Nervous System

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	Edexcel
Topic	Coordination, Response, Gene Technology
Sub-Topic	Nervous system
Booklet	Question paper 2

Time Allowed: **57 minutes**

Score: **/47**

Percentage: **/100**

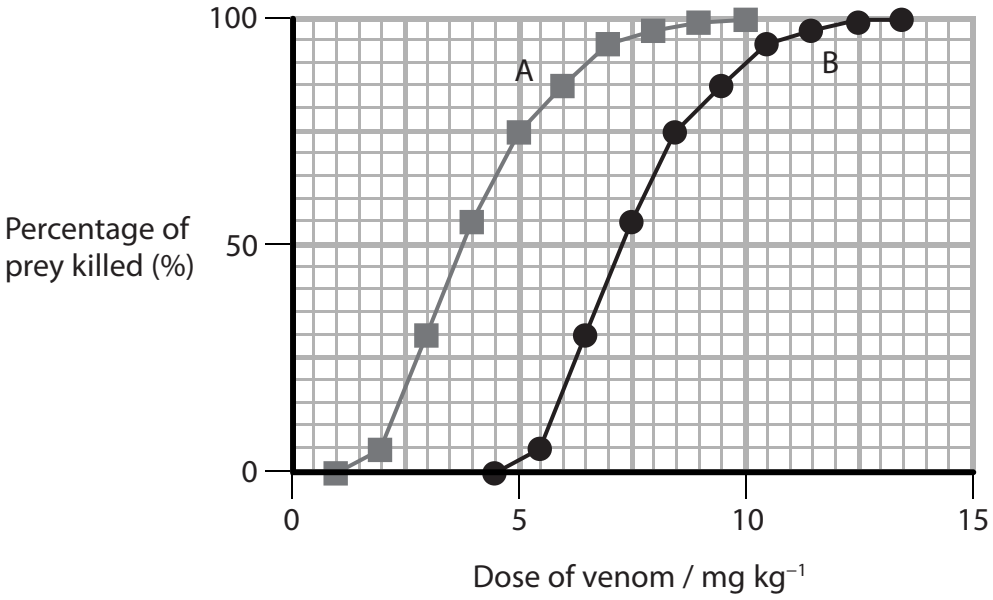
Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1 Some animals, such as spiders, bite and inject venom into their prey. The venom affects the transmission of nerve impulses and paralyses the prey.

In an investigation, scientists estimated the toxicity of the venom by measuring the dose that can kill 50% of prey after injection. This dose is called the LD_{50}.

The graph below shows the relationship between the percentage of prey killed and the dose of venom A and venom B.



(a) (i) Use the information in the graph to compare the toxicity of venom A and venom B.

(2)

(ii) Place a cross ☒ in the box next to the independent variable in this investigation.

☒ **A** dose of venom

☒ **B** mass of the prey

☒ **C** percentage of prey killed

☒ **D** toxicity of the venom

(1)

(b) Two scientists, P and Q, investigated the LD_{50} values for the venom produced by four species of spider. Their results are shown in the table below.

Scientist	Species of spider	LD_{50}
P	*L. m tans*	0.002 mg kg^{-1}
	H. uwenum	0.700 mg kg^{-1}
Q	*P. bahiensi*	0.610 μg kg^{-1}
	A. obustus	160.0 μg kg^{-1}

Scientist P measured the toxicity in mg kg^{-1} and scientist Q measured the toxicity in μg kg^{-1}. One μg is equal to 0.001 mg.

Name the species with the most toxic venom.

(1)

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(c) The venom from *L. mactans* (black widow spider) causes constant impulses to be sent along motor neurones. This results in cramps (constant muscle contractions), a symptom of a black widow spider bite.

Suggest how constant impulses along motor neurones cause cramps.

(4)

(Total for Question 1 = 8 marks)

2 Weisel and Hubel studied the development of vision during the critical window (critical period) of various mammals.

(a) In one investigation, kittens were used.

(i) Suggest why kittens were used to study the development of vision in humans.

(1)

(ii) Suggest why the kittens used were all from one set of parents.

(1)

(b) A kitten had its right eye covered for the first seven weeks after birth. The right eye was then uncovered. The left eye was not covered.

After seven weeks the visual cortex of this kitten was studied.

(i) Describe what happens to the visual pigment in a rod cell when stimulated by light.

(2)

(ii) Explain what happens to the visual cortex when the right eye of this kitten is covered for the first seven weeks after birth.

(3)

(c) Give **one** reason why some people believe that it is ethically unacceptable to use kittens in medical research.

