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Human Perspectives ATAR Units 3 & 4

Answers: Chapter 4 The nervous system is highly organised

Questions 4.1

RECALL KNOWLEDGE

1 Label the following structures on the diagram below.

a Cerebellum

b Hypothalamus

c Pituitary gland

d Cerebrum

e Medulla oblongata

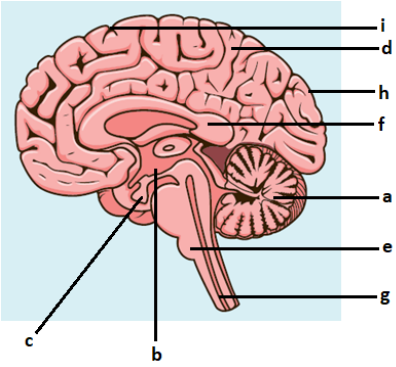
f Corpus callosum

g Spinal cord

h Convolution

i Sulci.

Answer:



2 Explain how the central nervous system is different from the peripheral nervous system.

Answer: The central nervous system consists of the brain and spinal cord and the peripheral nervous system consists of the nerves that connect the CNS to the receptors, muscles and glands.

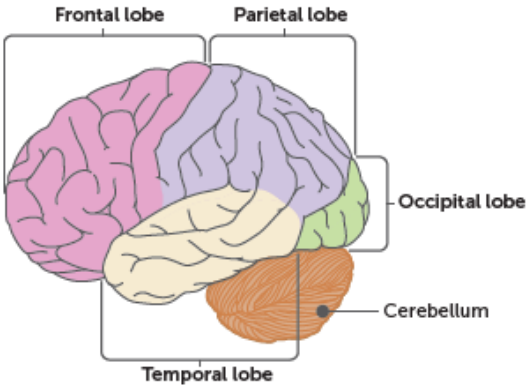
3 List the structures that protect the central nervous system.

Answer: Bone, meninges, cerebrospinal fluid

4 Explain how cerebrospinal fluid protects the brain.

Answer: The cerebrospinal fluid acts as a shock absorber to cushion any shocks or blows to the central nervous system.

5 a Label the parietal, frontal, occipital and temporal lobes of the cerebral cortex on the diagram below.
Answer: Refer to Figure 4.7 on page 83 of the student book for correct labelling:



b Explain why it is not possible to label the insula in this diagram.
Answer: The insula is located deep inside the brain and cannot be seen on this diagram of the external parts of the brain.

6 Describe the functional areas of the cerebrum.
Answer: There are three functional areas of the cerebrum. Sensory areas interpret impulses from receptors, motor areas control muscle movements and the association areas which are concerned with emotional and intellectual processes.

7 Describe the appearance of a cross-section of the cerebellum.
Answer: The white matter in the cerebellum is branched throughout the entire cerebellum and looks like a tree. The grey matter surrounds the white matter and also makes up the outer folded surface.

8 Name and describe the centres that are located in the medulla oblongata.
Answer:

Centre	**Function**
Cardiac centre	Regulates the rate and force of the heartbeat
Respiratory centre	Controls the rate and depth of breathing
Vasomotor centre	Regulates the diameter of blood vessels

9 Compare and contrast the structure of the brain and spinal cord.
Answer:
Compare: Both brain and spinal cord contain grey and white matter. Both the brain and spinal cord contain tracts within the white matter.
Contrast: The brain has grey matter on the outside (the cerebral cortex) then areas of white matter where the tracts are located, then the basal ganglia which is grey matter found toward the base of the brain. The spinal cord has white matter on the outside surrounds the grey matter in the centre which is arranged in an H shape.

10 Draw a labelled cross-section of the spinal cord to show the grey matter, white matter and central canal.
Answer: Refer to Figures 4.13 and 4.14 on page 86 of the student book to show arrangement of grey and white matter and the location of the central canal.

APPLY KNOWLEDGE

11 Explain why a broken back can result in the inability to move limbs.
Answer: A broken back would refer to the vertebral column being broken. The vertebral column encases and protects the spinal cord. A break to these bones will damage and potentially sever the spinal cord so nerve impulses along the motor neurons are unable to reach the muscles of the limbs to bring about contraction/movement.

