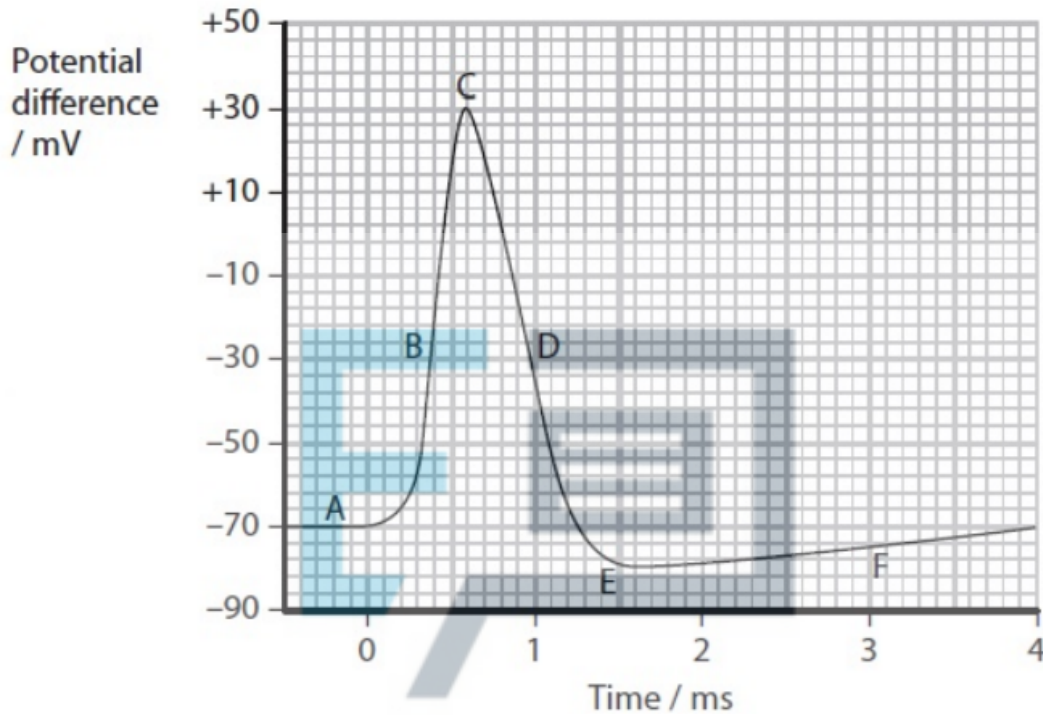
**(Total for question = 9 marks)**





Q22.

(a) The graph below shows the changes in potential difference across the membrane of a neurone after stimulation.



(i) Using the information in the graph, state the maximum change in potential difference across the membrane of this neurone during depolarisation.

(1)

..... mV

(ii) The table below describes three of the stages shown in the graph.

Place a cross in the box (  ) below the letter that correctly links the description to one of the labels on the graph above.

(3)



Q23.

The neurones of the central nervous system contain TAU proteins. These proteins help to maintain cell structure.

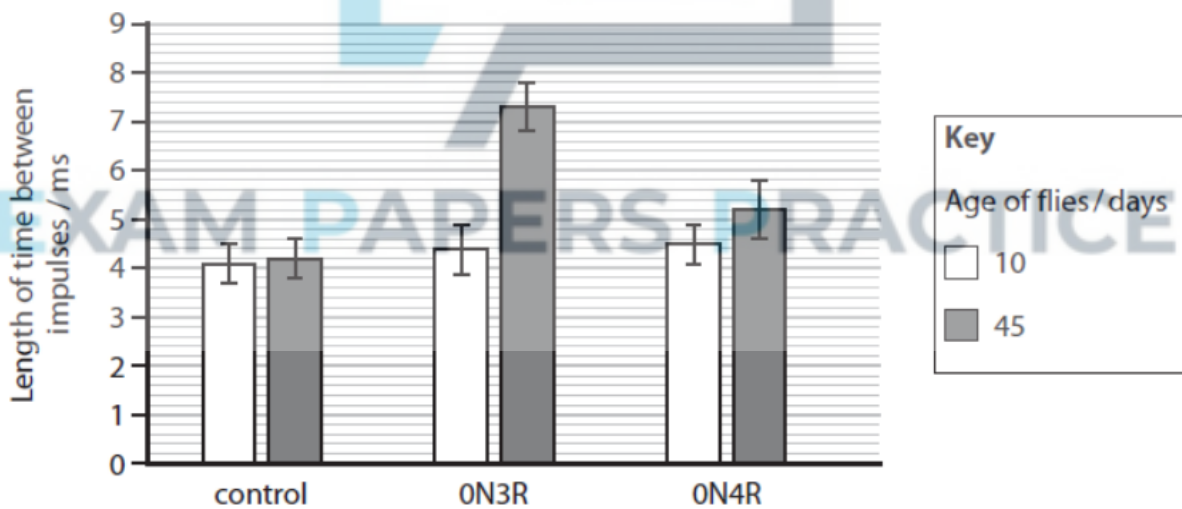
In humans, six different TAU proteins can be produced from a single gene.

