The Brain (Option C1): Eduqas A Level Biology Exam Questions by Topic

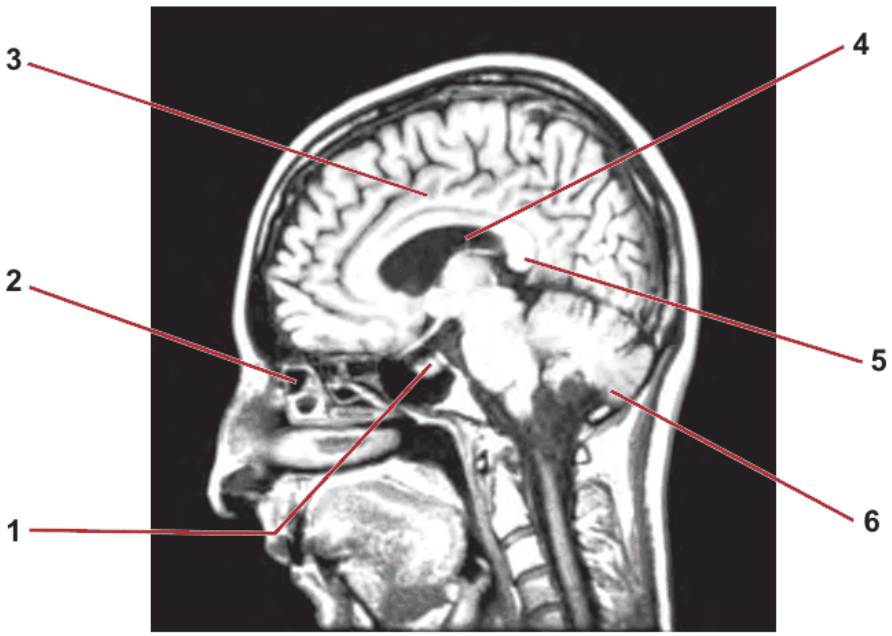
19 questions · 36 marks · about 43 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Component 3 · June 2017 · Q9(a)(i) · 1 mark

9. Scientists carried out research into possible changes that occur in the brains of taxi drivers, as a result of learning. To qualify as a London taxi driver, they have to learn every street name, landmark and direction of traffic flow. MRI images can be analysed to measure the volume of specific brain structures.

(a) (i) The following image depicts an MRI scan of a human brain. Which number **(1-6)** shows the hippocampus? [1]

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Question 2 · A level Component 3 · June 2017 · Q9(a)(ii) · 2 marks

(ii) Suggest why the scientist studied the hippocampus region of the brain. Give reasons for your answer. [2]

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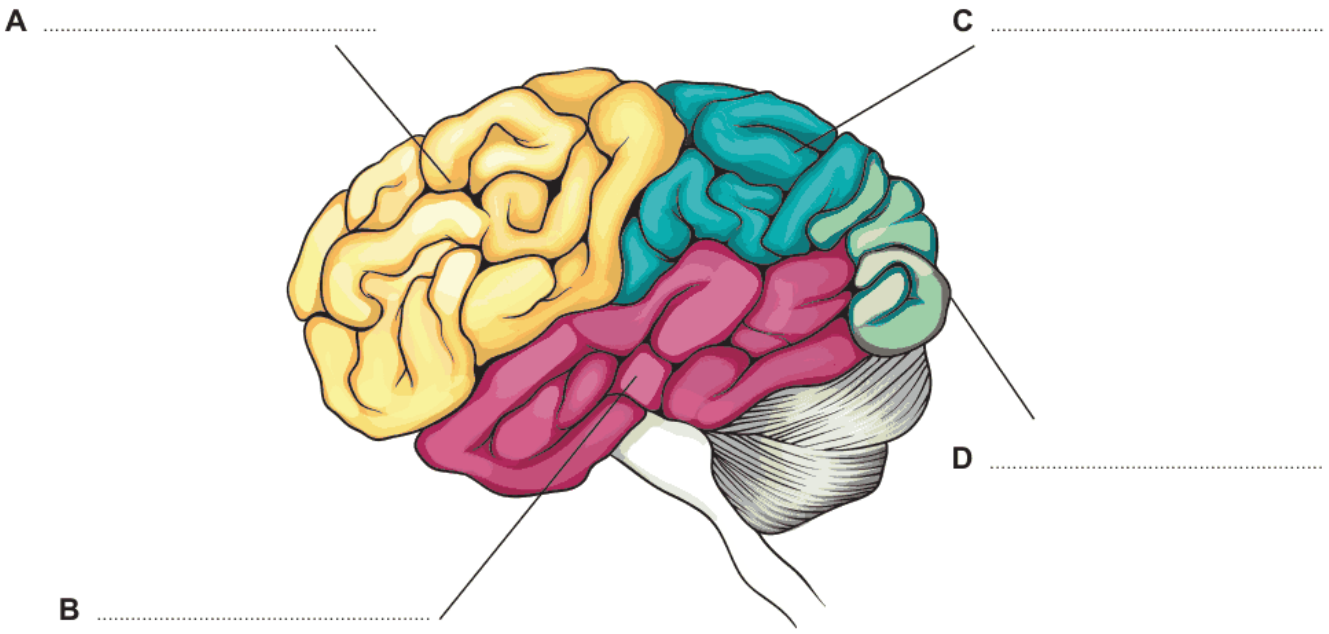
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10. *(a)* Figure 10.1 shows the lobes of the cerebral hemispheres of the human brain.

