

Essential Insight Exam Guide

Human Biology

Year 12 WACE

Western Australian Curriculum

2025 Edition

Suellen Mary

Essential Insight Exam Guide

Human Biology

Year 12 WACE

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Acknowledgements

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Notes	<ul style="list-style-type: none"> • Science Inquiry Skills is a component of the curriculum that is often embedded within the questions of other topics. Questions which focus primarily on Science Inquiry Skills have been categorised within their own topic as the last chapter of this Exam Guide. • Some question material has not been released by SCSA due to copyright restrictions and are not able to be included in this exam guide. This has been flagged in the relevant questions in the exam guide. Teachers may still be able to locate many of these sources and provide these to students by following the links at the end of the original SCSA exams on the SCSA website.
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Unit 3 – Homeostasis and disease

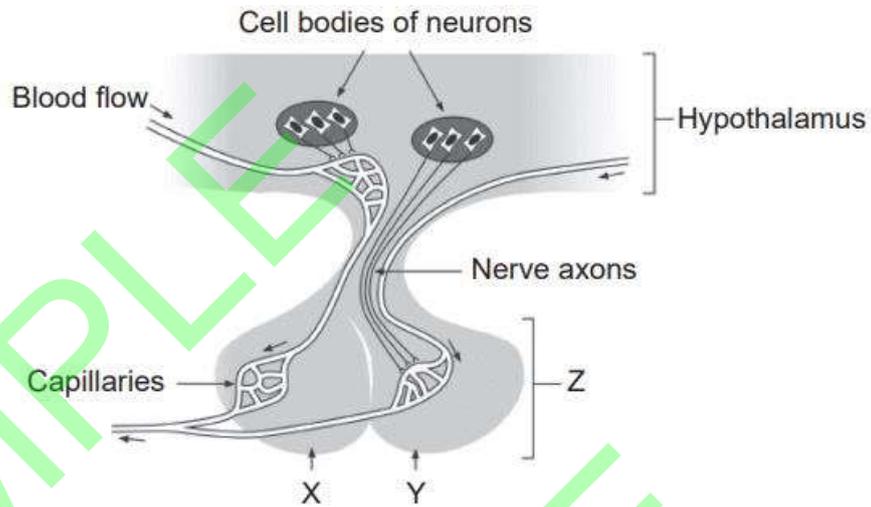
Unit 3 – Endocrine system

Section 1

2023
Section 1
Questions
7-8

Endocrine
system

Questions 7 and 8 refer to the diagram shown below.



7. Structure Z interacts closely with the hypothalamus to maintain many bodily functions. It consists of two lobes. Which of the following identifies X, Y and Z correctly?

	X	Y	Z
(a)	anterior lobe	posterior lobe	pituitary gland
(b)	anterior lobe	posterior lobe	thyroid gland
(c)	posterior lobe	anterior lobe	pituitary gland
(d)	posterior lobe	anterior lobe	thyroid gland

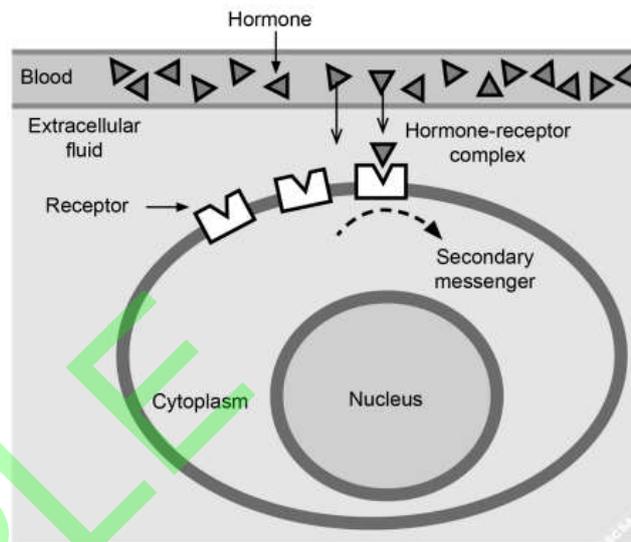
8. A hormone released from structure Y is

- (a) growth hormone.
- (b) prolactin.
- (c) thyroxine.
- (d) oxytocin.

2022
Section 1
Question
6-7

Endocrine
system

Questions 6 and 7 refer to the diagram shown below, which represents a hormonal action.



6. The hormonal action shown in the diagram is **best** described as

- (a) water soluble, as the hormone-receptor complex will enter the nucleus and act on the DNA molecule.
- (b) lipid soluble, as the hormone diffuses across the cell membrane to attach to a receptor inside the cell.
- (c) lipid soluble, as the secondary messenger will enter the nucleus and act on the DNA molecule.
- (d) water soluble, as the hormone binds to a receptor on the outside of the cell membrane to form a hormone-receptor complex.

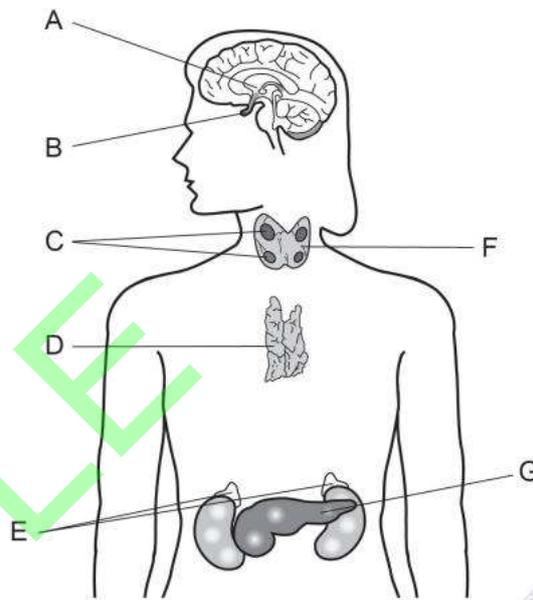
7. Which of the following is a correct comparison between a hormonal mode of transmission (like the one shown in the diagram) and neural transmission?

- (a) speed of transmission can be faster
- (b) duration of the message can be long-lasting
- (c) the message is only short lived in the cell
- (d) nature of the transmission is electrochemical

2021
Section 1
Question
4-5

Endocrine
system

Questions 4 and 5 refer to the diagram shown below.

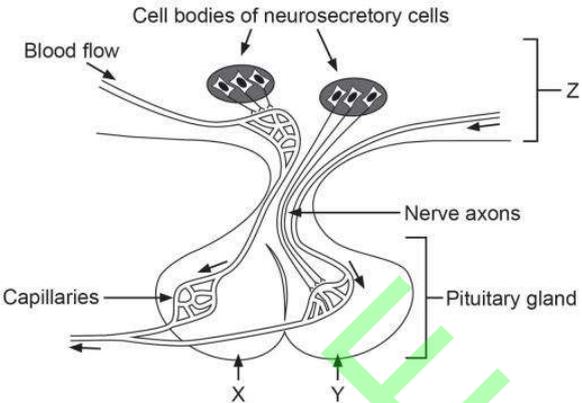


4. Which of the following identifies correctly the endocrine gland, with the hormone it secretes and the target organ?

	Endocrine gland	Hormone secreted	Target organ
(a)	D	Adrenaline	Brain
(b)	E	Cortisol	Stomach
(c)	F	Thyroid	Kidneys
(d)	G	Glucagon	Liver

5. Which of the endocrine glands labelled is/are responsible for controlling metabolic rate?

- (a) F only
- (b) F and C
- (c) B only
- (d) B and F

<p>2021 Section 1 Question 26-27</p> <p>Endocrine system</p>	<p>Questions 26 and 27 refer to the diagram below</p>  <p>In which location/s is growth hormone produced?</p> <p>(a) X (b) X and Y (c) Z (d) X and Z</p> <p>Which of the following hormones are released from structure 'Y'?</p> <p>(a) antidiuretic hormone and adrenocorticotrophic hormone (b) adrenocorticotrophic hormone and oxytocin (c) follicle stimulating hormone and luteinising hormone (d) antidiuretic hormone and oxytocin</p>
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<p>2020 Section 1 Question 1</p> <p>Endocrine system</p>	<p>The target organ for the hormone calcitonin is the</p> <p>(a) parathyroid gland. (b) adrenal gland. (c) bones. (d) liver.</p>
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<p>2019 Section 1 Question 22</p> <p>Endocrine system</p>	<p>Enlargement of the thyroid gland due to a lack of iodine is called</p> <p>(a) exophthalmia. (b) thyrotoxicosis. (c) goitre. (d) Graves' disease.</p>
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Section 2

2020
Section 2
Question
31

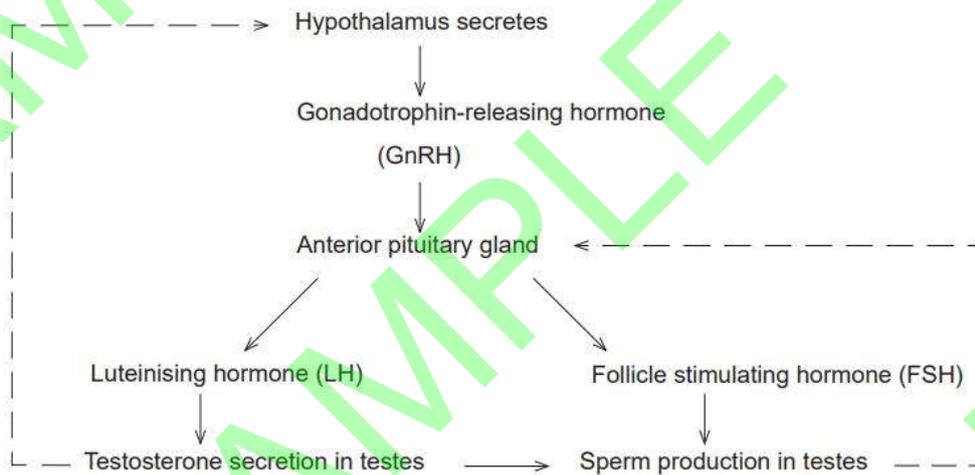
Endocrine
system

The nervous system and endocrine system often work together to ensure homeostasis is maintained within the human body.

(a) Hormones differ from nerves in their mode of action. In relation to the mode of transmission and response time, state how a hormonal response is different from a nervous response. (2 marks)

Mode of transmission:

Response time:



The following questions refer to the diagram on page 16 showing the hormonal control of the male testes.

(b) (i) The dotted lines on the diagram indicate negative feedback. Outline what is meant by the term negative feedback. (1 mark)

(ii) Describe the role of the receptor in a feedback loop. (2 marks)

Trisha noticed that she had similar physiological changes when she was placed in a stressful situation. These changes were brought about by secretions from the adrenal glands.

Shown below is a diagram of an adrenal gland.

Copyright restrictions prohibit the release of this SCSA exam material.