12 Justify the naming of the grey matter and white matter.
Answer: White matter contains the myelinated nerve fibres, as myelin ins a white fatty substance that surrounds the axons, vast collections of these nerve fibres will result in the area looking white. Grey matter contains unmyelinated fibres and cell bodies which cannot be myelinated. As such the collections of these nerves and cell bodies will look grey.

13 Describe the movement of someone without a cerebellum. Justify your prediction using your knowledge of the functions of the cerebellum.
Answer: The movement of a person without a cerebellum would be spasmodic, jerky and uncontrolled. They may also display poor posture and balance. The cerebellums function is to exercise control over posture, balance and voluntary muscle movement, it results in smooth coordinated movements.

14 Suggest a reason for the hypothalamus being located towards the centre of the brain.
Answer: One of the most important functions of the hypothalamus is to link the nervous system and the endocrine system through its relationship with the pituitary gland. Being located just above the pituitary gland allows for this relationship. The hypothalamus also controls many bodily actions and is primarily concerned with maintaining homeostasis. Its location in the centre of the brain allows for the detection of substance levels that signal the need for homeostatic change.

Questions 4.2

RECALL KNOWLEDGE

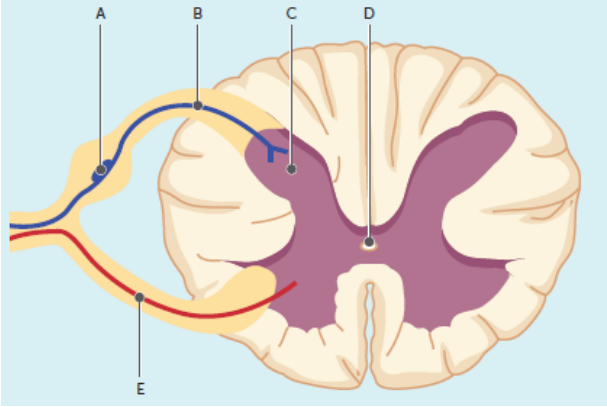
1 What structures make up the peripheral nervous system?
Answer: The peripheral nervous system is made up of nerve fibres that carry information to and from the central nervous system, and groups of nerve cell bodies called ganglia.

2 State the number of:
a cranial nerves
Answer: 12 pairs

b spinal nerves.
Answer: 31 pairs

3 'All of the nerves in the peripheral nervous system are mixed nerves, made up of both motor and sensory fibres.' Discuss this statement.
Answer: This statement is mostly true as all 31 pairs of spinal nerves are mixed nerves. However, there are three cranial nerves that carry only sensory information and five cranial nerves that only carry motor information, leaving four cranial nerves that are classified as mixed nerves.

4 Label structures A–E on the diagram below.



Answer:
A – Dorsal root ganglion
B – Sensory neuron
C – Central canal
D – Grey matter
E – Motor neuron

5 Draw a tree diagram to show the divisions of the peripheral nervous system.
Answer: Refer to Figure 4.18 on page 90 of the student book for a clear tree diagram.

6 Which division of the PNS takes messages:
a into the CNS from the internal organs?
Answer: Afferent, visceral sensory

b from the CNS to the muscles and glands?
Answer: Efferent division

c from the CNS to the involuntary muscles?
Answer: Efferent, autonomic division

d into the CNS from the skin and muscles?
Answer: Afferent, somatic sensory

7 Compare and contrast the sympathetic and parasympathetic nervous systems.
Answer:
Compare: Both nervous systems form the autonomic division of the peripheral nervous system and both are involved in maintaining the internal environment of the body.
Contrast: The sympathetic division is activated in times when an increase in activity is required (fight or flight response). The parasympathetic division acts to stabilise the body during quiet situations.

8 Explain how the sympathetic nervous system is able to prepare the body for a fight-or-flight response.
Answer: The sympathetic nervous system acts to bring more oxygen and glucose to the organs and structures that will be used in a fight or flight situation. For example, the heart under sympathetic stimulation will increase rate and strength of contraction to deliver blood more quickly to skeletal muscles and lungs. The liver, under sympathetic stimulation, will increase the breakdown of glycogen to release more glucose into the blood stream.

APPLY KNOWLEDGE

9 State one similarity and one difference between an ascending tract and a sensory nerve.
Answer:
Similarity: The ascending tract and sensory nerve both carry nerve impulses toward the brain.
Difference: The ascending tract is located only in the spinal cord, whereas sensory nerves can be found outside of the central nervous system.