Figure 10.1



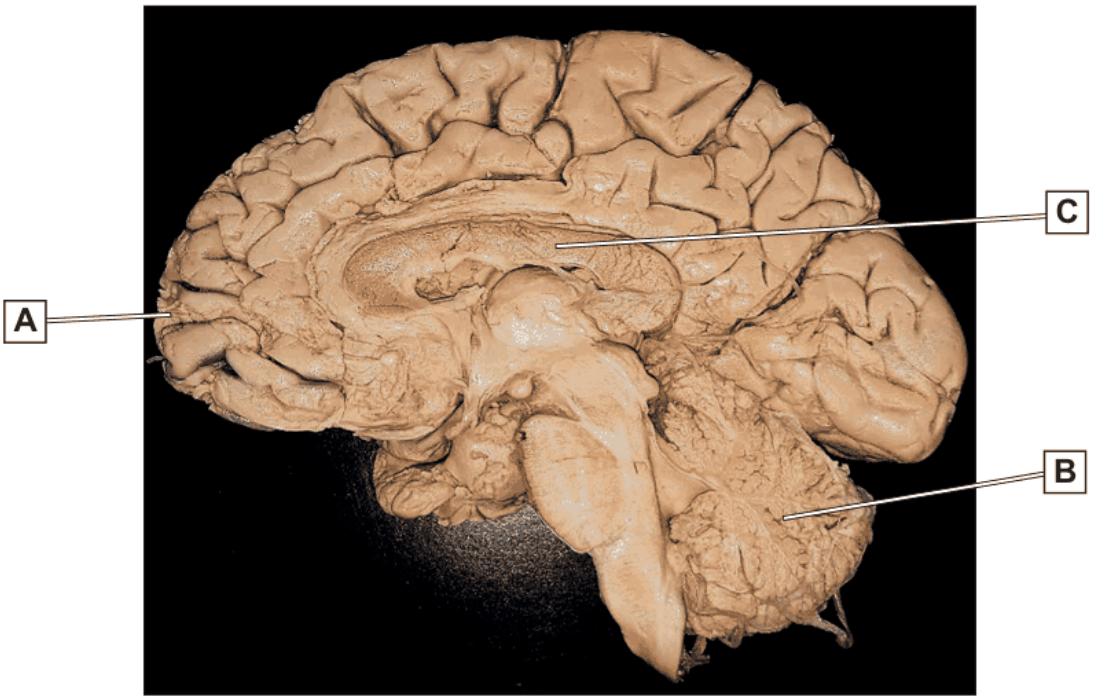
(i) **Label the lobes A-D of the cerebral cortex** shown in figure 10.1. [2]

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Question 4 · A level Component 3 · June 2023 · Q9(a)(i) · 2 marks

9. **Image 9.1** is a photograph of a section through the brain showing the right hemisphere.

Image 9.1



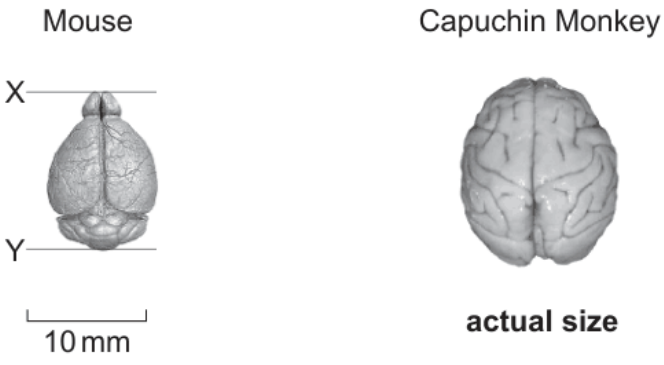
(a) (i) Identify the structures labelled **A**, **B** and **C** on **Image 9.1**. [2]

Label	Name of structure
A	.....
B	.....
C	.....

Question 5 · information from earlier in the question

9. (a) **Image 9.1** shows the brains of a mouse and a capuchin monkey.

Image 9.1



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Question 5 · A level Component 3 · June 2025 · Q9(a)(ii) · 1 mark

(ii) The monkey has a larger brain than the mouse and is considered to be a more intelligent animal.
Use **Image 9.1** to identify **one** other difference between the two brains that might account for this. [1]

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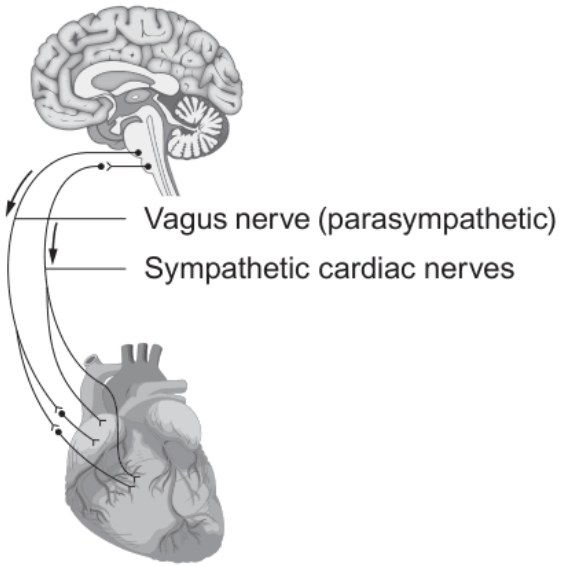
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Question 6 · A level Component 3 · Autumn 2021 · Q9(a)(i) · 1 mark

9. The autonomic nervous system controls the function of many organs and tissues without conscious intervention.

Image 9.1 shows peripheral nerves of the autonomic nervous system supplying the heart.