Parkinson's disease has been linked to the different forms of the TAU proteins present in neurones.

Scientists are studying the effect of these different TAU proteins in animal models. One model used is the fruit fly, *Drosophila*.

In another investigation, the effect of these TAU proteins and age on the conduction of nerve impulses along the axon of neurones was studied.

The length of time between impulses was measured for *Drosophila* flies of different ages. The results are shown in the graph.



Determine the effect of these TAU proteins on the maximum frequency at which nerve impulses can be conducted along the axon of the neurone.

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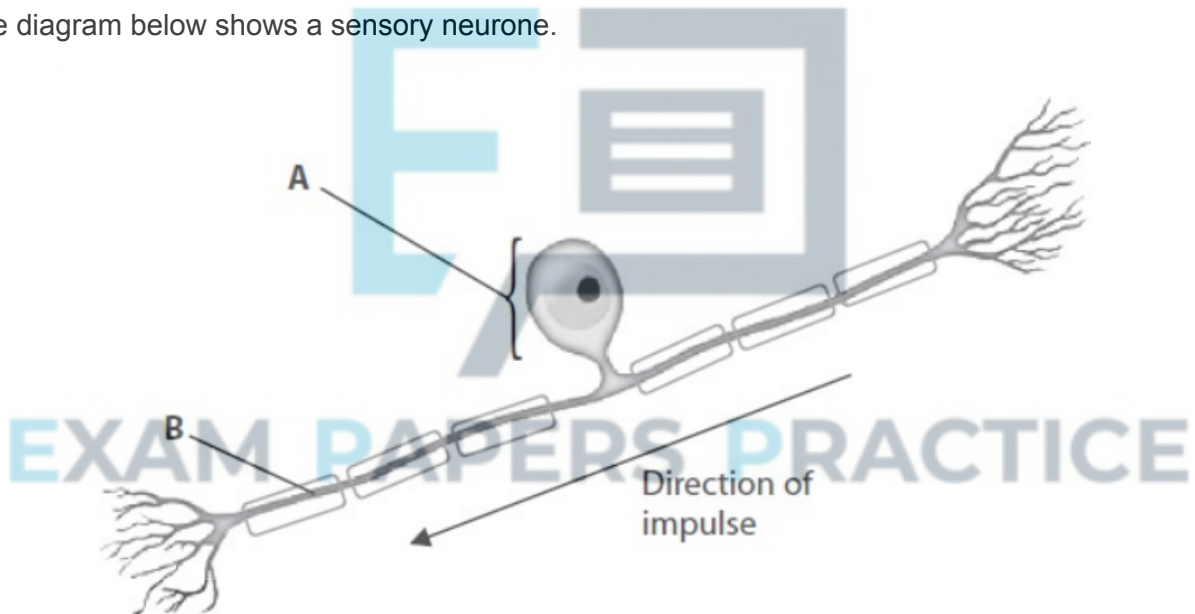
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(Total for question = 4 marks)

Q24.

The diagram below shows a sensory neurone.



(a) Name the structures labelled **A** and **B**.

(2)

