PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 9: CONTROL SYSTEMS

STRUCTURE AND FUNCTION OF THE MAMMALIAN NERVOUS SYSTEM

SCORE	PERCENTAGE
/63	%

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Q1. There are various ways of investigating brain structure and function.

(a) Compare the use of computed tomography (CT) with magnetic resonance imaging (MRI) for studying brain structure.

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(b) Suggest why functional magnetic resonance imaging (fMRI) is considered better than CT for studying brain function.

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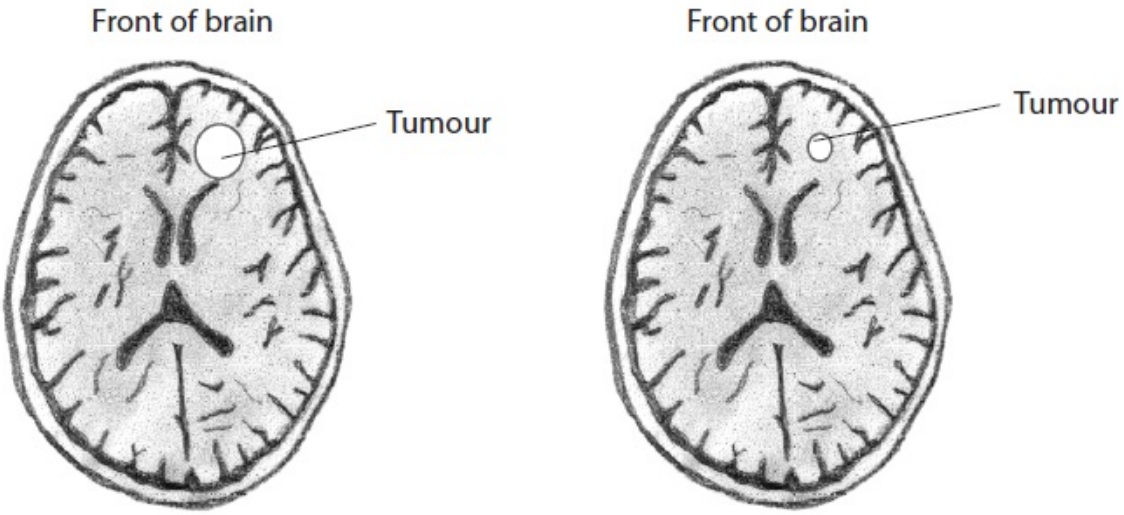
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(c) The diagrams below show two MRI scans of the brain of a patient with a tumour. Scan 1 was taken before treatment was carried out, and scan 2 after treatment.



Scan 1 before treatment

Scan 2 after treatment

(i) Suggest why the tumour appeared white in the scans.

(2)

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(ii) Using the information in the diagrams, describe the effect of the treatment on this tumour.

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(iii) Using the information in the diagrams, suggest **two** brain functions that may have improved after treatment. Give a reason for your answer.

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(Total for Question = 12 marks)

Q2. There are various ways of investigating brain structure and function.

(a) Describe how scans from magnetic resonance imaging (MRI) may be used to investigate brain tumours.

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(b) An investigation was carried out to study brain activity when eating chocolate.

Functional magnetic resonance imaging (fMRI) was used to study the brain activity of people eating chocolate.

It was found that certain areas in their brains became more active when they ate chocolate.

(i) Suggest **two** variables that should be taken into account when selecting the people for this investigation.

(1)

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(ii) Suggest how fMRI was able to show that certain areas in the brain became more active when people ate chocolate.

(3)

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(iii) Some of these more active areas were in the cerebral hemispheres of the brain. The cerebral hemispheres have a number of functions.

State **two** functions associated with the cerebral hemispheres.

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(Total for Question = 8 marks)

Q3.

The photograph shows a female gymnast on a narrow beam.



(a) The table below refers to two regions of the brain.

Complete the table by describing **one** role of each region of the brain, while she is on the beam.

(2)

Region of the brain	One role while she is on the beam
Cerebellum	
Medulla oblongata	

(b) This gymnast will generate a lot of heat while she is on the beam.

Describe and explain how changes in blood flow in the skin will help her to control her body temperature.

(4)

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(c) Gymnasts can damage their cruciate ligaments. This is an injury that can be repaired using keyhole surgery.