(b) Complete the table below, contrasting the two different parts of the adrenal gland. (10 marks)

	X	Y
Part of the adrenal gland	(1 mark)	(1 mark)
Hormone produced	(1 mark)	Adrenaline and noradrenaline
Effect of the hormone	Helps the body to deal with stress and promotes repair of damaged tissue	
		(1 mark)
Outline how the release of this hormone is stimulated	(3 marks)	(3 marks)

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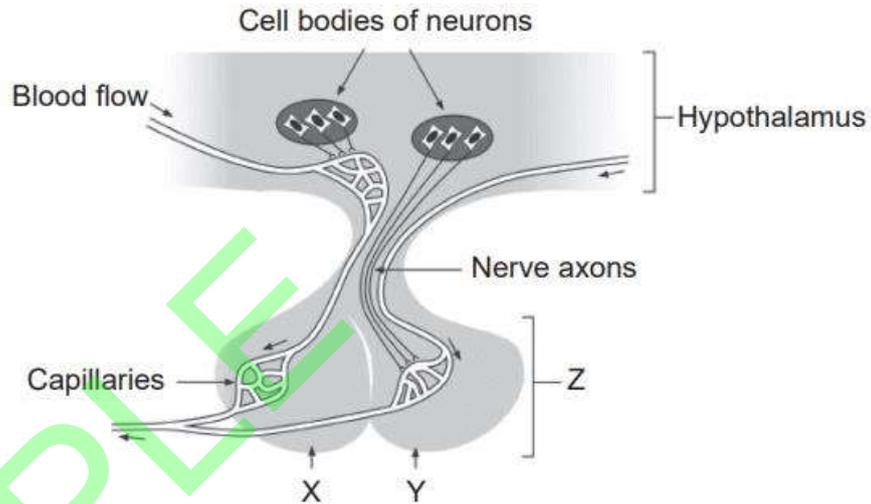
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2023
Section 1
Questions
7-8
Endocrine
system

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(b)	anterior lobe	posterior lobe	thyroid gland
(c)	posterior lobe	anterior lobe	pituitary gland
(d)	posterior lobe	anterior lobe	thyroid gland

Answer is a.

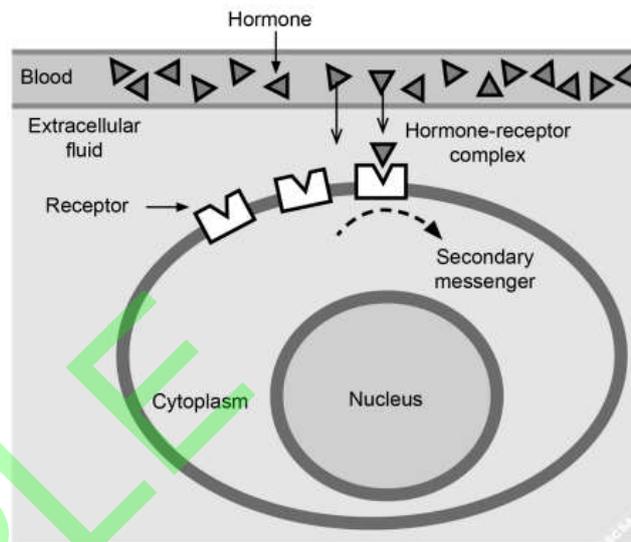
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- (a) growth hormone.
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- (c) thyroxine.
- (d) oxytocin. – Answer

2022
Section 1
Question
6-7

Endocrine
system

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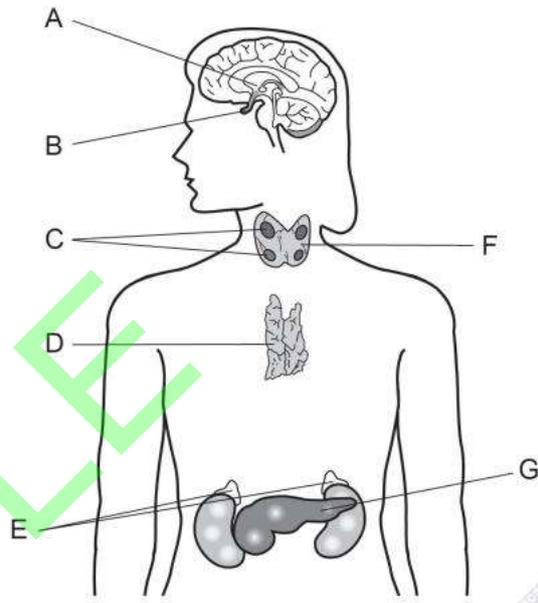
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- (a) speed of transmission can be faster
- (b) duration of the message can be long-lasting – Answer**
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**2021
Section 1
Question
4-5**

**Endocrine
system**

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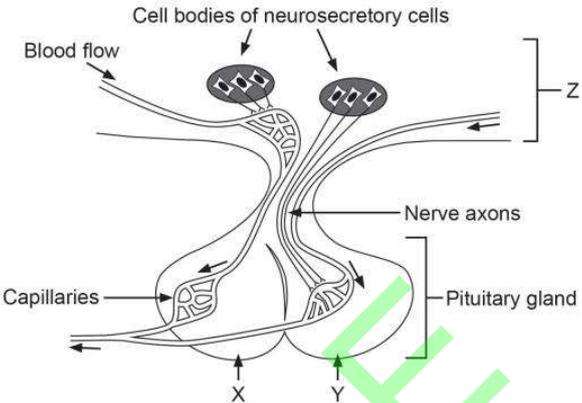
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(b)	E	Cortisol	Stomach
(c)	F	Thyroid	Kidneys
(d)	G	Glucagon	Liver

Answer is D.

5. Which of the endocrine glands labelled is/are responsible for controlling metabolic rate?

- (a) F only
- (b) F and C
- (c) B only
- (d) B and F – Answer**

<p>2021 Section 1 Question 26-27</p> <p>Endocrine system</p>	<p>Questions 26 and 27 refer to the diagram below</p>  <p>In which location/s is growth hormone produced?</p> <p>(a) X – Answer (b) X and Y (c) Z (d) X and Z</p> <p>Which of the following hormones are released from structure 'Y'?</p> <p>(a) antidiuretic hormone and adrenocorticotropic hormone (b) adrenocorticotropic hormone and oxytocin (c) follicle stimulating hormone and luteinising hormone (d) antidiuretic hormone and oxytocin – Answer</p>
<p>2020 Section 1 Question 1</p> <p>Endocrine system</p>	<p>The target organ for the hormone calcitonin is the</p> <p>(a) parathyroid gland. (b) adrenal gland. (c) bones. – Answer (d) liver.</p>
<p>2019 Section 1 Question 22</p> <p>Endocrine system</p>	<p>Enlargement of the thyroid gland due to a lack of iodine is called</p> <p>(a) exophthalmia. (b) thyrotoxicosis. (c) goitre. – Answer (d) Graves' disease.</p>

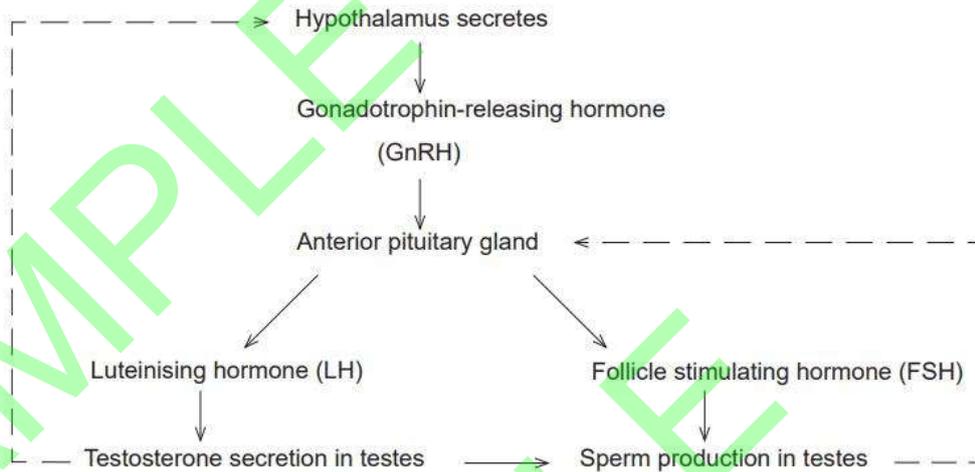
2020
Section 2
Question
31

Endocrine
system

The nervous system and endocrine system often work together to ensure homeostasis is maintained within the human body.

(a) Hormones differ from nerves in their mode of action. In relation to the mode of transmission and response time, state how a hormonal response is different from a nervous response. (2 marks)

Description	Marks
Mode of transmission – bloodstream	1
Response time – slower	1
Total	2



The following questions refer to the diagram on page 16 showing the hormonal control of the male testes.

(b) (i) The dotted lines on the diagram indicate negative feedback. Outline what is meant by the term negative feedback. (1 mark)

Description	Marks
response reduces stimulus/response works in opposition to stimulus	1
Total	1

(ii) Describe the role of the receptor in a feedback loop. (2 marks)

Description	Marks
detects stimulus/change	1
sends signal to coordinating centre/modulator/control centre	1
Total	2

(c) Identify the following components shown in the diagram on page 16. (2 marks)

Description	Marks
Control centre – hypothalamus	1
Effector – testes	1
Total	2

(d) If a tumour began to affect the functioning of the anterior pituitary by inhibiting the production of LH and FSH, explain the impact this would have on the fertility of the affected male. (3 marks)

Description	Marks
decreased fertility	1
tumour reduces the secretion of testosterone	1
which will reduce the production/maturation of sperm	1
Total	3

**2019
Section 2
Question
36**

**Endocrine
system**

On a hot, dry day, Trisha noticed several physiological changes to her body while exposed to the sun.

(a) Identify two separate effectors and describe the physiological responses that occur in each that would help Trisha maintain her body temperature in the scenario above. (6 marks)

Description	Marks
For each two effectors	
<ul style="list-style-type: none"> • skin/peripheral arterioles • vasodilation • via ↑ radiation/convection/conduction 	1–3
<ul style="list-style-type: none"> • sweat glands • ↑ sweating • ↑ evaporation 	1–3
Total	6

Trisha noticed that she had similar physiological changes when she was placed in a stressful situation. These changes were brought about by secretions from the adrenal glands.

Shown below is a diagram of an adrenal gland.

Copyright restrictions prohibit the release of this SCSA exam material.

(b) Complete the table below, contrasting the two different parts of the adrenal gland. (10 marks)

Description			Marks
1 mark per box for first three criteria 3 marks for each process			
	X	Y	
part of the adrenal gland	cortex	medulla	1–2
Hormone it produced	cortisol	Adrenaline and noradrenaline	1
Effect of the hormone	Helps the body to deal with stress and promotes repair of damaged tissue	prepares the body for the fight or flight response/or name a specific response (e.g. increase heart rate)	1
Outline how the release of this hormone is stimulated	<ul style="list-style-type: none"> • anterior pituitary releases • adrenocorticotrophic hormone (ACTH) • travels via blood stream 	<ul style="list-style-type: none"> • CNS/hypothalamus sends • electrical impulses • travels along the ANS/sympathetic pathways 	1–6
	Total		10
Accept other relevant answers.			

Marking Guide – Section 3

2023
Section 3
Question
38

Endocrine
system

Changes to the amount of thyroxine being released from the thyroid gland can have major impacts on the functioning of the body.

(a) Name each of the disorders that may lead to an over-secretion or under-secretion of thyroxine; describe how the over-secretion or under-secretion impacts on the body; and explain how each disorder can be treated. (12 marks)

Description		Marks
Disorder	Disorder	
Hypothyroidism/Hashimoto's disease	Hyperthyroidism/Graves' disease	1–2
Subtotal		2
Impacts	Impacts	
low levels of thyroxine lead to a decrease in metabolic rate causing symptoms such as	high levels of thyroxine lead to overstimulation of body cells which cause things such as	1–2
Subtotal		2
Any two of	Any two of	
<ul style="list-style-type: none"> • decreased heart rate • decreased BP • cold intolerance • weight gain • goitre/neck swelling • slow brain functioning • fatigue 	<ul style="list-style-type: none"> • increased HR • high BP • weight loss • hyperactivity • protruding eyeballs • increased sweating • increased appetite 	1–4
Subtotal		4
Treatment any two of	Treatment any two of	
<ul style="list-style-type: none"> • increase iodine in diet • synthetic hormone tablets • surgery 	<ul style="list-style-type: none"> • taking drugs to block thyroid's use of iodine • surgery to remove all/part of gland • radioactive iodine 	1–4
Subtotal		4
Total		12

(b) Explain the role of the liver in the maintenance of blood glucose levels. (8 marks)

Description	Marks
glucose removed from blood to provide energy for liver functioning	1
glucose also converted to glycogen	1
by the process of glycogenesis	1
controlled by insulin	1
glycogen is stored in the liver	1
when blood sugar levels fall glycogen is converted back to glucose	1
by the process of glycogenolysis	1
controlled by glucagon	1
Total	8

2022
Section 3
Question
38
Endocrine
system

Two unrelated patients; X and Y, visited the same neurosurgeon. The patients had very similar names, and both had a form of brain damage. The neurosurgeon asked Patient X to complete a point-to-point movement test, where the index finger touches the nose and then touches the outstretched finger of the neurosurgeon. He was also asked to walk across the room while the neurosurgeon observed his stability. Patient X found this very strange, as these tests were not what he normally experienced. He has a benign growth below the hypothalamus, reducing levels of thyroid-stimulating hormone. When Patient X questioned this, the neurosurgeon realised he had mixed up the two patients and mistakenly thought he was seeing Patient Y.