Image 9.1



(a) (i) Name the main region of the brain responsible for controlling the autonomic nervous system. [1]

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Question 7 · A level Component 3 · June 2024 · Q9(a)(iii) · 1 mark

(iii) Structure **X** is part of the autonomic nervous system.

Describe the function of the autonomic nervous system. [1]

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Question 8 · information from earlier in the question

The sympathetic nerves release the neurotransmitter noradrenaline from nerve endings when an individual is under stress.

Noradrenaline binds to adrenergic receptors on the plasma membranes of several tissues. This causes the effects experienced during the fight or flight response.

Question 8 · A level Component 3 · Autumn 2021 · Q9(a)(ii)II · 1 mark

II. Explain why this tissue has a nerve supply from both the parasympathetic and the sympathetic branch of the autonomic nervous system. [1]

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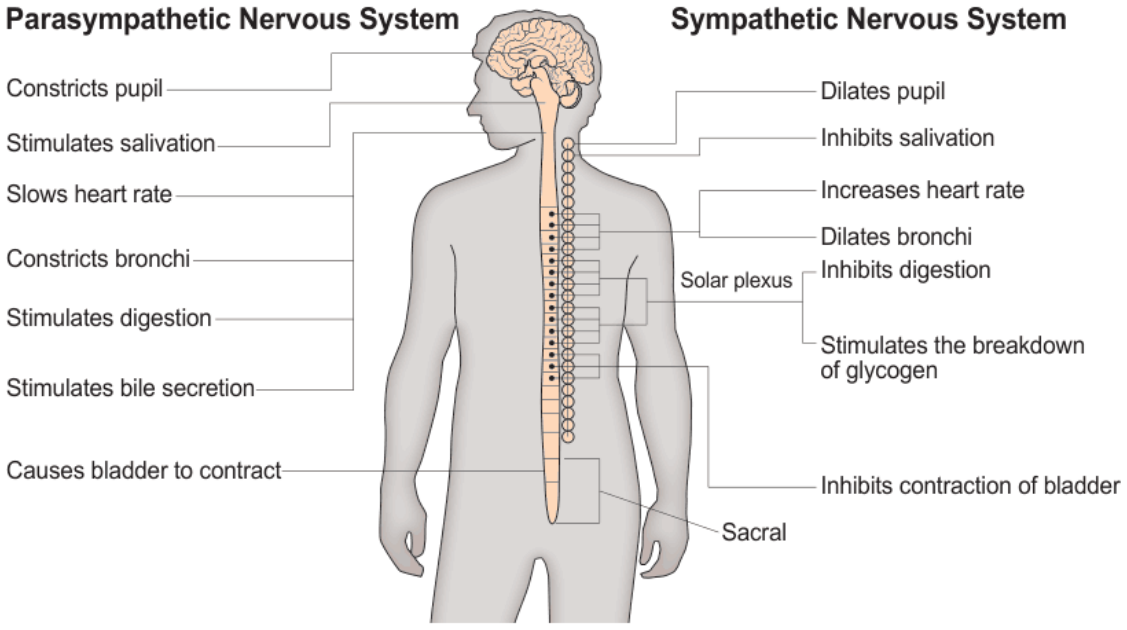
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Question 9 · information from earlier in the question

(b) Figure 10.4 shows the autonomic nervous system.

Figure 10.4



Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 9 · A level Component 3 · June 2019 · Q10(b)(ii) · 2 marks

(ii) Using figure 10.4, describe and explain how the sympathetic nervous system helps an individual during a fight or flight response. [2]

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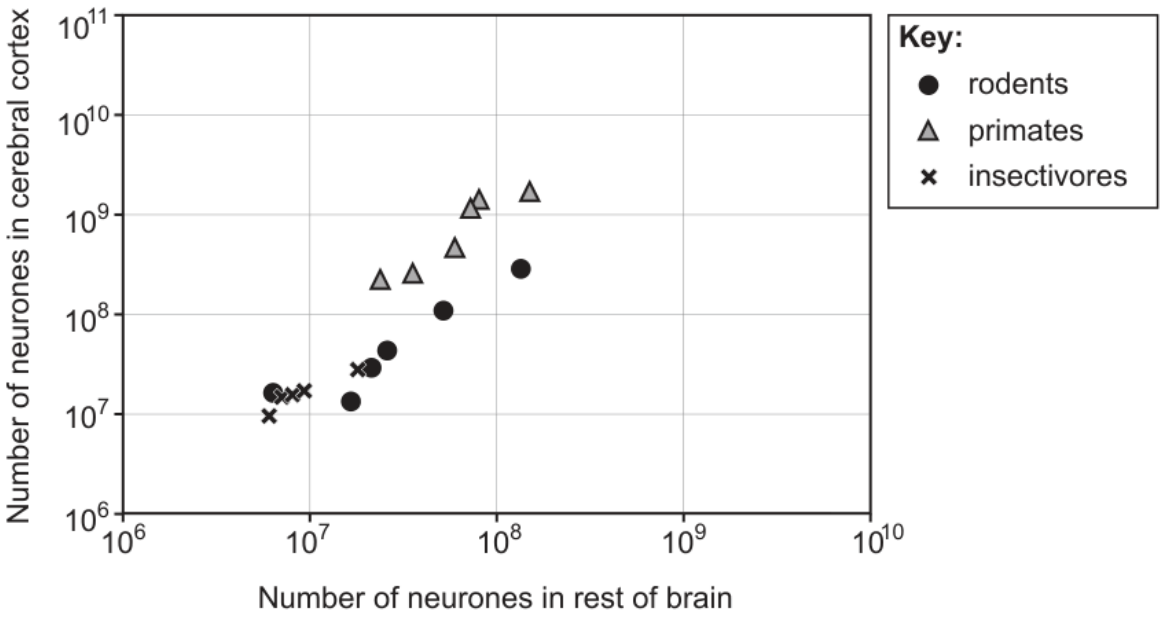
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Question 10 · information from earlier in the question