(i) Explain what is meant by the term **cruciate ligament**.

(2)

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(ii) A gymnast was offered keyhole surgery to repair her damaged cruciate ligament.

Suggest and explain **two** reasons why she might choose this type of surgery.

(2)

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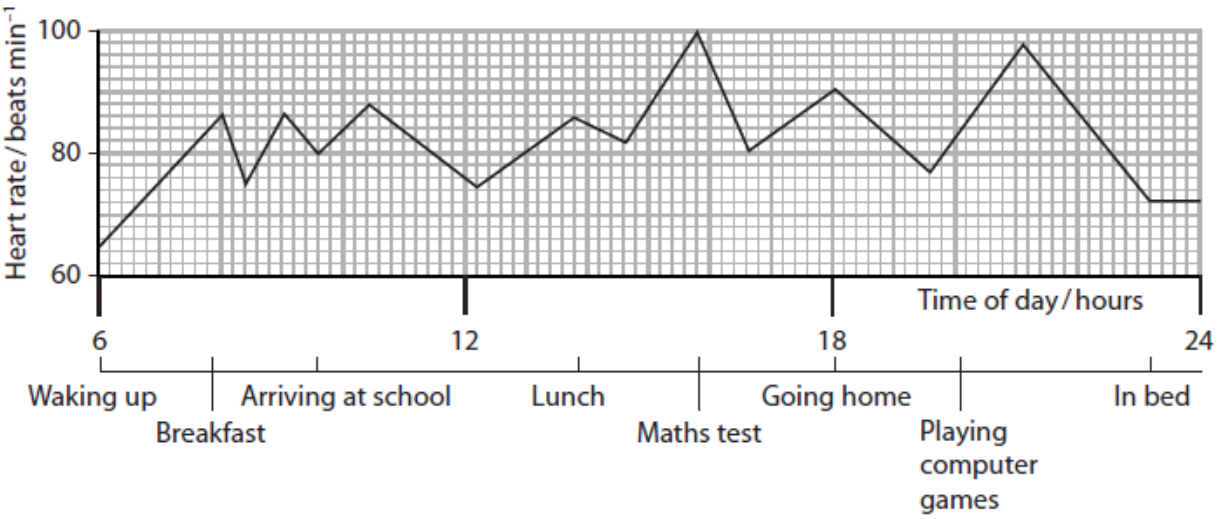
(Total for question = 10 marks)

Q4.

A student was interested to find out how his heart rate would vary throughout the day.

He wore a heart rate monitor from the time he woke up until the time he went to bed.

The graph shows the data collected and some of the student's activities during the day.



Calculate the rate of increase in the student's heart rate between 6 am and 8 am.

(2)

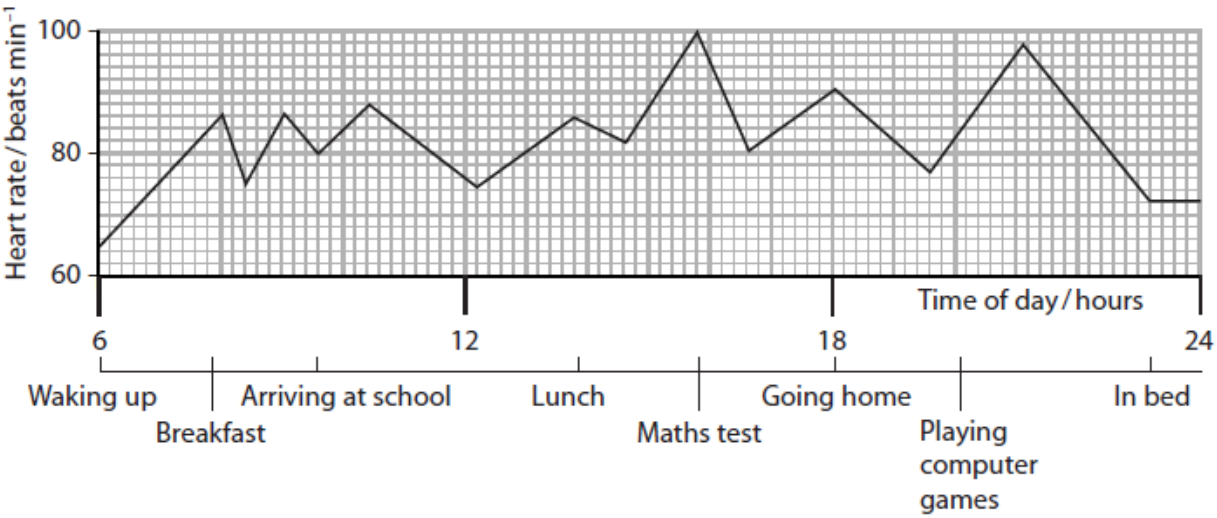
Answer .....