(1)

(Total for Question 2 = 8 marks)

3 A neurone is a cell that has a potential difference across its cell surface membrane. This potential difference changes when a neurone is stimulated.

(a) The potential difference across the membrane of a neurone was investigated before and after stimulation.

The table below shows the results of this investigation.

Time / ms	Potential difference / mV
0.00	–70
1.00	–70
1.25	0
1.50	+30
1.75	0
2.00	–80

(i) Place a cross in the box ☒ that completes the following statement.

The resting potential for this neurone is

(1)

☒ **A** – 80 mV

☒ **B** – 70 mV

☒ **C** 0 mV

☒ **D** + 30 mV

(ii) Using the information in the table, describe the changes in the potential difference from 1.00 ms to 1.50 ms.

(2)

(iii) Suggest an explanation for the change in potential difference across the membrane between 1.00 ms and 1.50 ms.

(5)

(b) This neurone was given a second stimulus at 1.50 ms.
This had no effect on the changes in the potential difference shown in the table.

Suggest reasons why the second stimulus had no effect on the changes in the potential difference.

(2)

(Total for Question 3 = 10 marks)

4 Humans have a nervous system that has a variety of neurones.

(a) The human brain is made up of a number of areas containing many millions of neurones.

Place a cross in the box ☒ that identifies the areas of the brain associated with riding a bicycle uphill.

(i) the decision to ride the bicycle

(1)

☒ **A** cerebrum

☒ **B** cerebellum

☒ **C** hypothalamus

☒ **D** medulla

(ii) initiating an increase in sweating during the ride

(1)

☒ **A** cerebrum

☒ **B** cerebellum

☒ **C** hypothalamus

☒ **D** medulla

(b) Voltage-gated K^+ and Na^+ channels are involved in the transmission of impulses in sensory and motor neurones.

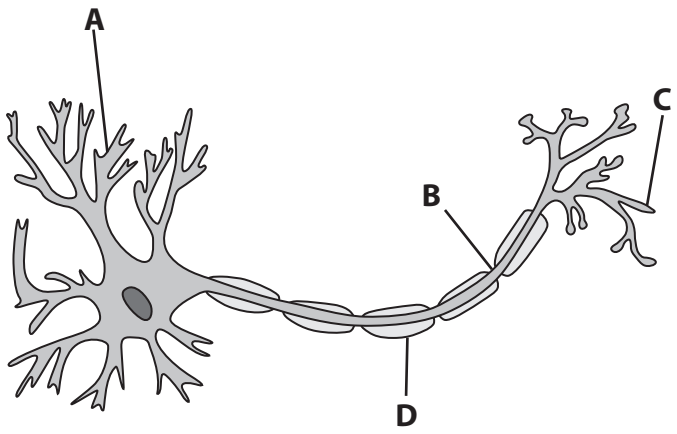
(i) The table below identifies two stages in the transmission of an impulse in a sensory neurone.

Place a tick (✓) in each box that correctly identifies whether the channels are open or closed during these two stages.

(2)

Stage	Voltage-gated K^+ channels open	Voltage-gated K^+ channels closed	Voltage-gated Na^+ channels closed
Depolarisation			
Repolarisation			

(ii) The diagram below shows a myelinated motor neurone.



Place a cross in the box ☒ that labels the site where neurotransmitters bind and initiate depolarisation.

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(iii) Describe the differences in the structure of a myelinated sensory neurone and a myelinated motor neurone.

(3)

(Total for Question 4 = 8 marks)

5 An investigation was carried out to study the effect of light on the mammalian retina.

Part of the retina of a young rat was removed and kept in the dark for two hours. This allowed the pigment in the rod cells to recover from bleaching caused by exposure to light.

(a) Suggest what happens in the rod cells during this two hours of darkness.

(5)

(b) When the retina had recovered from bleaching, the resting potential of the bipolar neurones in the retina was found to be –43 mV.

The retina was then exposed to a range of light intensities. Each light intensity caused the bipolar neurones to depolarise. The peak voltage of the depolarisation for each light intensity was recorded.

All other variables were kept constant.

The investigation used retinas from an additional 14 rats.

The mean results are shown in the table below.

Light intensity / arbitrary units	**Mean peak voltage of depolarisation / mV**
1	11
3	18
6	19
9	20
12	20

(i) Using the information in the table, describe the effect of light intensity on the mean peak voltage of depolarisation.

(2)

(ii) Suggest an explanation for the effect of light intensity on the mean peak voltage of depolarisation in these neurones.

(4)

(c) Suggest **two** reasons why some people might have objections to the use of rats in this investigation.

(2)

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(Total for Question 5 = 13 marks)