(b) An investigation was carried out into the relationship between the number of neurones in the cerebral cortex compared to the rest of the brain in different mammals. Researchers examined the brains of six species of primate (including apes and monkeys), six species of rodent (including rats and mice) and five species of insectivore (including shrews, moles and hedgehogs).

Graph 9.3 shows the relationship between the number of neurones in the cerebral cortex compared to the rest of the brain in the three different groups of mammals.

Graph 9.3



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Question 10 · A level Component 3 · June 2024 · Q9(b)(ii) · 3 marks

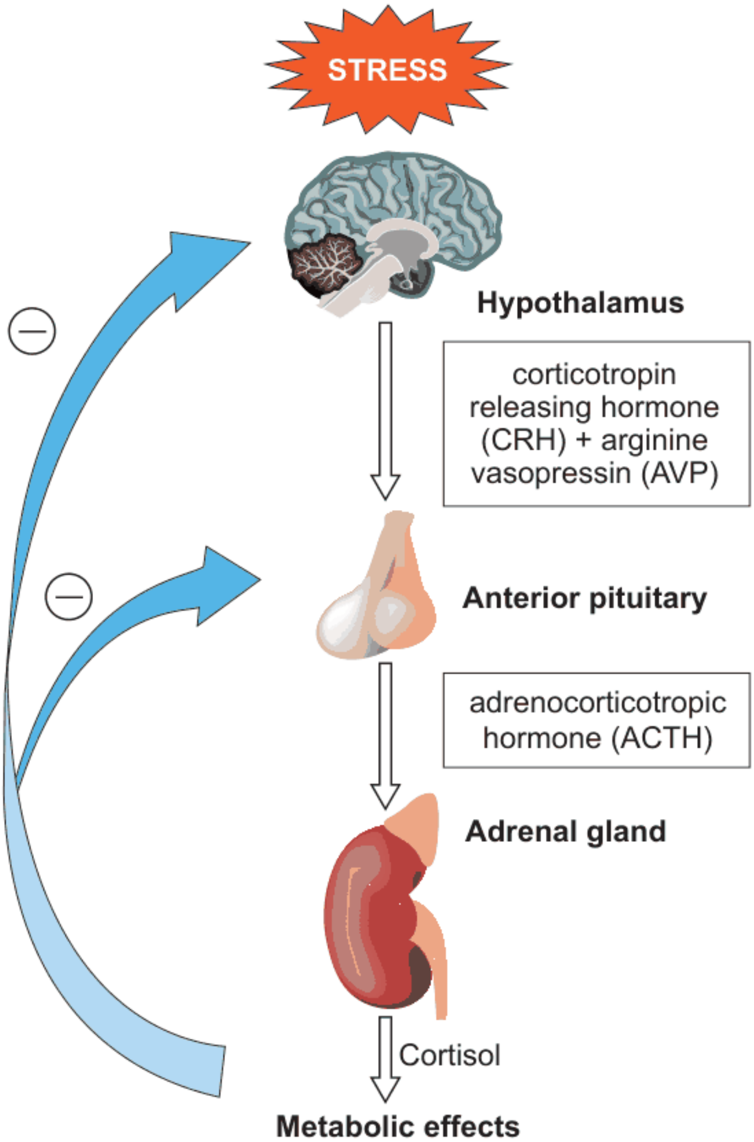
(ii) Primates generally exhibit complex social behaviours such as imitation and insight. They are capable of higher levels of cognitive functioning than the other groups of mammals in this study.

The researchers concluded that these behaviours are linked to the relative number of neurones in the cerebral cortex. Explain how the data supports their conclusion. [3]

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(c) Cortisol is produced by the adrenal glands in response to stress via the pathway shown in **Image 9.4**.

Image 9.4



(i) Use **Image 9.4** and your knowledge of cortisol production to describe and explain the effect on this pathway of increasing cortisol concentrations in the blood. [3]

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Question 12 · A level Component 3 · June 2023 · Q9(a)(ii) · 2 marks

(ii) The symptoms of a patient who had suffered a brain injury included partial paralysis of the right arm and hand and the right side of the face.
Conclude which hemisphere of the brain is likely to have been damaged and explain your reasoning. [2]