Q5.

A student was interested to find out how his heart rate would vary throughout the day.

He wore a heart rate monitor from the time he woke up until the time he went to bed.

The graph shows the data collected and some of the student's activities during the day.



Explain why the student's heart rate changed at the time of his maths test.

(5)

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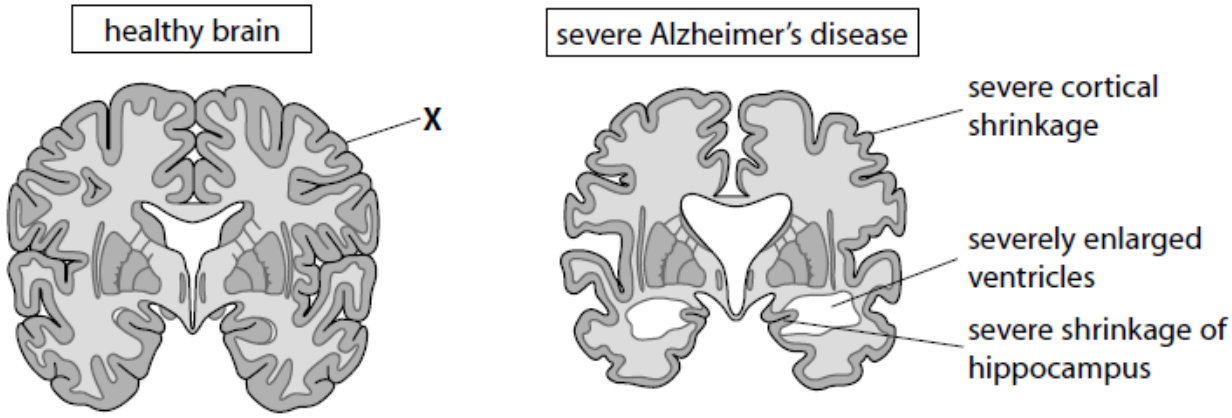
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Q6.

The diagrams below show a horizontal cross section of a healthy human brain and a brain from a person with severe Alzheimer's disease.



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Explain why a person with Alzheimer's disease may show a change in behaviour.

(2)

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(Total for question = 2 marks)

Q7.

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.

(3)

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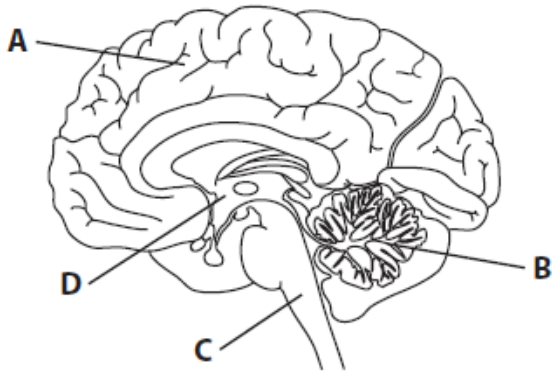
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(ii) It was found that an area of the brain called the insula was involved in both physical experiences and emotional experiences. The insula is found just above the hypothalamus.

Using the diagram below, place a cross in the box ☒ that identifies the area of the insula.

(1)