(a) Using the information above, identify the part of the brain damaged in both patients (X and Y), describe the role of these parts in normal body functioning and describe the effects damage to these structures would have on both patients. (12 marks)

Description	Marks
Patient X	
Affected part – Anterior Pituitary	1
Normal role – any two of <ul style="list-style-type: none"> • produces hormones • releases hormones • maintain homeostasis 	1–2
Possible effects of damage – any three of <ul style="list-style-type: none"> • hypothyroidism/reduced thyroxine • fatigue/reduced energy levels/weakness/lethargy/reduced metabolic rate • loss of appetite • slow heart rate • feeling cold (especially in hands and feet) • increase weight/fluid retention 	1–3
Subtotal	6
Patient Y	
Affected part – Cerebellum	1
Normal role – any two of <ul style="list-style-type: none"> • coordination of voluntary motor movement • balance/equilibrium/posture • muscle tone 	1–2
Possible effects of damage – any three of <ul style="list-style-type: none"> • loss of coordination of motor movement • the inability to judge distance and when to stop • the inability to perform rapid alternating movements • movement tremors • staggering, wide based walking • tendency toward falling • weak muscles • slurred speech • abnormal eye movements 	1–3
Subtotal	6
Total	12

(b) Describe how the hypothalamus and pituitary work together to achieve their main function. (8 marks)

Description	Marks
Posterior pituitary	
Hormones are produced (in cell bodies located) in the hypothalamus/not produced by pituitary.	1
Hormones are transported down the axons/neurosecretory cells.	1
Hormones stored in posterior lobe.	1
Released via nervous stimulation.	1
Subtotal	4
Anterior pituitary	
Hormones produced in anterior lobe.	1
Inhibiting and releasing factors secreted by hypothalamus determine the release of hormones.	1
Blood vessels (hypothalamic-hypophyseal portal system) connect hypothalamus with the anterior lobe/travels in the blood.	1
Released via chemical/hormonal stimulation.	1
Subtotal	4
Total	8

2020
Section 3
Question
40

Endocrine
system

Production of the human growth hormone (hGH) is controlled by a gene. Lack of this hormone leads to dwarfism in humans.

(a) hGH is released from the pituitary gland. State from which lobe of the pituitary this hormone is secreted and explain the relationship between this lobe of the pituitary gland and the hypothalamus. (6 marks)

Description	Marks
secreted from the anterior lobe	1
communication between the hypothalamus and the anterior pituitary occurs through chemicals/hormones	1-5
through the infundibulum/blood vessels	
hypothalamus stimulates the anterior pituitary to release hormones	
via releasing factors/hormones	
the hormones are released into a capillary network and transported through veins	
also produces inhibiting factors to inhibit activity of the pituitary	
Total	6

(b) hGH is a water-soluble hormone. Explain how hGH enters and affects the functioning of its target cell. (6 marks)

Description	Marks
Enters target cell	
dissolve in water (not fats) so cannot pass through cell membrane	1–3
hormone molecule attaches to receptor molecule	
receptor molecule found on surface of target cell	
receptor molecule must match shape of signalling molecule	
Subtotal	3
Affects target cell	
binding of hormone to receptor triggers a secondary messenger/response inside the cell	1–3
secondary messenger activates enzymes inside the cytoplasm	
enzymes adjust chemical activity of the cell	
speed of reactions will either increase or decrease	
Subtotal	3
Total	6

(c) Dwarfism can be treated using synthetically produced hGH. Explain how hGH could be produced using recombinant DNA technology. (8 marks)

Description	Marks
gene for hGH located (on human chromosome)	1–8
gene cut out using endonuclease/treated with restriction enzyme	
cuts DNA at specific sites/produces sticky ends	
plasmid cut with same restriction enzyme	
gene inserted into plasmid using ligase	
acts as a vector/produces a transgenic organism	
recombinant plasmid enters into host bacterial cell	
which propagates/replicates/clone	
bacteria express gene to synthesize human protein/hormone	
produces large scale amounts of hGH	
Total	8

Unit 3 – Central and peripheral nervous system

Section 1

<p>2023 Section 1 Question 1</p> <p>Central and peripheral nervous system</p>	<p>The difference between grey and white matter found within the spinal cord is that</p> <p>(a) white matter contains dendrites of neurons, while grey matter contains cell bodies of neurons. (b) grey matter contains unmyelinated neurons, while white matter contains myelinated neurons. (c) white matter contains cell bodies of neurons, while grey matter contains dendrites of neurons. (d) grey matter contains myelinated neurons, while white matter contains unmyelinated neurons.</p>
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<p>2023 Section 1 Question 10</p> <p>Central and peripheral nervous system</p>	<p>Chemoreceptors monitor the level of gases in the body and can be found in all areas listed except the</p> <p>(a) carotid body. (b) aortic arch. (c) nose. (d) brain.</p>
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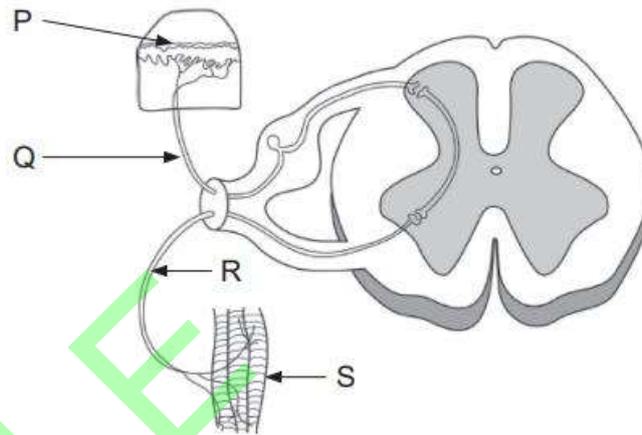
<p>2023 Section 1 Question 22-23</p> <p>Central and peripheral nervous system</p>	<p>Questions 22 and 23 refer to the diagram shown below.</p> <p style="text-align: center;">Copyright restrictions prohibit the release of this SCSA exam material.</p> <p>22. Which of the following matches the name of the stage of the action to the labels shown on the diagram?</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td style="text-align: center;">polarisation</td> <td style="text-align: center;">depolarisation</td> <td style="text-align: center;">repolarisation</td> <td style="text-align: center;">resting state</td> </tr> <tr> <td>(b)</td> <td style="text-align: center;">depolarisation</td> <td style="text-align: center;">hyperpolarisation</td> <td style="text-align: center;">repolarisation</td> <td style="text-align: center;">polarised</td> </tr> <tr> <td>(c)</td> <td style="text-align: center;">depolarisation</td> <td style="text-align: center;">repolarisation</td> <td style="text-align: center;">hyperpolarisation</td> <td style="text-align: center;">resting state</td> </tr> <tr> <td>(d)</td> <td style="text-align: center;">polarisation</td> <td style="text-align: center;">hyperpolarisation</td> <td style="text-align: center;">depolarisation</td> <td style="text-align: center;">polarised</td> </tr> </tbody> </table> <p>23. The stage at which potassium ions flow out of the neuron is</p> <p>(a) 1. (b) 2. (c) 3. (d) 4.</p>		2	3	4	5	(a)	polarisation	depolarisation	repolarisation	resting state	(b)	depolarisation	hyperpolarisation	repolarisation	polarised	(c)	depolarisation	repolarisation	hyperpolarisation	resting state	(d)	polarisation	hyperpolarisation	depolarisation	polarised
	2	3	4	5																						
(a)	polarisation	depolarisation	repolarisation	resting state																						
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(d)	polarisation	hyperpolarisation	depolarisation	polarised																						

<p>2023 Section 1 Question 27</p> <p>Central and peripheral nervous system</p>	<p>Which division of the nervous system is most likely to have been damaged if a person has a loss of touch sensations and numbness in their hands?</p> <p>(a) autonomic sympathetic (b) afferent parasympathetic (c) efferent autonomic (d) afferent somatic</p>
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**2023
Section 1
Question
18-20**

**Central and
peripheral
nervous
system**

Questions 18,19 and 20 refer to the diagram shown below.



18. Which of the labels identifies structures Q, R and S correctly?

	Q	R	S
(a)	sensory neuron	interneuron	effector
(b)	motor neuron	sensory neuron	receptor
(c)	sensory neuron	motor neuron	effector
(d)	interneuron	motor neuron	receptor

19. The key difference between structures Q and R is

- (a) R carries impulses towards the central nervous system, while Q carries impulses away from the central nervous system.
- (b) Q carries impulses towards the ganglion, while R carries impulses away from the ganglion.
- (c) Q has only one nerve fibre, while R has two nerve fibres.
- (d) R carries impulses away from the central nervous system, while Q carries impulses towards the central nervous system.

20. If an individual was involved in an accident that cut structure Q, what would be the consequence of this?

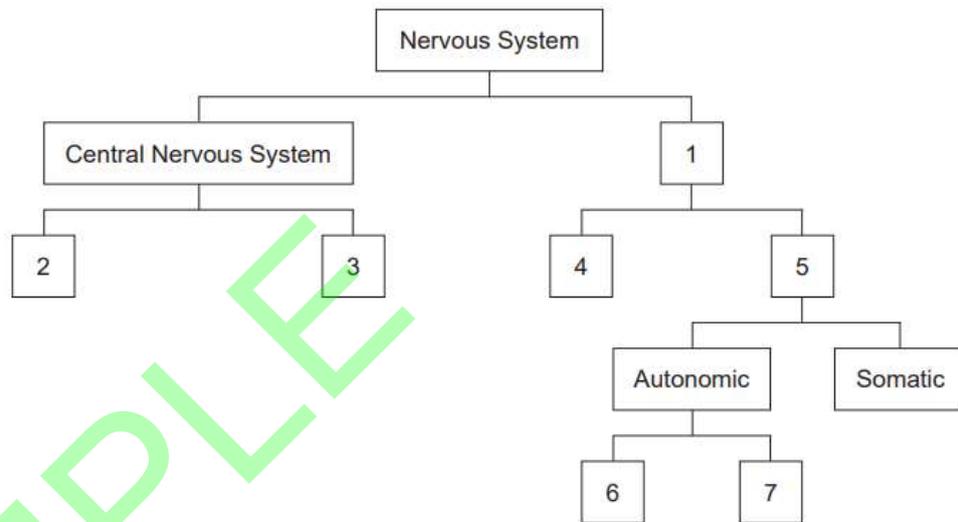
The transmission of impulses from the

- (a) effector to the spinal cord would be affected.
- (b) receptor to the spinal cord would be affected.
- (c) spinal cord to the effector would be affected.
- (d) spinal cord to the receptor would be affected.

**2022
Section 1
Question
1-2**

**Central and
peripheral
nervous
system**

Questions 1 and 2 refer to the diagram shown below, which represents the divisions of the nervous system.