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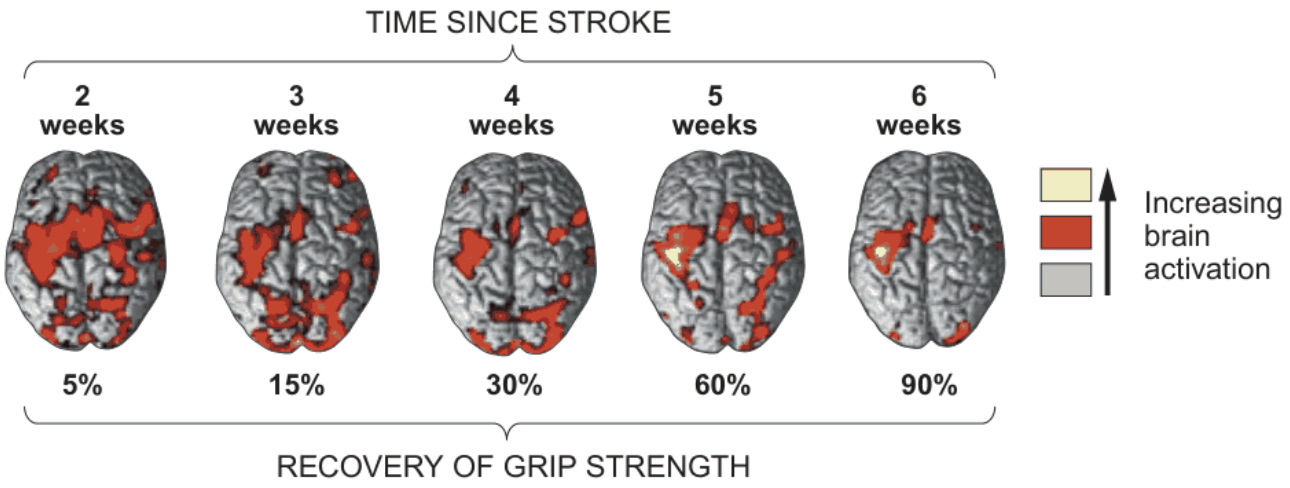
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Question 13 · information from earlier in the question

(b) A stroke is the interruption of blood flow to the brain. It may result in the death of brain cells. Individual patients can recover from strokes over a period of time. The image below shows functional magnetic resonance imaging (fMRI) scans showing the brain during repetitive gripping with the hand. Each brain image represents the activation pattern at different time points over the first six weeks after a stroke for one patient. After 6 weeks, the image is very similar to what is seen during learning of a new complex motor task in the undamaged human brain.



Question 13 · A level Component 3 · June 2018 · Q10(b)(iii) · 2 marks

(iii) Use the scans opposite to suggest which part of the brain was damaged. Give reasons for your answer. [2]

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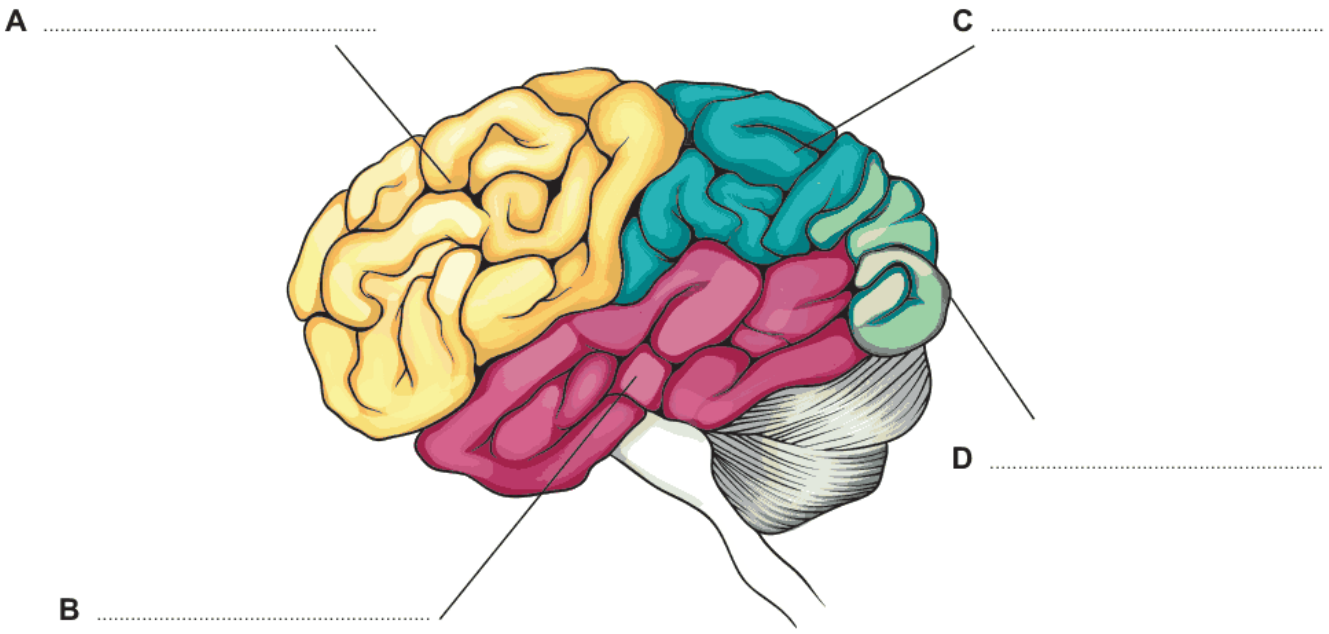
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Question 14 · information from earlier in the question

10. *(a)* Figure 10.1 shows the lobes of the cerebral hemispheres of the human brain.