10 Suggest what would happen if the body could not produce acetylcholine.
Answer: Acetylcholine is the neurotransmitter required at the neuromuscular junction to bring about muscle contraction. Without acetylcholine there would be no muscle contraction. Acetylcholine is also important in learning and working memory, as such reduced acetylcholine has been linked to learning and memory impairment and brain disorders such as dementia and Alzheimer's disease.

Chapter 4 activities

ACTIVITY 4.1 Examining a dissected brain

Putting it together

2 A human brain has many more convolutions than a sheep's brain. Explain the significance of the greater number of convolutions in humans.
Answer: The grey matter of the cerebrum, consisting of nerve cell bodies, is at the surface of the cerebrum. The convolutions increase the surface area of the cerebrum and therefore increase the number of nerve cells. More neuronal connections are possible, resulting in humans having greater intelligence than a sheep.

3 What is the function of the inner meningeal layer?
Answer: The inner meningeal layer contains many blood vessels and adheres to the surface of the brain and spinal cord. It protects the surface and supplies the cells with oxygen and nutrients.

4 You would have noticed that the inside of the brain is moist.
a What is the name of the fluid that fills spaces inside the brain?
Answer: The fluid filling the spaces in the brain is cerebrospinal fluid (CSF).

b Where does the fluid come from, and what is its function?
Answer: CSF is formed from the blood. It has three functions – protection, support and transport.
• Protection: CSF cushions the brain from any bumps or blows to the head.
• Support: CSF surrounds the brain so that the brain is floating in, and supported by, the fluid.
• Transport: CSF circulates around and through the brain taking nutrients and oxygen to the brain cells and removing carbon dioxide and other waste.

ACTIVITY 4.2 Phineas Gage

1 How is it possible that Gage was able to function relatively normally with damage to such a large and vital part of his brain?

Answer: The rod clearly missed the parts of the brain that are responsible for vital functions: the medulla, cerebellum and hypothalamus. These parts must have been undamaged.

2 Changes in a person's functioning or behaviour as a result of injury to the brain were used by scientists to determine the functions of the affected parts of the brain. Were scientists able to learn anything about the brain from Gage's injury?

Answer: Hypotheses were advanced at the time of Gage's accident but none of these can be substantiated because of the following:

• The parts of the brain that were injured were inferred from the points of entry and exit of the iron rod. However, there must have been much more damage than that caused by the passage of the rod. Fragments of bone would have been pushed into other parts of the brain and there would have been massive bleeding placing pressure on the brain.

• There is insufficient knowledge about Gage's behaviour before and after the accident to be able to make any conclusions about behavioural functions in the brain.

3 Did Gage's injury have any positive benefits for medical science?

Answer: Recent analyses of Gage's post-accident history have determined that he was able to function fairly normally and was a reliable employee. This shows that some cases of severe brain injury resulting in behavioural change can be overcome by social adjustment.

ACTIVITY 4.3 Observing an autonomic reflex

1 What change was observed in the subject's pupils when the eyes were opened?

Answer: The pupil gets smaller in diameter.

2 What change was observed in the subject's iris when the eyes were opened?

Answer: The width of the iris increased.

3 Why is the response that you observed described as a reflex?

Answer: It has the four characteristics of a reflex:

• It occurs without conscious thought.
• It occurs automatically.
• It is rapid.
• The response is always the same.

4 Many reflexes are described as protective. Is the reflex that you observed a protective reflex? Explain.

Answer: Yes, because it is protecting the retina of the eye from being damaged by receiving light that is too intense.

5 Would it be possible to consciously prevent the response that you observed from occurring?

Answer: No, because the muscles of the iris are not under conscious control; they are controlled by the autonomic nervous system.

6 Which division of the autonomic nervous system caused the response that you observed?
Answer: The parasympathetic division

7 Optometrists place drops of a drug in the eyes to dilate the pupils so that the eyes can be examined. The drug blocks receptors for acetylcholine. Suggest why such a drug placed in the eyes could cause the pupils to dilate.
Answer: Acetylcholine is the neurotransmitter responsible for the transmission of nerve impulses in the parasympathetic nervous system. If acetylcholine receptors on the muscles of the iris are blocked, the muscles cannot receive messages transmitted by acetylcholine.