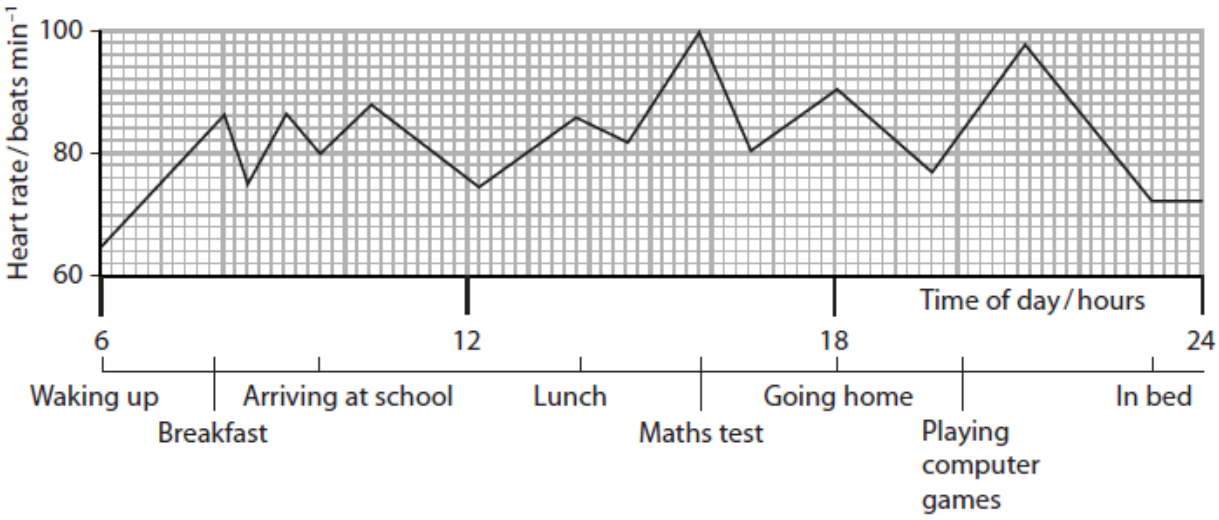
- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

Q8.

A student was interested to find out how his heart rate would vary throughout the day.

He wore a heart rate monitor from the time he woke up until the time he went to bed.

The graph shows the data collected and some of the student's activities during the day.



The student noticed that the graph showed a change in his heart rate while he was playing computer games.

He designed an investigation to find out how different computer games affect heart rate.

The student played one computer game and recorded the increase in his heart rate.

He then played four other different computer games and again recorded the increase in his heart rate.

He repeated this on six different occasions throughout the week.

(i) Explain how the design of the student's investigation could be improved.

(4)

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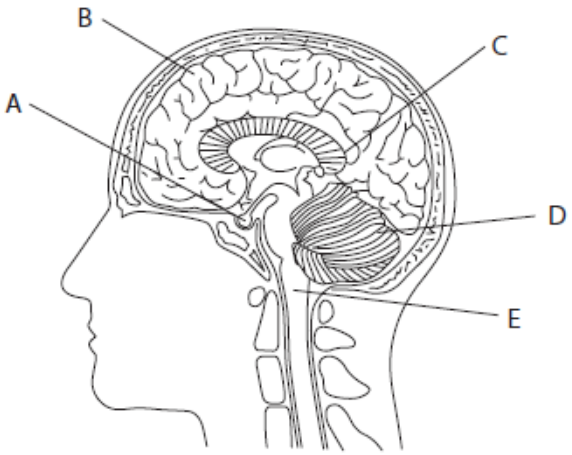
(ii) Sketch a suitable graph that the student could use to present the results of his investigation.

(2)

Q9.

The human brain controls many functions.

The diagram shows a section through a human brain with parts labelled A to E.



Which letter labels the part of the brain that controls heart rate?

(1)

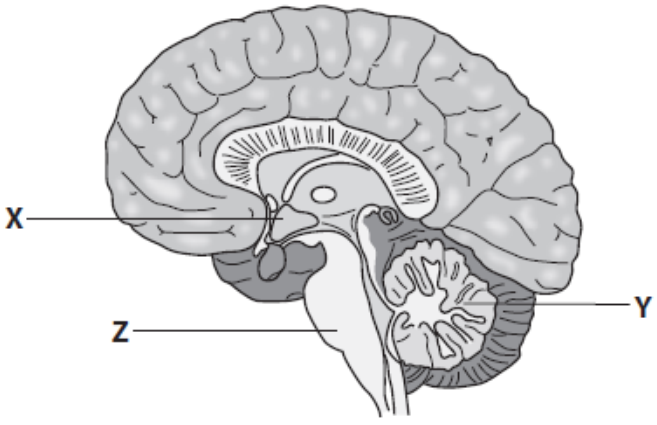
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(Total for question = 1 mark)

Q10.

The brain is involved in many homeostatic mechanisms.

The diagram shows a vertical section through a human brain.