Figure 10.1



Question 14 · A level Component 3 · June 2019 · Q10(a)(iv) · 2 marks

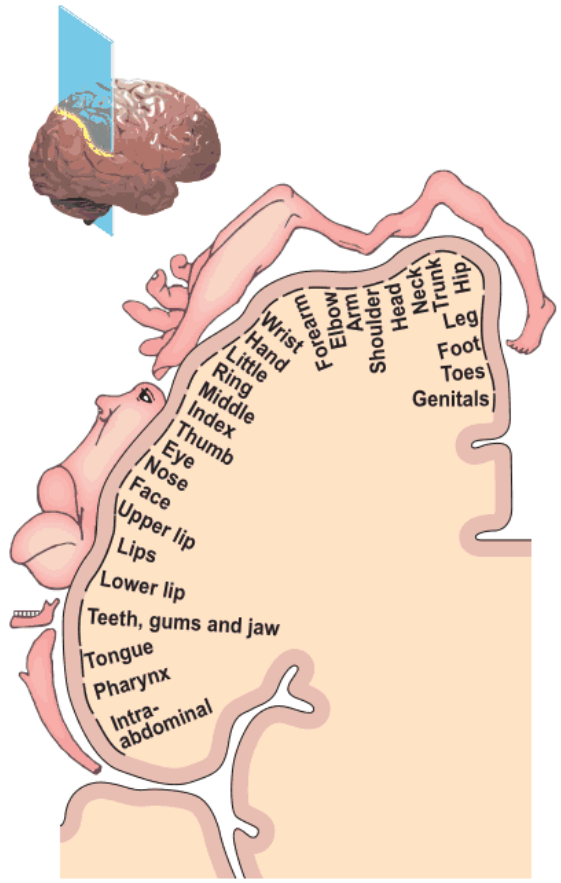
(iv) Damage to the cerebral cortex, through either injury or disease, produces different symptoms according to which lobe of the cerebral cortex is affected. Consider the case studies below and complete figure 10.3: [2]

Figure 10.3

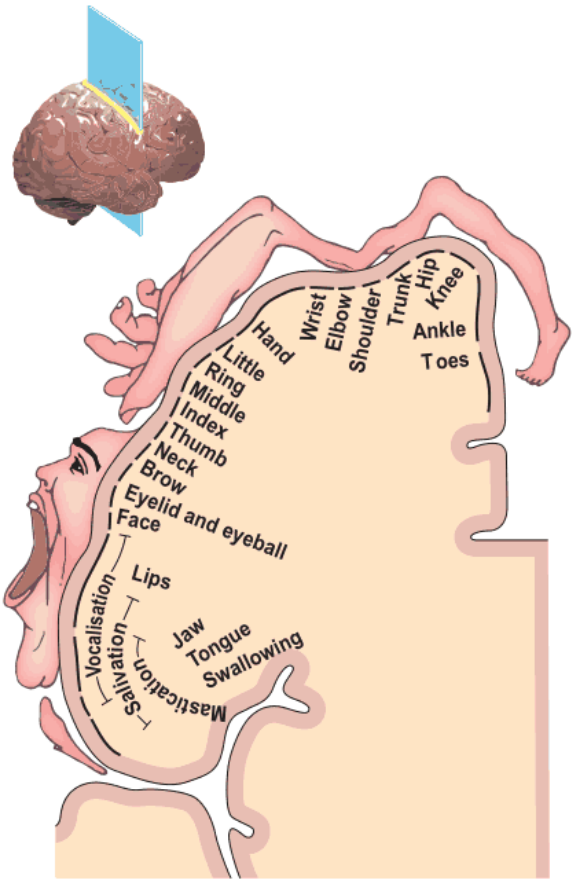
Description of damage	Symptoms	Lobe of cerebral cortex affected
A steel bar went through the head of the patient in an accident in the 19th century.	Personality affected so he was rude to friends and lost all inhibitions, exhibiting very aggressive behaviour.	.....
Road traffic accident, the patient suffered head trauma.	Inability to distinguish colours and reported hallucinations.	.....
Injury sustained falling from mountain bike and banging his head against a tree.	The patient could not remember his children's names and forgot how to read a map.	.....

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10. *(a)* The cortical homunculus is a drawing showing the area of cortex devoted to specific regions of the body. It correlates the anatomy of the body with a neurological map. There are two types of cortical homunculus: the sensory homunculus and the motor homunculus.



Sensory cortex in right cerebral hemisphere



Motor cortex in right cerebral hemisphere

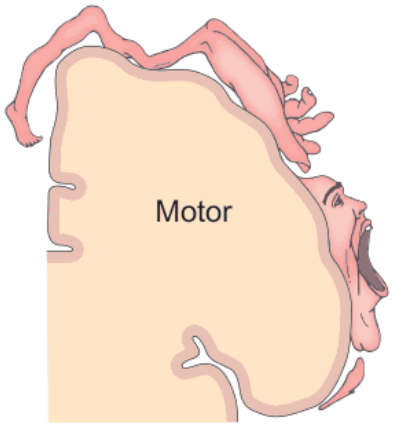
With reference to the homunculi shown above, identify what they show and describe and explain the major differences between the two images. [4]

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All primates can use an opposable thumb to grip or manipulate objects. Neurones in the cerebral cortex of the brain control thumb movements.

The diagram in **Image 9.7** is known as a homunculus and represents the cerebral **motor** cortex of a human brain. Some parts of the body are illustrated alongside the brain in the diagram.