Chapter 4 Review questions

Recall

1 Describe the three structures that protect the central nervous system.
Answer: The central nervous system is protected by:
• bone – the cranium and the vertebrae
• meninges – three layers of membranes that cover the whole of the CNS
• cerebrospinal fluid – a fluid that cushions the CNS from bumps and shocks.

2 a What is cerebrospinal fluid?
Answer: Cerebrospinal fluid (CSF) is a fluid that circulates through and around the central nervous system. It is a clear, watery fluid that contains some cells, glucose, protein, urea and salts.

b Where does CSF come from?
Answer: It is formed from the blood and enters the CNS from tissue fluid that has been forced out of the capillaries.

c Where does CSF go to?
Answer: After it has circulated around the CNS it will return to the blood capillaries.

d What does CSF do?
Answer: The function of CSF is to supply nutrients to the cells of the brain and spinal cord and to carry away the wastes produced by these cells. It suspends the brain, surrounds the spinal cord and offers a shock absorption to the brain and spinal cord.

3 a Describe the cerebral cortex.
Answer: The cerebral cortex is the grey matter that forms a layer 2–4 millimetres thick on the outside of the cerebrum.

b List the advantages of the cerebral cortex being folded.
Answer: The folding of the cerebral cortex greatly increases its surface area. Since the cortex is grey matter, made up of the cell bodies of nerve cells, the folding means that the cortex can contain many more nerve cells than if it were not folded.

c What is the difference between a sulcus and a fissure?
Answer: Shallow downfolds of the cerebral cortex are called sulci (singular: sulcus). Fissures are much deeper downfolds.

4 a Describe the functions of the cerebral cortex.
Answer: The cerebral cortex is involved in higher-order mental activities such as thinking, reasoning, learning, memory, intelligence, emotions and sense of responsibility. It also makes us consciously aware of input from the sense organs and initiates and controls voluntary muscle contractions.

b Name the three types of area in the cerebral cortex and identify the function of each type.
Answer: The three types of functional area in the cerebral cortex are:
• sensory areas, which interpret impulses received from receptors
• motor areas, which consciously control muscular movements
• association areas, which process intellectual and emotional responses.

5 a Describe the location of the hypothalamus.
Answer: The hypothalamus is in the middle of the brain. It is underneath the cerebrum and just above the pituitary gland.

b List some of the functions of the hypothalamus.
Answer: The hypothalamus controls many activities relating to homeostasis including:
• regulation of heart rate and blood pressure
• secretion of digestive juices and movement of the alimentary canal
• the diameter of the pupil
• body temperature
• food and water intake
• patterns of waking and sleeping
• contraction of the urinary bladder
• emotional responses such as fear, anger, aggression, pleasure and contentment
• secretion of certain hormones and coordination of parts of the endocrine system.

6 a Describe the location of the cerebellum.
Answer: The cerebellum is underneath and at the back of the cerebrum.

b What are the main functions of the cerebellum?
Answer: The cerebellum receives impulses from the inner ear and from stretch receptors in the voluntary muscles. Using that information, it controls posture and balance and it coordinates the fine movements of voluntary muscles.

7 How many pairs of nerves arise from each of the brain and spinal cord?
Answer: There are 12 pairs of cranial nerves arising from the brain and 31 pairs of spinal nerves.

8 On what sort of nerve would you find a ventral root and a dorsal root? Explain where these roots are located.
Answer: Each of the spinal nerves is joined to the spinal cord by a ventral and a dorsal root. The roots are located where the spinal nerve joins the spinal cord. Each ventral root contains axons of motor neurons that have their cell bodies in the grey matter of the spinal cord. Each dorsal root contains axons of sensory neurons that have their cell bodies in a small swelling on the dorsal root known as the dorsal root ganglion.

9 Does the autonomic nervous system require conscious control? Why is this important?
Answer: No, the autonomic nervous system is under unconscious control. It is regulated by groups of nerve cells in the hypothalamus, medulla oblongata and the cerebral cortex. This is important as much of the function of the autonomic nervous system is to regulate the heart and involuntary muscles and glands.