1. Which of the following identifies the numbered components in the diagram correctly?

	2	3	4	5
(a)	brain	spinal cord	afferent	efferent
(b)	voluntary	involuntary	sensory	motor
(c)	visceral	peripheral	efferent	afferent
(d)	spinal cord	brain	voluntary	involuntary

2. The activation of Component 7 results in the constriction of the pupil of the eye. Which of the following would also occur when Component 7 is activated?

- (a) increased sweating
- (b) increased release of glucose from the liver
- (c) decreased heart rate
- (d) decreased secretion of saliva

**2022
Section 1
Question 3**

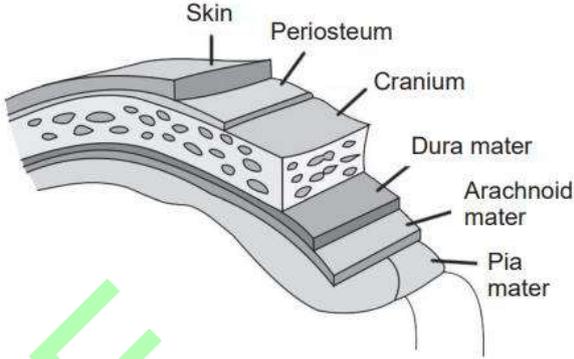
**Central and
peripheral
nervous
system**

Blind people are taught to read Braille (raised marks that create patterns on paper). They do this by running their fingertips over the markings. The pathway the impulse travels from the fingers to the brain includes some of the following components:

- I. touch receptors
- II. connector neuron
- III. motor neuron
- IV. sensory neuron
- V. thalamus to cerebrum
- VI. thalamus to cerebellum.

The correct order of the components in the pathway is

- (a) IV - II - III - VI
- (b) I - IV - II - V
- (c) III - II - IV - V
- (d) I - II - V - VI

<p>2022 Section 1 Question 23</p> <p>Central and peripheral nervous system</p>	<p>Question 23 refers to the diagram shown below, which represents the layers around the brain.</p>  <p>Referring to the layers around the brain as shown in the diagram, where is cerebrospinal fluid found?</p> <p>(a) between the periosteum and the cranium (b) under the pia mater layer (c) between the cranium and the dura mater (d) within the arachnoid mater layer</p>
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<p>2022 Section 1 Question 24</p> <p>Central and peripheral nervous system</p>	<p>Cell replacement therapy for the treatment of Parkinson's disease involves the</p> <p>(a) injection of adult stem cells to replace neurons in the brain that have been damaged by the build-up of plaque. (b) differentiating of stem cells into dopamine-signalling neurons and transplanting them into a patient's brain to replace dying neurons. (c) patient's own neurons being extracted with the DNA inside the cells then altered and the cells reinserted into the patient's body. (d) extraction of non-functioning neurons and replacing them with new cells that have the correct gene and can function normally.</p>
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<p>2022 Section 1 Question 26</p> <p>Central and peripheral nervous system</p>	<p>Which of the following is the key difference between adrenaline and insulin? Insulin</p> <p>(a) is secreted in response to a chemical stimulus, while adrenaline secretion is controlled by a nerve impulse. (b) controls blood sugar concentrations, while adrenaline helps regulate temperature. (c) is secreted by the pancreas, while adrenaline is secreted by the kidneys. (d) is a water-soluble hormone, while adrenaline is a lipid-soluble one.</p>
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<p>2022 Section 1 Question 17</p> <p>Central and peripheral nervous system</p>	<p>The single, long process of a neuron that delivers signals, is termed a/an</p> <p>(a) axon. (b) axon terminal. (c) Schwann cell. (d) dendrite.</p>
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<p>2022 Section 1 Question 29</p> <p>Central and peripheral nervous system</p>	<p>Which of the following lists endocrine glands that are not controlled directly by the hypothalamus?</p> <p>(a) pituitary, thymus, adrenal medulla (b) thymus, pancreas, adrenal cortex (c) parathyroid, pancreas, adrenal medulla (d) pancreas, thyroid, pituitary</p>
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<p>2021 Section 1 Question 1</p> <p>Central and peripheral nervous system</p>	<p>Which of the following is a response when the parasympathetic nervous system is activated?</p> <p>(a) increased heart rate and breathing rate (b) pupil dilation (c) increased activity of the gastrointestinal tract (d) vasodilation of blood vessels in the skin</p>
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<p>2021 Section 1 Question 3</p> <p>Central and peripheral nervous system</p>	<p>Homeostatic response mechanisms require the transfer and recognition of information from a sensory receptor and an effector. The transmission of this information</p> <p>(a) may involve both the endocrine and nervous systems. (b) relies only on hormones for a short-term response. (c) is usually a conscious process. (d) is under control of the autonomic system only.</p>
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<p>2021 Section 1 Question 9</p> <p>Central and peripheral nervous system</p>	<p>Which of the following statements about the meninges is correct?</p> <p>They are membranes</p> <p>(a) that surround the axon of a neuron. (b) and fluids found around the brain and spinal cord. (c) that cover and protect the brain. (d) that are not found around the lower spinal cord.</p>
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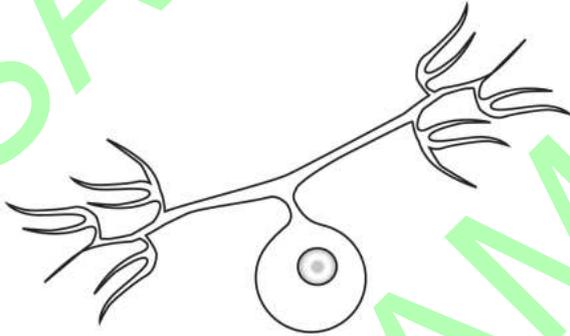
<p>2021 Section 1 Question 14-15</p> <p>Central and peripheral nervous system</p>	<p>Questions 14 and 15 refer to the diagram shown below.</p> <p>14. The correct labels for 'X', 'Y' and 'Z' for the diagram shown are</p> <table border="1"> <thead> <tr> <th></th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>osmoreceptor</td> <td>cerebellum</td> <td>diaphragm and intercostal muscles</td> </tr> <tr> <td>(b)</td> <td>chemoreceptor</td> <td>medulla oblongata</td> <td>ribcage and intercostal muscles</td> </tr> <tr> <td>(c)</td> <td>thermoreceptor</td> <td>hypothalamus</td> <td>diaphragm and alveoli</td> </tr> <tr> <td>(d)</td> <td>chemoreceptor</td> <td>medulla oblongata</td> <td>diaphragm and intercostal muscles</td> </tr> </tbody> </table>		X	Y	Z	(a)	osmoreceptor	cerebellum	diaphragm and intercostal muscles	(b)	chemoreceptor	medulla oblongata	ribcage and intercostal muscles	(c)	thermoreceptor	hypothalamus	diaphragm and alveoli	(d)	chemoreceptor	medulla oblongata	diaphragm and intercostal muscles
	X	Y	Z																		
(a)	osmoreceptor	cerebellum	diaphragm and intercostal muscles																		
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(d)	chemoreceptor	medulla oblongata	diaphragm and intercostal muscles																		

	<p>15. Where are receptors X located?</p> <p>(a) skin and hypothalamus (b) carotid artery and aorta (c) carotid artery and hypothalamus (d) aorta and cerebellum</p>
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<p>2021 Section 1 Question 17</p> <p>Central and peripheral nervous system</p>	<p>Which row identifies correctly components of the central and peripheral nervous systems?</p> <table border="1"> <thead> <tr> <th></th> <th colspan="2">Central nervous system</th> <th colspan="2">Peripheral nervous system</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>spinal cord</td> <td>brain</td> <td>autonomic</td> <td>medulla oblongata</td> </tr> <tr> <td>(b)</td> <td>somatic</td> <td>autonomic</td> <td>spinal cord</td> <td>cerebellum</td> </tr> <tr> <td>(c)</td> <td>brain</td> <td>spinal cord</td> <td>sympathetic</td> <td>somatic</td> </tr> <tr> <td>(d)</td> <td>sympathetic</td> <td>parasympathetic</td> <td>somatic</td> <td>brain</td> </tr> </tbody> </table>		Central nervous system		Peripheral nervous system		(a)	spinal cord	brain	autonomic	medulla oblongata	(b)	somatic	autonomic	spinal cord	cerebellum	(c)	brain	spinal cord	sympathetic	somatic	(d)	sympathetic	parasympathetic	somatic	brain
	Central nervous system		Peripheral nervous system																							
(a)	spinal cord	brain	autonomic	medulla oblongata																						
(b)	somatic	autonomic	spinal cord	cerebellum																						
(c)	brain	spinal cord	sympathetic	somatic																						
(d)	sympathetic	parasympathetic	somatic	brain																						

<p>2021 Section 1 Question 21</p> <p>Central and peripheral nervous system</p>	<p>The purpose of peripheral vasoconstriction in temperature regulation is to</p> <p>(a) reduce blood oxygen levels when cold thermoreceptors are triggered. (b) increase blood oxygen levels when hot thermoreceptors are triggered. (c) conserve body heat when cold thermoreceptors are triggered. (d) reduce heat loss when hot thermoreceptors are triggered.</p>
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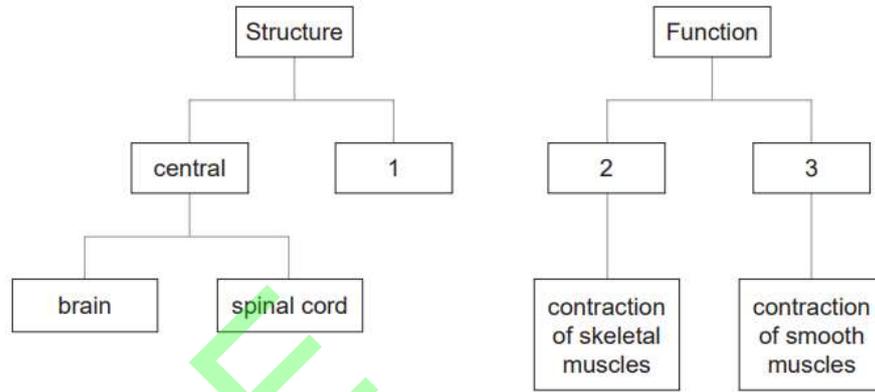
<p>2021 Section 1 Question 25</p> <p>Central and peripheral nervous system</p>	<p>The myelin sheath is</p> <p>(a) fatty tissue that speeds up the neural impulse through the cell body. (b) grey matter that changes up the neural impulse along a dendrite. (c) white matter that reduces the speed of a neural impulse along an axon. (d) fatty tissue that speeds up the neural impulse along sections of the axon.</p>
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<p>2020 Section 1 Question 19</p> <p>Central and peripheral nervous system</p>	<p>Question 19 refers to the diagram shown below.</p>  <p>The neuron illustrated would be classified correctly as</p> <p>(a) motor. (b) sensory. (c) connector. (d) multipolar.</p>
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**2020
Section 1
Question 26**

Central and peripheral nervous system

Question 26 refers to the diagram below.



26. The diagram shows two separate ways in which we can classify the nervous system. Which row correctly identifies numbers 1, 2 and 3?

	1	2	3
(a)	peripheral	somatic	autonomic
(b)	somatic	autonomic	peripheral
(c)	autonomic	peripheral	somatic
(d)	peripheral	autonomic	somatic

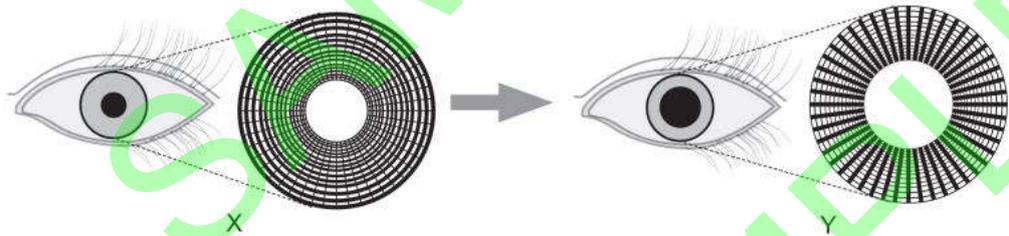
27. Target cells respond to specific hormones as a result of

- (a) nucleic acid binding sites in the membrane and cytoplasm.
- (b) specific binding sites on enzymes found in the cytoplasm.
- (c) carbohydrate receptors in the plasma membrane.
- (d) protein receptors in the plasma membrane and cytoplasm.