Image 9.7



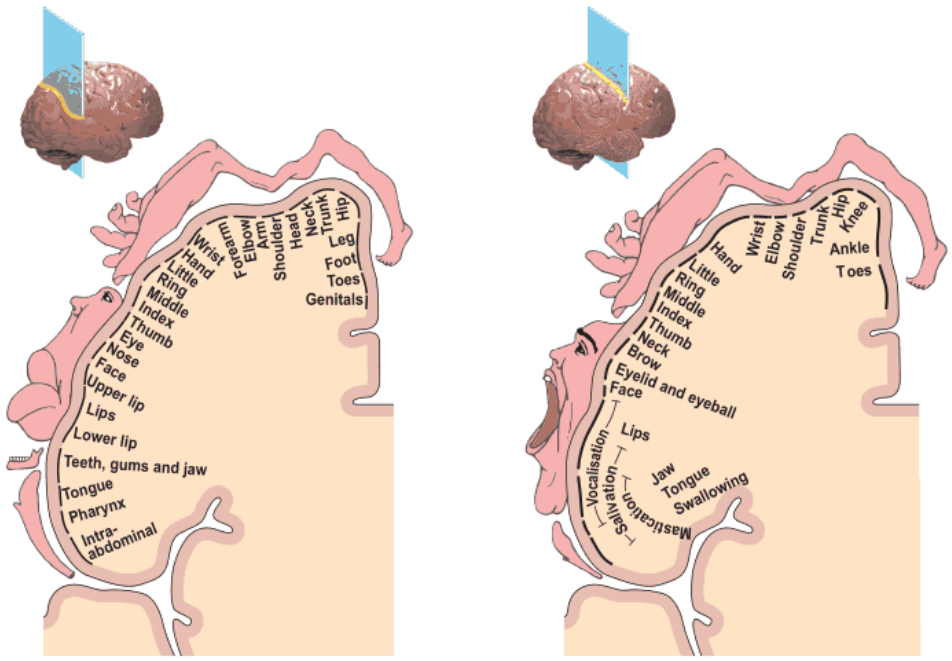
(ii) Explain why the shape and size of the hand appears distorted and disproportionately large compared to other parts of the body in **Image 9.7**. [2]

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Question 17 · information from earlier in the question

Homunculi are used to represent the sizes of the relevant parts of the cerebrum associated with receiving sensory information from different parts of the body and their motor control. **Image 9.2** shows sensory and motor homunculi.

Image 9.2



Sensory cortex in right cerebrum

Motor cortex in right cerebrum

Question 17 · A level Component 3 · June 2025 · Q9(a)(iii)II · 2 marks

II. Explain why the size of the fingers in both the sensory and motor homunculi are similar. [2]

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Question 18 · A level Component 3 · June 2018 · Q10(b)(iv) · 2 marks

(iv) A stroke affecting Wernicke's area has a different affect to a stroke affecting Broca's area. Using your knowledge of these areas of the cerebral cortex describe the effect of each type of stroke. [2]

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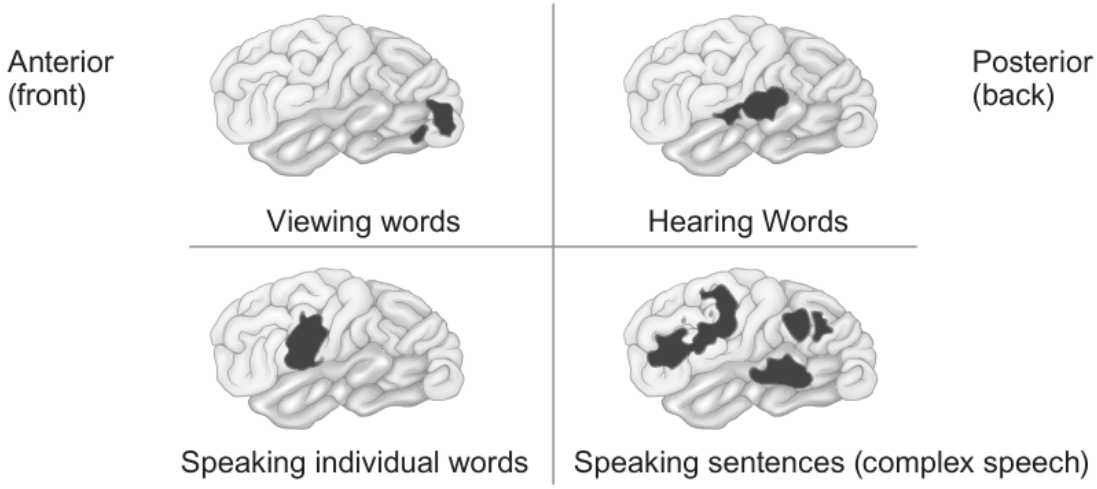
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Question 19 · information from earlier in the question

(d) Humans are the only primates to develop the ability to use speech.

Image 9.8 shows a PET scan of the brain of a single individual. It indicates the highest activity in different parts of the brain as the individual carries out activities associated with speech and language. These areas appear darker on the image.

Image 9.8



A PET scanner detects the quantity of radiation from the most active areas of the brain then uses the data to produce an image.