10 Describe four differences between the somatic and autonomic divisions of the peripheral nervous system.
Answer: The somatic division carries impulses from the central nervous system to the skeletal muscles; the autonomic division carries impulses from the central nervous system to heart muscle, involuntary muscle and glands. The autonomic division is further subdivided into the sympathetic division and the parasympathetic division. The somatic division uses acetylcholine at the effector, the autonomic division uses either acetylcholine or noradrenaline. The somatic division uses one set of nerves to the target organ, the autonomic division uses two sets.

11 What is a ganglion?
Answer: A ganglion is a group of nerve cell bodies found outside the central nervous system.

12 In general terms, what is the difference between responses brought about by the sympathetic and parasympathetic divisions of the autonomic nervous system?
Answer: The parasympathetic division generally produces responses that maintain the body during relatively quiet conditions. On the other hand, the sympathetic division tends to produce responses that prepare the body for strenuous physical activity. (Responses produced by the sympathetic division are often called fight-or-flight responses, because they prepare the body for situations that may involve aggression or fleeing from a threat.)

Explain

13 Explain how the structure of the corpus callosum allows it to achieve its function.
Answer: The corpus callosum is a wide band of white matter containing tracts found bridging the left and right hemispheres of the brain. It is found at the base of the longitudinal fissure and allows for communication between the two hemispheres of the cerebrum.

14 Explain the medulla oblongata's role in adjusting normal body functions.
Answer: There are three centres located in the medulla oblongata that have an important role in automatically adjusting body function. The cardiac centre regulates the force and rate of heartbeat, the respiratory centre that controls the rate and depth of breathing and the vasomotor centre that regulates the diameter of blood vessels. It also regulates protective reflexes of swallowing, sneezing, coughing and vomiting. Although the centres in the medulla oblongata are influenced by higher centres in the brain, if you sustained damage to some of these higher centres, the medulla oblongata would continue to function normally and keep vital functions of the body going.

15 Explain what a mixed nerve is.
Answer: Mixed nerves have both sensory and motor fibres; that is, fibres that carry impulses into the CNS, as well as fibres that carry impulses away from the CNS.

16 a What is the difference between the afferent and efferent divisions of the peripheral nervous system?
Answer: The afferent (or sensory) division of the peripheral nervous system has fibres that carry impulses into the central nervous system. The efferent (or motor) division has fibres that carry impulses away from the central nervous system.

b What is the difference between the somatic and autonomic divisions of the efferent division of the peripheral nervous system?
Answer: The somatic division carries impulses from the central nervous system to the skeletal muscles; the autonomic division carries impulses from the central nervous system to heart muscle, involuntary muscle and glands. The autonomic division is further subdivided into the sympathetic division and the parasympathetic division.

Apply

17 Compare and contrast the grey matter in the cerebrum, cerebellum and spinal cord.
Answer:
Compare: The grey matter in each structure will contain unmyelinated nerve fibres and cell bodies of neurons.
Contrast: The location of the grey matter is different. In the cerebrum grey matter is found in the convolutions of the cerebral cortex and also in the basal ganglia. The cerebellum has grey matter on the outside, surrounding the white matter and folded into parallel bands. The grey matter in the spinal cord is in the centre, surrounded by white matter.

18 After sustaining a head injury in a car accident, a person had difficulty chewing and swallowing. What part of the brain could have been damaged? Justify your answer.
Answer: The medulla oblongata may have been damaged, because this contains the control centre for swallowing. Also, the upper motor neurons that pass through and cross over in the medulla may have been damaged, thus affecting the mouth and jaw movements involved in chewing. Another possibility is damage to the cerebellum, which is responsible for the coordination of voluntary muscle contraction.

19 Paraplegia (inability to move the legs) may be caused by an injury to the spinal cord. Explain why such an injury could result in paraplegia.
Answer: One of the functions of the spinal cord is to carry sensory impulses towards the brain and motor impulses away from the brain. If the spinal cord is damaged or severed above the point at which the motor neurons exit to the legs, then the nerve impulses cannot reach the leg muscles to stimulate muscle contraction. In the same way, the damage to the spinal cord prevents the brain from receiving sensory impulses from the legs so the person has no feeling in the limbs.