**2019
Section 1
Question 2**

Central and peripheral nervous system

Question 2 refers to the diagram shown below.



Which of the following statements describes the diagram correctly?

- (a) The pupil is constricted in X. Once stimulated by the parasympathetic nervous system it will become dilated, as shown in Y.
- (b) The pupil is constricted in X. Once stimulated by the sympathetic nervous system it will become dilated, as shown in Y.
- (c) The pupil is dilated in X. Once stimulated by the parasympathetic nervous system it will become constricted, as shown in Y.
- (d) The pupil is dilated in X. Once stimulated by

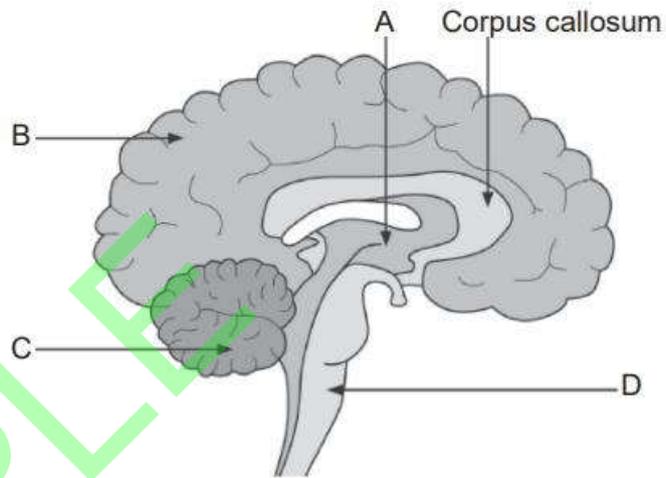
<p>2019 Section 1 Question 3</p> <p>Central and peripheral nervous system</p>	<p>The function of the corpus callosum is to</p> <p>(a) carry impulses between the left and right hemispheres of the brain. (b) connect various areas of the cortex within the same hemisphere of the brain. (c) provide protection, support and a transport network around the brain. (d) connect the cortex to other parts of the brain and to the spinal cord.</p>
<p>2019 Section 1 Question 9</p> <p>Central and peripheral nervous system</p>	<p>Which of the following is not a hypothesis as to why hominids became bipedal?</p> <p>Bipedalism</p> <p>(a) freed the hands to carry food and tools. (b) enabled the spinal column to develop a lumbar curve. (c) increased height and allowed better visibility. (d) is a more energy-efficient way of walking.</p>
<p>2019 Section 1 Question 21</p> <p>Central and peripheral nervous system</p>	<p>The stimulus for the regulation of water balance by the thirst mechanism is received by the osmoreceptors in the</p> <p>(a) cerebrum. (b) hypothalamus. (c) kidney tubule. (d) medulla oblongata.</p>
<p>2019 Section 1 Question 24</p> <p>Central and peripheral nervous system</p>	<p>Cell replacement therapy involves</p> <p>(a) injecting islet cells into a patient. (b) transplanting stem cells into a patient. (c) removing faulty genes and replacing with healthy ones. (d) inserting a recombinant gene in the cells of a patient.</p>
<p>2019 Section 1 Question 27</p> <p>Central and peripheral nervous system</p>	<p>In general, when compared to hormones, nervous impulses have a</p> <p>(a) short duration and a short response time and are involved in long-term adjustments. (b) long duration and a long response time and are involved in short-term adjustments. (c) long duration and a short response time and are involved in short-term adjustments. (d) short duration and a short response time and are involved in short-term adjustments.</p>

Section 2

2023
Section 2
Question
31

Central and
peripheral
nervous
system

The following question refers to the diagram of the human brain shown below.



(a) Identify structures A and C. (2 marks)

A:

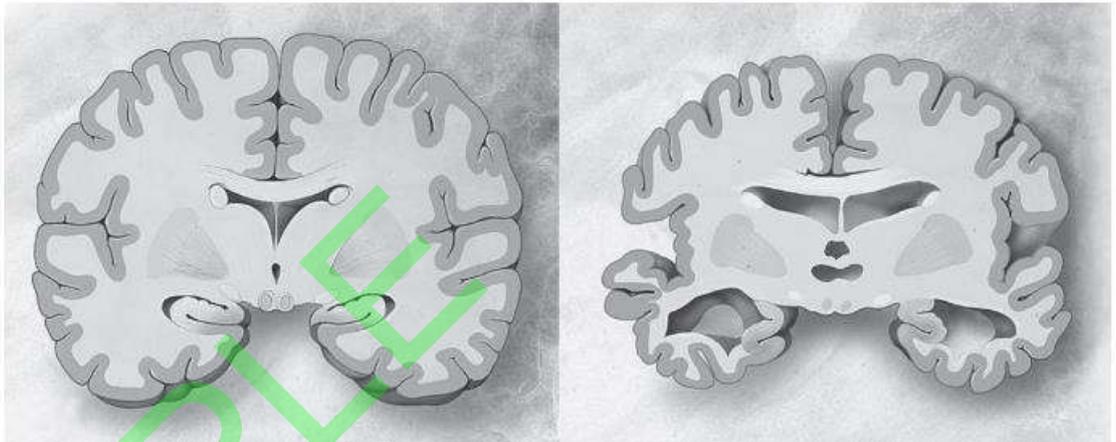
C:

(b) List **two** homeostatic processes that are controlled by structure D. (2 marks)

One:

Two:

Alzheimer's is a disease of the brain that mostly affects older people. The diagram below shows differences that can be observed when comparing a normal brain to that of an individual suffering from Alzheimer's. One of the main differences that can be observed is the change to the cerebral cortex.



(c) (i) State the change that has occurred to the cerebral cortex of an Alzheimer's sufferer. (1 mark)

(ii) Describe how the change to the cerebral cortex has occurred. (2 marks)

Emerging evidence suggests that Alzheimer's-related brain changes may be produced because of clumping together of proteins and the creation of tangles in-between neurons that disrupt cell functioning and synaptic transmission.

(d) (i) Define the term 'synapse'. (1 mark)

(ii) Annotate the diagram below to show the processes involved in the transmission of a nerve impulse across the synapse. Include labels of the parts and stages in the process. (6 marks)

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	(iii) Explain how cell replacement therapy aims to help Alzheimer's sufferers. (3 marks)

2022 Section 2 Question 31 Central and peripheral nervous system	The following question refers to the diagram below, which shows a neuron.
	Copyright restrictions prohibit the release of this SCSA exam material.
	(a) Identify the type of neuron shown in the diagram. (1 mark)
	(b) List two features of the neuron that can be used to distinguish it from other types of neurons found in the human body. (2 marks)
	One:
	Two:
(c) State the function of the structure labelled as X. (1 mark)	

The function of nerves is to transmit electrical impulses.

(d) Contrast the transmission of nerve impulses in myelinated and unmyelinated neurons. (4 marks)

Some local anaesthetics work by interfering with the sodium ion channels in the membrane of a neuron.

(e) (i) Describe the role of sodium channels found within a neuron's cell membrane. (2 marks)

(ii) If a local anaesthetic works by blocking the sodium channels, describe how this would affect the conduction of an action potential. (2 marks)

A study using rats looked at the impact of local anaesthetics on blocking the release of calcium ions at an axon terminal.

(f) Explain how this would lead to pain signals from affected parts of the body not reaching the brain. (6 marks)

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<p>2022 Section 2 Question 33</p> <p>Central and peripheral nervous system</p>	<p>Congenital insensitivity to pain is a genetic condition that affects the ability of the body to detect pain stimuli. The condition affects the sodium channels of the pain receptors that transmit messages to the brain and spinal cord.</p> <p>(a) State one specific location in the body where pain receptors are found. (1 mark)</p> <hr/> <p>Congenital insensitivity to pain is caused by a mutation to the SCN9A gene.</p> <p>(b) Distinguish a gene mutation from a chromosomal mutation. (2 marks)</p> <hr/> <hr/> <hr/> <hr/>
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	<p>The following question refers to the diagram below, which represents different types of mutations.</p> <p>Copyright restrictions prohibit the release of this SCSA exam material.</p> <p>(c) The mutation to the SCN9A gene is classified as a substitution mutation. Identify which of the three mutations shown above (X, Y or Z) is a substitution mutation and state how the substitution mutation alters the genome. (2 marks)</p> <hr/> <hr/> <hr/> <hr/> <p>(d) To examine the SCN9A mutation in patients, DNA sequencing needs to be carried out. For the following bacterial enzymes, state the biotechnological technique they are used in and describe their role in that technique. (4 marks)</p> <p>Restriction enzymes:</p> <hr/> <hr/> <hr/> <hr/> <p>DNA polymerase:</p> <hr/> <hr/> <hr/> <hr/>
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<p>2021 Section 2 Question 31</p> <p>Central and peripheral nervous system</p>	<p>The following question refers to the diagram of the brain shown below.</p> <p>Copyright restrictions prohibit the release of this SCSA exam material.</p> <p>(a) (i) Identify structure 'Z'. (1 mark)</p> <hr/> <p>(ii) State one function of structure 'Y'. (1 mark)</p> <hr/> <hr/>
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(iii) Indicate on the diagram, with a line and label, where the corpus callosum would be located. (1 mark)

(b) (i) Which region, A or B, shows structures that would be found in the outer layer of structure 'X'? (1 mark)

(ii) Justify your decision in part (b)(i). (2 marks)

A man injured his back in a diving accident. Doctors were concerned there was damage to his spine and neural pathways. They touched different areas of his skin with a sharp point and asked him to indicate each time if he felt a sharp point. The sharp point should be felt in two ways, one of which would be pain.

(c) (i) What other sensation would be experienced by the man? (1 mark)

(ii) Describe how this sensation would be detected and registered by the man. (2 marks)

The man felt the sharp point when the point touched his arms, but not when the point touched his legs.

(d) Suggest what this information could tell the doctors about the damage to the man's spinal cord. Explain your answer. (3 marks)

**2020
Section 2
Question
34**

**Central and
peripheral
nervous
system**

Opponents of the sport of boxing are often concerned with the incidence of traumatic brain injury that occurs among individuals who box on a regular basis. Punches that force the head up and back may cause damage to the cerebellum, as the brain is squashed up against the back of the skull.

(a) (i) List **three** structures that would normally assist in protecting the brain against injury. (3 marks)

One:

Two:

Three:

(ii) Suggest **two** symptoms a boxer might display if the cerebellum was damaged. (2 marks)

One:

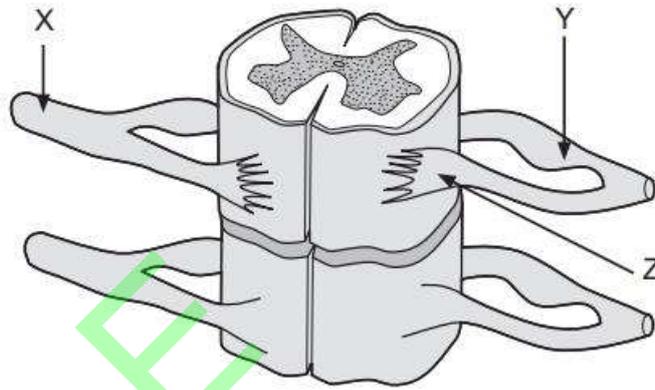
Two:

Muhammad Ali, a former boxer, developed Parkinson's disease. Although not conclusively linked to his boxing career, in his case it was associated with head trauma.