Which row of the table correctly matches the regions **X**, **Y** and **Z** with their functions?

(1)

	Control of breathing rate	Control of balance	Temperature regulation
☒ **A**	X	Y	Z
☒ **B**	Y	Z	X
☒ **C**	Z	X	Y
☒ **D**	Z	Y	X

(Total for question = 1 mark)

Q11.

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

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

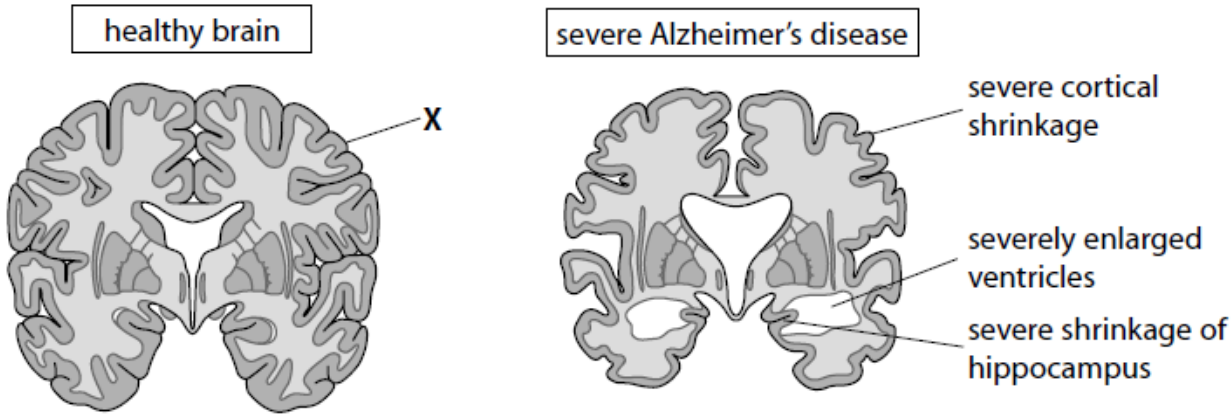
☒ **B** cerebellum

☒ **C** hypothalamus

☒ **D** medulla

Q12.

The diagrams below show a horizontal cross section of a healthy human brain and a brain from a person with severe Alzheimer's disease.



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Name the part of the brain which is labelled **X**.

(1)

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(Total for question = 1 mark)

Q13.

Compare and contrast the central nervous system and the peripheral nervous system.

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(Total for question = 3 marks)

Q14.

During the First World War, some soldiers received head wounds that damaged one side of the cerebellum.

One soldier said

'*The movements of my left hand are done subconsciously but I have to think out each movement of my right arm.*'

(i) State one function of the cerebellum.

(1)

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(ii) State the part of the brain the soldier used to think about moving his right arm.

(1)

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(iii) Explain why this soldier had problems moving his right arm.

(2)

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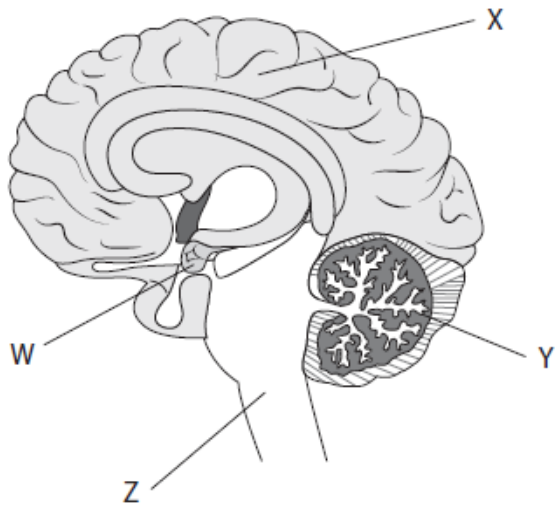
(Total for question = 4 marks)

Q15.

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

The autonomic nervous system controls the heart rate.

The diagram shows a human brain.



(i) Which region of the brain controls the heart rate?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Which one of the following would lead to an increase in heart rate?

(1)

☒ **A** release of acetylcholine by the sympathetic nervous system

☒ **B** release of acetylcholine by the parasympathetic nervous system

☒ **C** release of noradrenaline by the sympathetic nervous system

☒ **D** release of noradrenaline by the parasympathetic nervous system

(Total for question = 2 marks)