20 A person could survive complete destruction of one of the cerebral hemispheres, which make up nearly 40% of the volume of the brain. By contrast, destruction of the hypothalamus, which is only about the size of an almond, would result in certain death. Explain the reasons for this difference.
Answer: A person can survive destruction or removal of one cerebral hemisphere because the other cerebral hemisphere is still functional. Impairment of some, or many, functions would be likely. Removal of

a cerebral hemisphere (hemispherectomy) is sometimes performed in severe cases of epilepsy that do not respond to any other treatment.
It would not be possible to survive destruction of the hypothalamus because it is responsible for the regulation of many functions, such as heart rate, blood pressure, body temperature and secretion of digestive juices.

21 If the ventral root of a spinal nerve were damaged, would it affect the sensory functions or the motor functions of that nerve? Explain.
Answer: It would affect the motor functions because the axons of motor neurons are in the ventral root of a spinal nerve.

22 a List four stimuli that could lead to a fight-or-flight response.
Answer: Stimuli that could lead to a fight-or-flight response are fear, anger, stress, danger, competition or threat.

b List four responses that would prepare the body for fight or flight.
Answer: Students could mention any four of:
• increased rate and force of contraction of the heart (accompanied by increase in blood pressure)
• dilation of blood vessels in organs involved in strenuous activity (such as the skeletal muscles, heart and liver)
• constriction of blood vessels of organs not involved in activity (like the kidney, stomach, intestines and skin)
• dilation of airways in the lungs
• increased rate and depth of breathing
• rise in blood glucose level (because the liver converts more glycogen to glucose)
• increased secretion from sweat glands
• release (from the adrenal medulla) of the hormones adrenaline and noradrenaline, which intensify and prolong the above responses.
See also Table 4.4 on page 93 of the student book.

23 It is sometimes said that the sympathetic division of the autonomic nervous system produces fight-or-flight responses, while the parasympathetic division is concerned with ‘rest and digest’. Do you think these are appropriate descriptions for the two divisions? Explain your answer.
Answer: These are appropriate descriptions, because the sympathetic division is stimulated by situations that make a person either want to fight or run away. This division prepares the body for increased activity by increasing heart rate, breathing rate and sweating, while decreasing digestive functions. This is opposite to the effects of the parasympathetic division, which causes heart and breathing rates to decrease, and digestive functions to return to normal.
Students may say that these descriptions are not appropriate because a person’s state at any time depends on the balance between sympathetic and parasympathetic impulses.

24 Urinary retention (inability to empty the bladder or incomplete emptying of the bladder) and incontinence (uncontrollable, involuntary leaking of urine) are both possible symptoms of disease of the autonomic nervous system. Which part of the autonomic division would be affected in each case? Explain your answer.

Answer: Sympathetic stimulation relaxes the muscles of the bladder wall, so overstimulation of the sympathetic division may cause urinary retention as the bladder muscles would not constrict enough to push out all the urine. The opposite would be true of incontinence. Overstimulation of the parasympathetic division could mean that the bladder muscles contract, pushing urine out of the bladder.

25 If the dorsal root of a spinal nerve were damaged, would there be any impairment of the autonomic functions controlled by that nerve? Explain your answer.
Answer: No, there would be no impairment as the dorsal root carries sensory nerves only, and the autonomic nervous system controls activity in the body through action of motor nerves that exit from the ventral root of the spinal cord.

26 Would a drug that stimulated acetylcholine receptors affect the autonomic division, the somatic division or both? Give reasons for your answer.
Answer: It would affect both autonomic and somatic divisions because both use acetylcholine as the neurotransmitter that allows impulses to travel from axons to effectors, such as skeletal muscle or heart muscle.

27 The drug atropine occupies acetylcholine receptors at the synapse. Ophthalmologists once used atropine when they needed to dilate a patient's pupils. Explain why atropine would have this effect.
Answer: Atropine blocks the effects of acetylcholine, so that when placed in the eye, muscles in the eye cannot be stimulated to contract. Muscles in the iris relax and the pupil dilates. Muscles controlling the shape of the lens also relax.