Question 19 · A level Component 3 · June 2022 · Q9(d)(iii) · 1 mark

(iii) Suggest why speaking sentences (complex speech) uses a greater area of the cerebral cortex than all the other components combined. [1]

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Mark schemes

Question 1 · A level Component 3 · June 2017 · Q9(a)(i) · 1 mark

9	(a) (i)		Label 1	1		1

Question 2 · A level Component 3 · June 2017 · Q9(a)(ii) · 2 marks

(ii)		It is involved in learning/ consolidate memories/ spatial memory/ spatial awareness/ navigation(1) permanent memory storage(1) short term to long term memory = 2 marks	2		2

Question 3 · A level Component 3 · June 2019 · Q10(a)(i) · 2 marks

10	*(a)* (i)	A Frontal lobe B Temporal lobe C Parietal lobe D Occipital lobe 4 correct – 2 marks 2/3 correct – 1 mark 0/1 correct – 0 marks	2	2

Question 4 · A level Component 3 · June 2023 · Q9(a)(i) · 2 marks

9	(a)	(i)	**A:** frontal lobe/ cerebral cortex/ cerebrum/ cerebral hemisphere **B:** cerebellum **C:** corpus callosum All 3 for 2 marks, 1 or 2 for 1 mark	2	2	1

Question 5 · A level Component 3 · June 2025 · Q9(a)(ii) · 1 mark

(ii)	Surface area of cerebral cortex is greater / cerebral cortex has higher degree of folding ORA / larger {cerebral cortex/ cerebrum} relative to the total brain size (1)	1	1

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Question 6 · A level Component 3 · Autumn 2021 · Q9(a)(i) · 1 mark

9	(a)	(i)	Hypothalamus	1	1

Question 7 · A level Component 3 · June 2024 · Q9(a)(iii) · 1 mark

(iii)		Control of {involuntary / automatic} functions of the body	1		1

Question 8 · A level Component 3 · Autumn 2021 · Q9(a)(ii)II · 1 mark

(iii)	II	Sympathetic increases heart rate/SAN depolarisation (eq) increases in frequency AND parasympathetic decreases heart rate/ SAN depolarisation (eq) decreases in frequency. (1)	1	1

Question 9 · A level Component 3 · June 2019 · Q10(b)(ii) · 2 marks

(ii)		Increases heart rate/ ventilation/ blood pressure. (1) This ensures that muscles are supplied with blood to enable the response/ diversion of blood from {gut/skin} to muscles/ more oxygen delivered to muscles. (1)	1 1	2

Question 10 · A level Component 3 · June 2024 · Q9(b)(ii) · 3 marks

(ii)		Cerebral cortex involved in higher brain functions (such as complex social behaviour) (1) Primates have larger number of neurones in the cerebral cortex than other mammals (1) Primates have a higher proportion of neurones in the cerebral cortex compared to the number of neurones in the rest of the brain (than other mammals) (1)	1	2 3	

Question 11 · A level Component 3 · June 2024 · Q9(c)(i) · 3 marks

(c) (i)		**Any three (x1) from:** Cortisol binds to glucocorticoid receptors in <u>the hippocampus</u> (1) Inhibiting CRH release (from the hypothalamus) (1) So less ACTH released (from the pituitary gland) (1) Reducing the rate of cortisol release (1) Reference to negative feedback (1)	3		3

Question 12 · A level Component 3 · June 2023 · Q9(a)(ii) · 2 marks

(ii)		Left hemisphere; (1) Movement of the right side of the body is controlled by the left side of the brain; (1)	1 1		2

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Question 13 · A level Component 3 · June 2018 · Q10(b)(iii) · 2 marks

(iii)	Left motor {cortex/ area} (1) increasing brain activation seen on left side of cerebrum (1)	2	2

Question 14 · A level Component 3 · June 2019 · Q10(a)(iv) · 2 marks

(iv)	Frontal lobe Occipital lobe Temporal lobe 3 correct – 2 marks 2 correct – 1 mark 0/1 correct – 0 marks	2	2

Question 15 · A level Component 3 · June 2018 · Q10(a) · 4 marks

10	(a)		Sensory homunculus shows relative sensitivity of different parts of the body **and** Motor homunculus shows the motor control of different parts of the body. (1)	1		
			Any three (x1) from		1 1 1	4

Area for hand is greater in the motor cortex	fine motor control (1)
Area for face is greater in motor cortex	because of the fine motor control needed for {facial expressions/ chewing/swallowing/ vocalisation (1)
Area devoted to tongue/lips/genitals greater in sensory cortex	due to large number of sensory receptors (1)
No area in motor cortex for teeth, gums, genitals	No motor control of teeth, gums, genitals (1)

Question 16 · A level Component 3 · June 2022 · Q9(c)(ii) · 2 marks

	(ii)		Hands {have many muscles to control/make complex movements}. (1) A larger number of neurones are needed to control {these muscles/movement} (1) (Needs some reference of comparison or proportion)		2	2

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 17 · A level Component 3 · June 2025 · Q9(a)(iii)II · 2 marks

	II	Sensory: large number of sensory {receptors/ neurones} /owtte (1) Motor: need precise control / fine motor control / intricate movement/ owtte (1)	2	2	

Question 18 · A level Component 3 · June 2018 · Q10(b)(iv) · 2 marks

(iv)	Stroke in Broca's area – patient cannot produce speech (1) Stroke in Wernicke's area – patient does not understand speech (1)	1 1		2

Question 19 · A level Component 3 · June 2022 · Q9(d)(iii) · 1 mark

(iii)	Complex speech requires a {wider range of/conscious} thought processes/ uses (neural pathways from) other parts of the brain to think/uses stored memory.	1	1

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