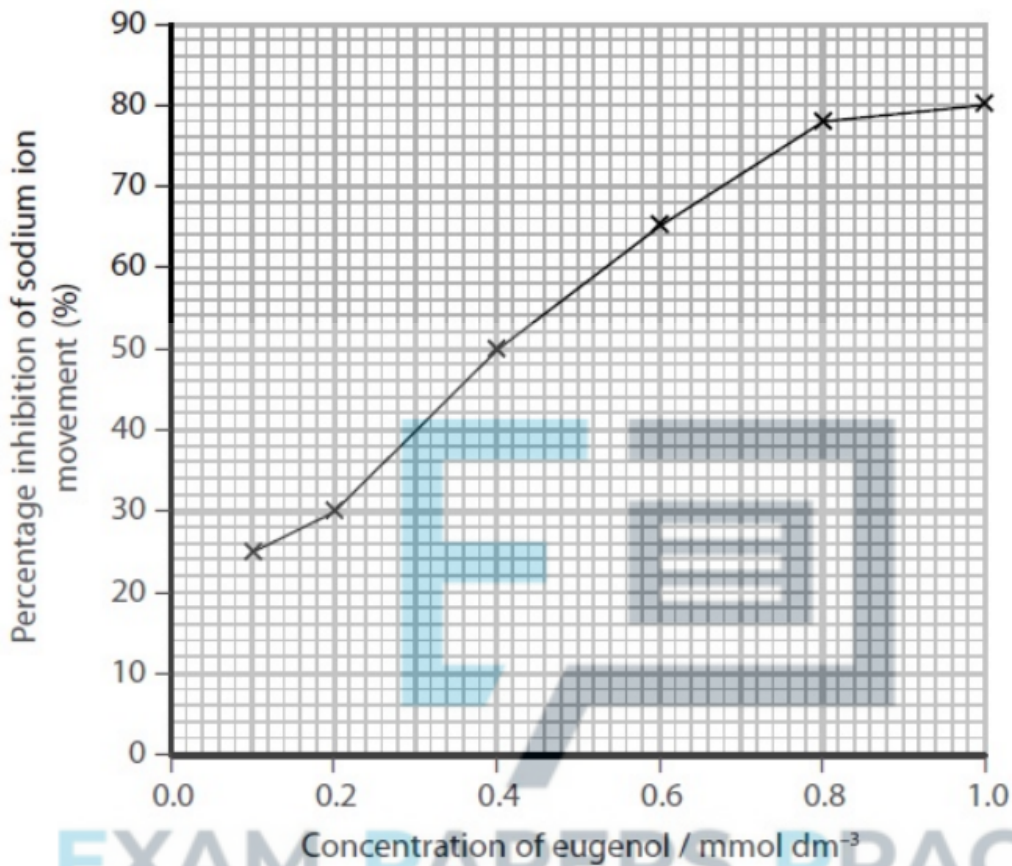
**A** .....

**B** .....

(b) Eugenol is a drug that inhibits the movement of sodium ions and calcium ions through the cell surface membranes of sensory neurones.



The graph below shows the effect of eugenol concentration on the percentage inhibition of sodium ion movement.



(i) Describe the relationship between the concentration of eugenol and the percentage inhibition of sodium ion movement.

(2)

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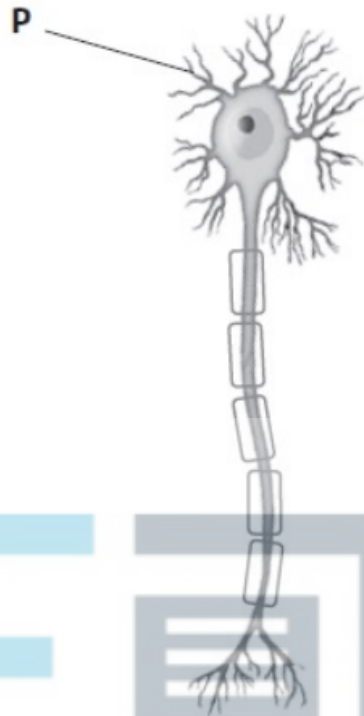
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\*(ii) Eugenol can be used to reduce pain.

Suggest an explanation for how eugenol affects the movement of calcium ions and reduces pain.









(i) Name the structure labelled P.

(1)

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(ii) Place a cross  in the box to identify the direction of the nerve impulse in the axon of this motor neurone.

- A 
- B 
- C 
- D 

(1)



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(b) Eugenol is a drug that inhibits the movement of sodium ions through the cell surface membranes of sensory neurones.

The table below shows the effect of eugenol concentration on the percentage inhibition of sodium ion movement.

Concentration of eugenol / $\text{mmol dm}^{-3}$	Percentage inhibition of sodium ion movement (%)
0.2	30
0.4	50
0.6	65
1.0	80

(i) Describe the effect of eugenol on the percentage inhibition of sodium ion movement.

(2)

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(ii) Using information from the table, calculate the percentage inhibition of sodium ion movement at a concentration of eugenol of  $0.8 \text{ mmol dm}^{-3}$ .

Show your working.

(2)

Answer.....%

\* (c) Eugenol can be used to reduce pain.

Suggest an explanation for how eugenol affects the movement of sodium ions and reduces pain. (6)

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(Total for Question = 12 marks)



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