Extend

28 In severe cases of epilepsy, as a last resort, the corpus callosum may be severed so that the two cerebral hemispheres can no longer communicate with each other. Patients who have had this procedure are commonly referred to as having a 'split brain'. As each of the two cerebral hemispheres has separate functions, a split brain has a significant impact on the performance of simple tasks. Use references to find out the effects that a split brain would have on a person's functioning.
Answer: Severing of the corpus callosum (corpus callosotomy) may not produce any obvious impairment of functions. The most common difficulties relate to speech and some patients are unable to follow verbal instructions that require the use of their non-dominant hand. Careful experiments have shown that when the patient's left and right eyes see different images (split pictures) the person can describe the picture seen with the right eye, but when asked to point to what was described, the person points to the picture seen with the left eye. This occurs because the centre controlling speech is in the left cerebral hemisphere and the centre that interprets visual and spatial information is in the right hemisphere (in most people). The two hemispheres are unable to communicate with each other because the corpus callosum has been cut.

29 We all need a certain amount of sleep to continue to function normally. Conduct research to find out:
a what happens to the brain during sleep
Answer: The brain requires sleep to allow the neurons to reorganise, contributing to memory function as short term memories are converted into long-term memories. The brain's glymphatic system (waste clearance) removes toxic by-products that have accumulated during the day.

b the difference between deep sleep and rapid eye movement (REM) sleep
Answer: REM sleep first occurs about 90 minutes after falling asleep. Your eyes move rapidly from side to side behind closed eyelids, breathing becomes faster and irregular and heartrate and blood pressure increase to near waking levels. Most dreaming occurs during REM, arms and legs become temporarily paralysed so you do not act out your dreams. Deep sleep occurs in longer periods during the first half of the night, your heartbeat and breathing slow to their lowest levels and muscles are relaxed. Your brainwaves are large and slow.

c the difference between sleep and a coma.
Answer: A coma is a prolonged state of unconsciousness. During a coma a person is unresponsive to their environment and cannot be awakened by any stimulation including pain. In most cases coma is a consequence to head trauma or brain problems (swelling, bleeding, stroke).
Sleep is a naturally occurring state of altered consciousness, happening every night and lasting for 7–8 hours (teenagers and children require more sleep). During sleep we are more or less responsive to our surroundings, depending on the sleep cycle.

30 Lie detectors measure ANS activity. Their use is based on the idea that when a person lies, there are involuntary changes in their body functions.
Find out:
a what kinds of things lie detectors measure and how they are measured
Answer: Lie detectors measure three indicators of autonomic stimulation, heart rate and blood pressure, breathing depth and rate and skin conductivity or sweating in the hands/palms. Heart rate and blood pressure are measured using a blood pressure cuff, breathing rate and depth are measured using a pneumography wrapped around a person's chest and skin conductivity is measured through electrodes attached to a subject's fingertips.

b whether it is the activity of the sympathetic or parasympathetic divisions that produces the responses measured
Answer: Increased activity of the sympathetic nervous system would produce and increase in all three indicators.

c how reliable lie detectors are, and reasons for their reliability or unreliability.
Answer: Assessments of lie detectors by both scientific and government bodies suggest that lie detectors are inaccurate, may be defeated by countermeasures and are in imperfect and invalid means of obtaining truthfulness. The premise behind lie detectors picking up deception is that liars will show increased autonomic arousal when answering the key questions, whereas truth tellers will not, however, there is no evidence to support this premise.

31 As people get older, changes occur in the nervous system. Some changes are serious enough to be called a disease; an example is Alzheimer's disease. Other changes are just a natural part of ageing.
Conduct research to find out:
a the changes to the nervous system that occur in everyone as they get older

Answer: As we age, the brain and spinal cord will lose nerve cells and weight (atrophy). Nerve cells will send impulses more slowly, waste products can collect in the brain tissue as nerve cells break down. Plaques and tables can form and a fatty brown pigment called lipofuscin can build up in nerve tissue. Reduced or lost reflexes, reduced or loss of sensation may occur. Slowing of thought, memory and thinking is a normal part of aging.

b the reasons for those changes
Answer: After the age of 30, neurons decrease in number, neuroglial cells increase in size and number, axons thin and decrease in number and dendrites decrease in number. This will result in reduction function, speed of thinking and processing and decreased cognition and memory. Reduction in the production of acetylcholine, dopamine, serotonin and noradrenaline plays a role in reduced cognition and increased depression.

c what can be done to reduce or delay the changes to the nervous system.
Answer: Mental and physical exercise can help the brain maintain its function. Reading, doing crossword puzzles and having stimulating conversation are examples of mental exercises. Physical activity will increase blood flow to the brain and can help reduce the loss of brain cells.