(b) (i) Describe the cause of Parkinson's disease. (2 marks)

(ii) Describe how cell replacement therapy could be used to treat Parkinson's disease. (2 marks)

The following questions refer to the diagram below, which shows a cross section of the spinal cord.



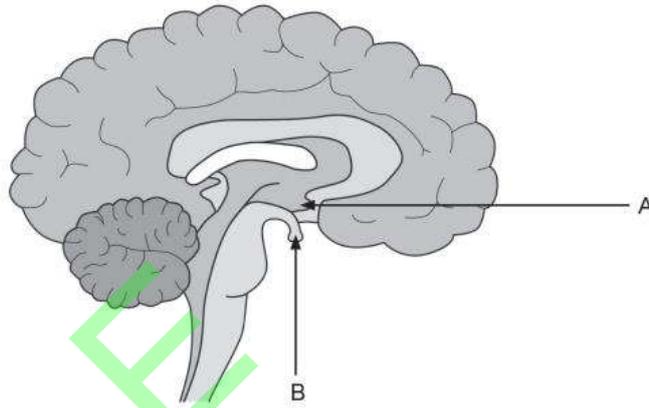
(c) (i) If 'X' is injured, it can lead to paralysis of part/s of the body and loss of sensation, depending on how high up the spinal cord the injury is. Why does this occur? (2 marks)

(ii) If Y is damaged, there will be a loss of feeling, but movement can still occur. Injury to Z leads to paralysis, but there will still be a sense of feeling. Explain why this difference occurs. (4 marks)

2019
Section 2
Question
32

Central and
peripheral
nervous
system

(a) The following question refers to the diagram of the brain shown below.



(i) Identify structure A. (1 mark)

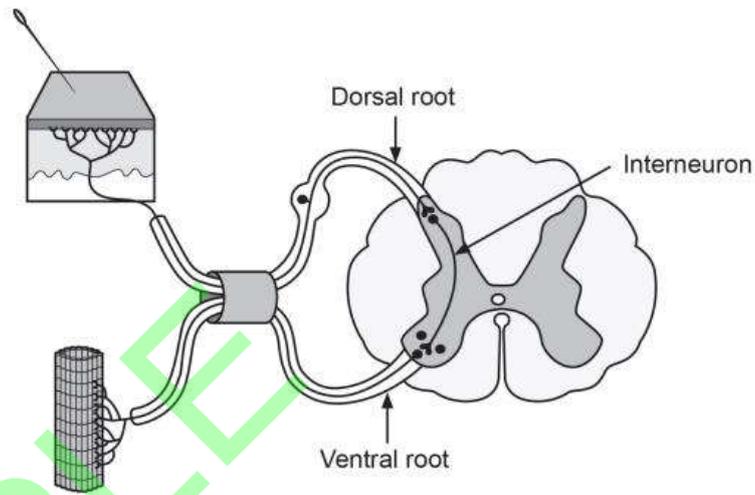
(ii) State one function of structure B. (1 mark)

(b) Contrast the role of the cerebellum and the medulla oblongata. (2 marks)

Multiple sclerosis (MS) is a disease that destroys Schwann cells in the central nervous system.

(c) (i) State the effect of the loss of the Schwann cells on the transmission of nerve impulses and describe why this occurs. (3 marks)

Question 35 (b) refers to the diagram of a spinal reflex arc show below.



(b) (i) Outline the purpose of a spinal reflex arc. (1 mark)

(ii) On the diagram of the reflex arc shown above, shade in the afferent pathway. (1 mark)

For the spinal reflex arc to function, the interneuron shown in the diagram must be triggered at the synapse. This creates an action potential that propagates along the neuron to be passed to the next neuron.

(iii) Explain how an action potential continues along the interneuron. (4 marks)

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Blank lined writing area with a light blue vertical margin on the left side.

Blank lined writing area with a light blue vertical margin on the left side.

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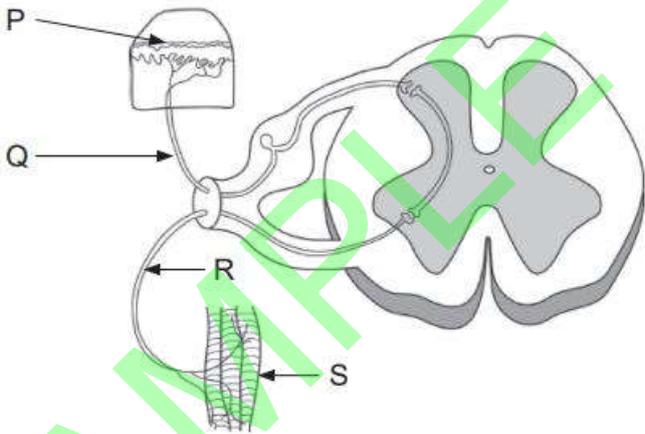
Handwriting practice area with a light blue vertical margin on the left and 20 horizontal lines for writing. The word "SAMPLE" is printed diagonally across the page in a light green font.

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Marking Guide – Section 1

<p>2023 Section 1 Question 1</p> <p>Central and peripheral nervous system</p>	<p>The difference between grey and white matter found within the spinal cord is that</p> <p>(a) white matter contains dendrites of neurons, while grey matter contains cell bodies of neurons. (b) grey matter contains unmyelinated neurons, while white matter contains myelinated neurons. – Answer (c) white matter contains cell bodies of neurons, while grey matter contains dendrites of neurons. (d) grey matter contains myelinated neurons, while white matter contains unmyelinated neurons.</p>
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<p>2023 Section 1 Question 10</p> <p>Central and peripheral nervous system</p>	<p>Chemoreceptors monitor the level of gases in the body and can be found in all areas listed except the</p> <p>(a) carotid body. (b) aortic arch. (c) nose. – Answer (d) brain.</p>
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<p>2023 Section 1 Question 18-20</p> <p>Central and peripheral nervous system</p>	<p>Questions 18,19 and 20 refer to the diagram shown below.</p>  <p>18. Which of the labels identifies structures Q, R and S correctly?</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">Q</th> <th style="text-align: center;">R</th> <th style="text-align: center;">S</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td style="text-align: center;">sensory neuron</td> <td style="text-align: center;">interneuron</td> <td style="text-align: center;">effector</td> </tr> <tr> <td>(b)</td> <td style="text-align: center;">motor neuron</td> <td style="text-align: center;">sensory neuron</td> <td style="text-align: center;">receptor</td> </tr> <tr> <td>(c)</td> <td style="text-align: center;">sensory neuron</td> <td style="text-align: center;">motor neuron</td> <td style="text-align: center;">effector</td> </tr> <tr> <td>(d)</td> <td style="text-align: center;">interneuron</td> <td style="text-align: center;">motor neuron</td> <td style="text-align: center;">receptor</td> </tr> </tbody> </table> <p>Answer is c.</p> <p>19. The key difference between structures Q and R is</p> <p>(a) R carries impulses towards the central nervous system, while Q carries impulses away from the central nervous system. (b) Q carries impulses towards the ganglion, while R carries impulses away from the ganglion. (c) Q has only one nerve fibre, while R has two nerve fibres. (d) R carries impulses away from the central nervous system, while Q carries impulses towards the central nervous system. – Answer</p>		Q	R	S	(a)	sensory neuron	interneuron	effector	(b)	motor neuron	sensory neuron	receptor	(c)	sensory neuron	motor neuron	effector	(d)	interneuron	motor neuron	receptor
	Q	R	S																		
(a)	sensory neuron	interneuron	effector																		
(b)	motor neuron	sensory neuron	receptor																		
(c)	sensory neuron	motor neuron	effector																		
(d)	interneuron	motor neuron	receptor																		

	<p>20. If an individual was involved in an accident that cut structure Q, what would be the consequence of this?</p> <p>The transmission of impulses from the</p> <p>(a) effector to the spinal cord would be affected. (b) receptor to the spinal cord would be affected. – Answer (c) spinal cord to the effector would be affected. (d) spinal cord to the receptor would be affected.</p>
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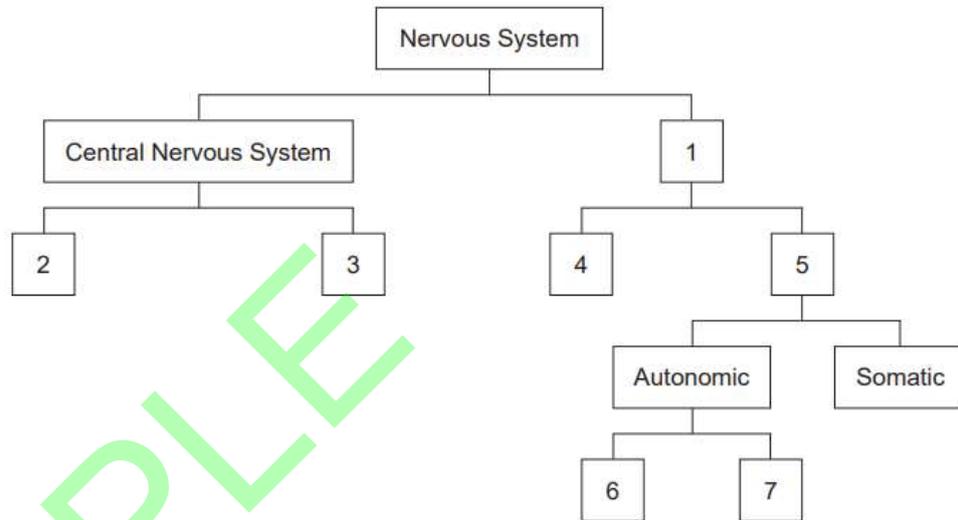
<p>2023 Section 1 Question 22-23</p> <p>Central and peripheral nervous system</p>	<p>Questions 22 and 23 refer to the diagram shown below.</p> <p style="text-align: center;">Copyright restrictions prohibit the release of this SCSA exam material.</p> <p>22. Which of the following matches the name of the stage of the action to the labels shown on the diagram?</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">2</th> <th style="text-align: center;">3</th> <th style="text-align: center;">4</th> <th style="text-align: center;">5</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>polarisation</td> <td>depolarisation</td> <td>repolarisation</td> <td>resting state</td> </tr> <tr> <td>(b)</td> <td>depolarisation</td> <td>hyperpolarisation</td> <td>repolarisation</td> <td>polarised</td> </tr> <tr> <td>(c)</td> <td>depolarisation</td> <td>repolarisation</td> <td>hyperpolarisation</td> <td>resting state</td> </tr> <tr> <td>(d)</td> <td>polarisation</td> <td>hyperpolarisation</td> <td>depolarisation</td> <td>polarised</td> </tr> </tbody> </table> <p>Answer is c.</p> <p>23. The stage at which potassium ions flow out of the neuron is</p> <p>(a) 1. (b) 2. (c) 3. – Answer (d) 4.</p>		2	3	4	5	(a)	polarisation	depolarisation	repolarisation	resting state	(b)	depolarisation	hyperpolarisation	repolarisation	polarised	(c)	depolarisation	repolarisation	hyperpolarisation	resting state	(d)	polarisation	hyperpolarisation	depolarisation	polarised
	2	3	4	5																						
(a)	polarisation	depolarisation	repolarisation	resting state																						
(b)	depolarisation	hyperpolarisation	repolarisation	polarised																						
(c)	depolarisation	repolarisation	hyperpolarisation	resting state																						
(d)	polarisation	hyperpolarisation	depolarisation	polarised																						

<p>2023 Section 1 Question 27</p> <p>Central and peripheral nervous system</p>	<p>Which division of the nervous system is most likely to have been damaged if a person has a loss of touch sensations and numbness in their hands?</p> <p>(a) autonomic sympathetic (b) afferent parasympathetic (c) efferent autonomic (d) afferent somatic – Answer</p>
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**2022
Section 1
Question
1-2**

**Central and
peripheral
nervous
system**

Questions 1 and 2 refer to the diagram shown below, which represents the divisions of the nervous system.



1. Which of the following identifies the numbered components in the diagram correctly?

	2	3	4	5
(a)	brain	spinal cord	afferent	efferent
(b)	voluntary	involuntary	sensory	motor
(c)	visceral	peripheral	efferent	afferent
(d)	spinal cord	brain	voluntary	involuntary

Answer is A.

2. The activation of Component 7 results in the constriction of the pupil of the eye. Which of the following would also occur when Component 7 is activated?

- (a) increased sweating
- (b) increased release of glucose from the liver
- (c) decreased heart rate – **Answer**
- (d) decreased secretion of saliva

**2022
Section 1
Question 3**

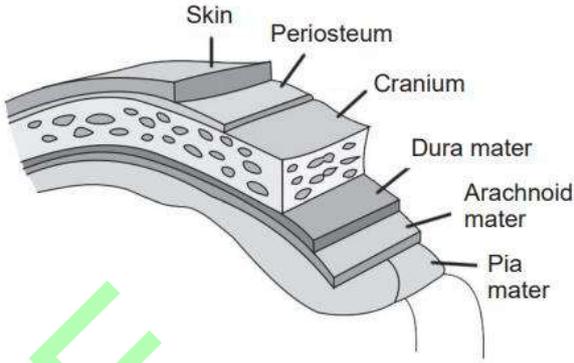
**Central and
peripheral
nervous
system**

Blind people are taught to read Braille (raised marks that create patterns on paper). They do this by running their fingertips over the markings. The pathway the impulse travels from the fingers to the brain includes some of the following components:

- I. touch receptors
- II. connector neuron
- III. motor neuron
- IV. sensory neuron
- V. thalamus to cerebrum
- VI. thalamus to cerebellum.

The correct order of the components in the pathway is

- (a) IV - II - III - VI
- (b) **I - IV - II - V – Answer**
- (c) III - II - IV - V
- (d) I - II - V - VI

<p>2022 Section 1 Question 23</p> <p>Central and peripheral nervous system</p>	<p>Question 23 refers to the diagram shown below, which represents the layers around the brain.</p>  <p>Referring to the layers around the brain as shown in the diagram, where is cerebrospinal fluid found?</p> <p>(a) between the periosteum and the cranium (b) under the pia mater layer (c) between the cranium and the dura mater (d) within the arachnoid mater layer – Answer</p>
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<p>2022 Section 1 Question 24</p> <p>Central and peripheral nervous system</p>	<p>Cell replacement therapy for the treatment of Parkinson's disease involves the</p> <p>(a) injection of adult stem cells to replace neurons in the brain that have been damaged by the build-up of plaque. (b) differentiating of stem cells into dopamine-signalling neurons and transplanting them into a patient's brain to replace dying neurons. – Answer (c) patient's own neurons being extracted with the DNA inside the cells then altered and the cells reinserted into the patient's body. (d) extraction of non-functioning neurons and replacing them with new cells that have the correct gene and can function normally.</p>
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<p>2022 Section 1 Question 26</p> <p>Central and peripheral nervous system</p>	<p>Which of the following is the key difference between adrenaline and insulin? Insulin</p> <p>(a) is secreted in response to a chemical stimulus, while adrenaline secretion is controlled by a nerve impulse. – Answer (b) controls blood sugar concentrations, while adrenaline helps regulate temperature. (c) is secreted by the pancreas, while adrenaline is secreted by the kidneys. (d) is a water-soluble hormone, while adrenaline is a lipid-soluble one.</p>
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<p>2022 Section 1 Question 17</p> <p>Central and peripheral nervous system</p>	<p>The single, long process of a neuron that delivers signals, is termed a/an</p> <p>(a) axon. – Answer (b) axon terminal. (c) Schwann cell. (d) dendrite.</p>
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<p>2022 Section 1 Question 29</p> <p>Central and peripheral nervous system</p>	<p>Which of the following lists endocrine glands that are not controlled directly by the hypothalamus?</p> <p>(a) pituitary, thymus, adrenal medulla (b) thymus, pancreas, adrenal cortex (c) parathyroid, pancreas, adrenal medulla – Answer (d) pancreas, thyroid, pituitary</p>
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2021 Section 1 Question 1 Central and peripheral nervous system	Which of the following is a response when the parasympathetic nervous system is activated? (a) increased heart rate and breathing rate (b) pupil dilation (c) increased activity of the gastrointestinal tract – Answer (d) vasodilation of blood vessels in the skin
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2021 Section 1 Question 3 Central and peripheral nervous system	Homeostatic response mechanisms require the transfer and recognition of information from a sensory receptor and an effector. The transmission of this information (a) may involve both the endocrine and nervous systems. – Answer (b) relies only on hormones for a short-term response. (c) is usually a conscious process. (d) is under control of the autonomic system only.
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2021 Section 1 Question 9 Central and peripheral nervous system	Which of the following statements about the meninges is correct? They are membranes (a) that surround the axon of a neuron. (b) and fluids found around the brain and spinal cord. (c) that cover and protect the brain. – Answer (d) that are not found around the lower spinal cord.
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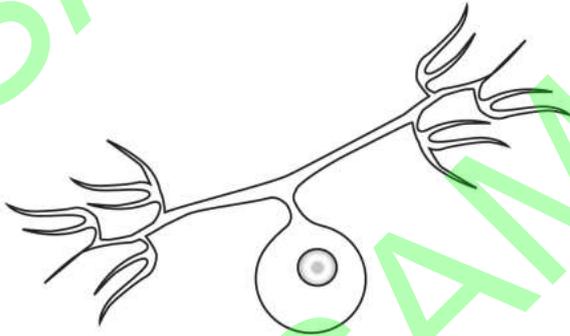
2021 Section 1 Question 14-15 Central and peripheral nervous system	<p>Questions 14 and 15 refer to the diagram shown below.</p> <p>14. The correct labels for 'X', 'Y' and 'Z' for the diagram shown are</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>osmoreceptor</td> <td>cerebellum</td> <td>diaphragm and intercostal muscles</td> </tr> <tr> <td>(b)</td> <td>chemoreceptor</td> <td>medulla oblongata</td> <td>ribcage and intercostal muscles</td> </tr> <tr> <td>(c)</td> <td>thermoreceptor</td> <td>hypothalamus</td> <td>diaphragm and alveoli</td> </tr> <tr> <td>(d)</td> <td>chemoreceptor</td> <td>medulla oblongata</td> <td>diaphragm and intercostal muscles</td> </tr> </tbody> </table> <p>Answer is d.</p>		X	Y	Z	(a)	osmoreceptor	cerebellum	diaphragm and intercostal muscles	(b)	chemoreceptor	medulla oblongata	ribcage and intercostal muscles	(c)	thermoreceptor	hypothalamus	diaphragm and alveoli	(d)	chemoreceptor	medulla oblongata	diaphragm and intercostal muscles
	X	Y	Z																		
(a)	osmoreceptor	cerebellum	diaphragm and intercostal muscles																		
(b)	chemoreceptor	medulla oblongata	ribcage and intercostal muscles																		
(c)	thermoreceptor	hypothalamus	diaphragm and alveoli																		
(d)	chemoreceptor	medulla oblongata	diaphragm and intercostal muscles																		

	<p>15. Where are receptors X located?</p> <p>(a) skin and hypothalamus (b) carotid artery and aorta – Answer (c) carotid artery and hypothalamus (d) aorta and cerebellum</p>
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<p>2021 Section 1 Question 17</p> <p>Central and peripheral nervous system</p>	<p>Which row identifies correctly components of the central and peripheral nervous systems?</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="2">Central nervous system</th> <th colspan="2">Peripheral nervous system</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>spinal cord</td> <td>brain</td> <td>autonomic</td> <td>medulla oblongata</td> </tr> <tr> <td>(b)</td> <td>somatic</td> <td>autonomic</td> <td>spinal cord</td> <td>cerebellum</td> </tr> <tr> <td>(c)</td> <td>brain</td> <td>spinal cord</td> <td>sympathetic</td> <td>somatic</td> </tr> <tr> <td>(d)</td> <td>sympathetic</td> <td>parasympathetic</td> <td>somatic</td> <td>brain</td> </tr> </tbody> </table> <p>Answer is c.</p>		Central nervous system		Peripheral nervous system		(a)	spinal cord	brain	autonomic	medulla oblongata	(b)	somatic	autonomic	spinal cord	cerebellum	(c)	brain	spinal cord	sympathetic	somatic	(d)	sympathetic	parasympathetic	somatic	brain
	Central nervous system		Peripheral nervous system																							
(a)	spinal cord	brain	autonomic	medulla oblongata																						
(b)	somatic	autonomic	spinal cord	cerebellum																						
(c)	brain	spinal cord	sympathetic	somatic																						
(d)	sympathetic	parasympathetic	somatic	brain																						

<p>2021 Section 1 Question 21</p> <p>Central and peripheral nervous system</p>	<p>The purpose of peripheral vasoconstriction in temperature regulation is to</p> <p>(a) reduce blood oxygen levels when cold thermoreceptors are triggered. (b) increase blood oxygen levels when hot thermoreceptors are triggered. (c) conserve body heat when cold thermoreceptors are triggered. – Answer (d) reduce heat loss when hot thermoreceptors are triggered.</p>
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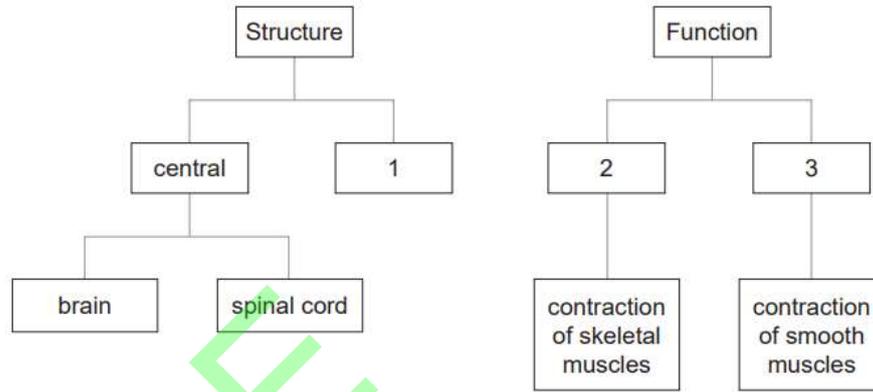
<p>2021 Section 1 Question 25</p> <p>Central and peripheral nervous system</p>	<p>The myelin sheath is</p> <p>(a) fatty tissue that speeds up the neural impulse through the cell body. (b) grey matter that changes up the neural impulse along a dendrite. (c) white matter that reduces the speed of a neural impulse along an axon. (d) fatty tissue that speeds up the neural impulse along sections of the axon. – Answer</p>
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<p>2020 Section 1 Question 19</p> <p>Central and peripheral nervous system</p>	<p>Question 19 refers to the diagram shown below.</p> <div style="text-align: center;">  </div> <p>The neuron illustrated would be classified correctly as</p> <p>(a) motor. (b) sensory. – Answer (c) connector. (d) multipolar.</p>
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2020
Section 1
Question 26

Central and peripheral nervous system

Question 26 refers to the diagram below.



26. The diagram shows two separate ways in which we can classify the nervous system. Which row correctly identifies numbers 1, 2 and 3?

	1	2	3
(a)	peripheral	somatic	autonomic
(b)	somatic	autonomic	peripheral
(c)	autonomic	peripheral	somatic
(d)	peripheral	autonomic	somatic

Answer is a.

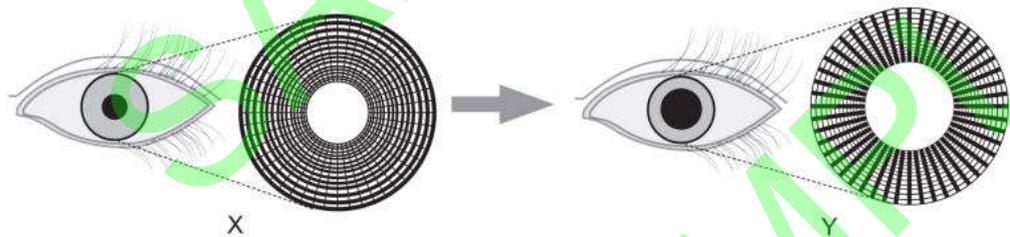
27. Target cells respond to specific hormones as a result of

- (a) nucleic acid binding sites in the membrane and cytoplasm.
- (b) specific binding sites on enzymes found in the cytoplasm.
- (c) carbohydrate receptors in the plasma membrane.
- (d) protein receptors in the plasma membrane and cytoplasm. – Answer**

2019
Section 1
Question 2

Central and peripheral nervous system

Question 2 refers to the diagram shown below.



Which of the following statements describes the diagram correctly?

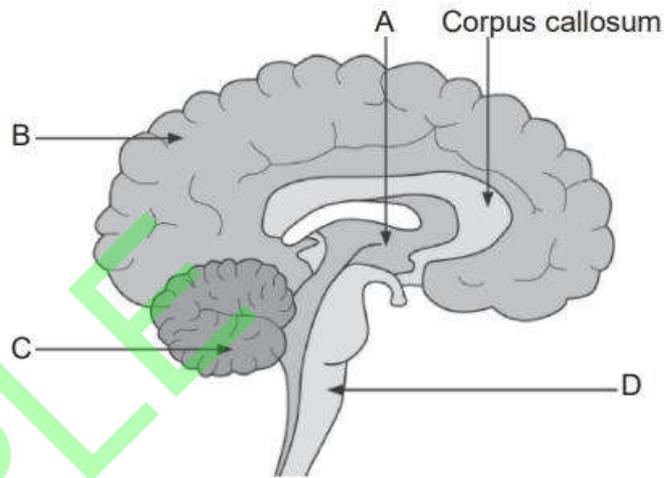
- (a) The pupil is constricted in X. Once stimulated by the parasympathetic nervous system it will become dilated, as shown in Y.
- (b) The pupil is constricted in X. Once stimulated by the sympathetic nervous system it will become dilated, as shown in Y. – Answer**
- (c) The pupil is dilated in X. Once stimulated by the parasympathetic nervous system it will become constricted, as shown in Y.
- (d) The pupil is dilated in X. Once stimulated by

<p>2019 Section 1 Question 3</p> <p>Central and peripheral nervous system</p>	<p>The function of the corpus callosum is to</p> <p>(a) carry impulses between the left and right hemispheres of the brain. – Answer (b) connect various areas of the cortex within the same hemisphere of the brain. (c) provide protection, support and a transport network around the brain. (d) connect the cortex to other parts of the brain and to the spinal cord.</p>
<p>2019 Section 1 Question 9</p> <p>Central and peripheral nervous system</p>	<p>Which of the following is not a hypothesis as to why hominids became bipedal?</p> <p>Bipedalism</p> <p>(a) freed the hands to carry food and tools. (b) enabled the spinal column to develop a lumbar curve. – Answer (c) increased height and allowed better visibility. (d) is a more energy-efficient way of walking.</p>
<p>2019 Section 1 Question 21</p> <p>Central and peripheral nervous system</p>	<p>The stimulus for the regulation of water balance by the thirst mechanism is received by the osmoreceptors in the</p> <p>(a) cerebrum. (b) hypothalamus. – Answer (c) kidney tubule. (d) medulla oblongata.</p>
<p>2019 Section 1 Question 24</p> <p>Central and peripheral nervous system</p>	<p>Cell replacement therapy involves</p> <p>(a) injecting islet cells into a patient. (b) transplanting stem cells into a patient. – Answer (c) removing faulty genes and replacing with healthy ones. (d) inserting a recombinant gene in the cells of a patient.</p>
<p>2019 Section 1 Question 27</p> <p>Central and peripheral nervous system</p>	<p>In general, when compared to hormones, nervous impulses have a</p> <p>(a) short duration and a short response time and are involved in long-term adjustments. (b) long duration and a long response time and are involved in short-term adjustments. (c) long duration and a short response time and are involved in short-term adjustments. (d) short duration and a short response time and are involved in short-term adjustments. – Answer</p>

2023
Section 2
Question
31

Central and
peripheral
nervous
system

The following question refers to the diagram of the human brain shown below.



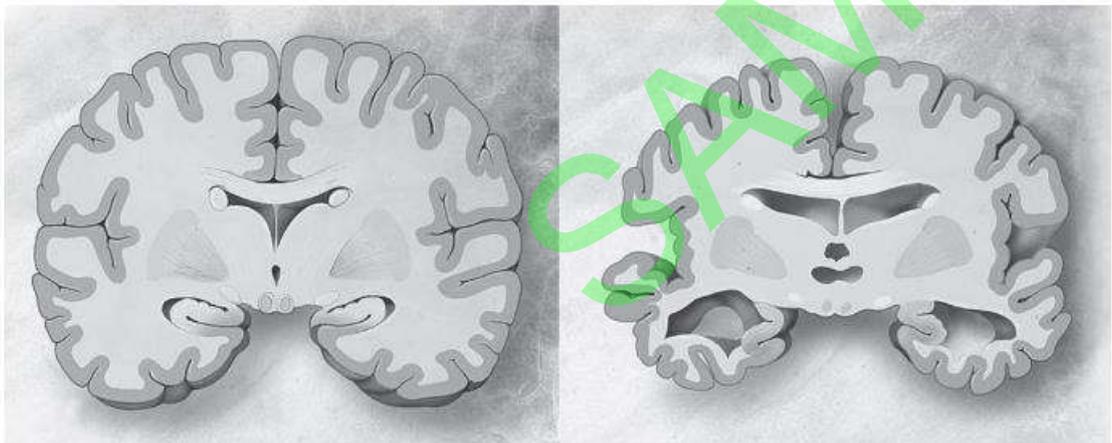
(a) Identify structures A and C. (2 marks)

Description	Marks
A: hypothalamus	1
C: cerebellum	1
Total	2

(b) List **two** homeostatic processes that are controlled by structure D. (2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> • breathing rate • heart rate • blood pressure • blood vessel diameter 	1–2
Total	2

Alzheimer's is a disease of the brain that mostly affects older people. The diagram below shows differences that can be observed when comparing a normal brain to that of an individual suffering from Alzheimer's. One of the main differences that can be observed is the change to the cerebral cortex.



(c) (i) State the change that has occurred to the cerebral cortex of an Alzheimer's sufferer. (1 mark)

Description	Marks
shrinkage/reduction in size of cerebral cortex/decreasing white matter	1
Total	1

(ii) Describe how the change to the cerebral cortex has occurred. (2 marks)

Description	Marks
neurons die/are injured	1
connections between neurons break down	1
Total	2

Emerging evidence suggests that Alzheimer's-related brain changes may be produced because of clumping together of proteins and the creation of tangles in-between neurons that disrupt cell functioning and synaptic transmission.

(d) (i) Define the term 'synapse'. (1 mark)

Description	Marks
small gap/junction/space between adjacent neurons	1
Total	1

(ii) Annotate the diagram below to show the processes involved in the transmission of a nerve impulse across the synapse. Include labels of the parts and stages in the process. (6 marks)

Description	Marks
label vesicle and neurotransmitter inside	1
label calcium channel and show calcium ions moving in	1
label synaptic cleft and show neurotransmitter moving across	1
label receptor and show neurotransmitter attached	1
indicate action potential arriving at presynaptic neuron and being initiated at postsynaptic neuron	1
indicate the stages (1 = action potential arrives, 2 = diffusion of neurotransmitter and 3 = attach to postsynaptic neuron and trigger next action action) names not needed by an indication of the sequence shown in some way	1
Total	6



(iii) Explain how cell replacement therapy aims to help Alzheimer's sufferers. (3 marks)

Description	Marks
replace the damaged cells/neurons with healthy stem cells	1
that can create new healthy brain cells	1
stem cells may reduce protein deposits/may halt progression of the disease	1
Total	3

The following question refers to the diagram below, which shows a neuron.

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(a) Identify the type of neuron shown in the diagram. (1 mark)

Description	Marks
Motor/efferent/multipolar	1
Total	1

(b) List **two** features of the neuron that can be used to distinguish it from other types of neurons found in the human body. (2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> long singular axon multipolar located in ventral root of spinal cord carries nerve impulses from CNS/towards effectors cell body located at end of neuron 	1–2
Total	2

(c) State the function of the structure labelled as X. (1 mark)

Description	Marks
Any one of	
<ul style="list-style-type: none"> receives messages/impulses from receptor/other neurons carry messages/impulses into/towards the cell body 	1
Total	1

The function of nerves is to transmit electrical impulses.

(d) Contrast the transmission of nerve impulses in myelinated and unmyelinated neurons. (4 marks)

Description	Marks
Myelinated – any two of	
<ul style="list-style-type: none"> depolarization occurs in nodes of Ranvier action potential jumps from node to node/saltatory conduction impulse moves faster 	1–2
Unmyelinated – any two of	
<ul style="list-style-type: none"> depolarization occurs along length of axon action potential must travel full axon length/does not jump nerve impulse moves slower 	1–2
Total	4

Some local anaesthetics work by interfering with the sodium ion channels in the membrane of a neuron.

(e) (i) Describe the role of sodium channels found within a neuron's cell membrane. (2 marks)

Description	Marks
allow sodium ions to diffuse (rapidly) into axon	1
this brings about depolarisation/action potentials generated	1
Total	2

(ii) If a local anaesthetic works by blocking the sodium channels, describe how this would affect the conduction of an action potential. (2 marks)

Description	Marks
sodium ions can no longer enter the axon	1
there is no action potential/no depolarisation of membrane/no nerve impulse	1
Total	2

A study using rats looked at the impact of local anaesthetics on blocking the release of calcium ions at an axon terminal.

(f) Explain how this would lead to pain signals from affected parts of the body not reaching the brain. (6 marks)

Description	Marks
calcium ions cannot diffuse into the synaptic knob	1
prevents (synaptic) vesicles from fusing with presynaptic membrane	1
no neurotransmitter is released	1
no influx of sodium ions into post-synaptic neuron	1
no action potential is generated on next neuron	1
therefore pain signal is not sent along sensory neuron to brain	1
Total	6

**2022
Section 2
Question
33**

**Central and
peripheral
nervous
system**

Congenital insensitivity to pain is a genetic condition that affects the ability of the body to detect pain stimuli. The condition affects the sodium channels of the pain receptors that transmit messages to the brain and spinal cord.

(a) State one specific location in the body where pain receptors are found. (1 mark)

Description	Marks
skin/cornea/mucosa/muscles/joints/bladder/visceral organs	1
Total	1

Congenital insensitivity to pain is caused by a mutation to the SCN9A gene.

(b) Distinguish a gene mutation from a chromosomal mutation. (2 marks)

Description	Marks
gene mutations only affect one gene (loci)	1
chromosomal mutations affects more than one gene/part of a chromosome/whole chromosome	1
Total	2

The following question refers to the diagram below, which represents different types of mutations.

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(c) The mutation to the SCN9A gene is classified as a substitution mutation. Identify which of the three mutations shown above (X, Y or Z) is a substitution mutation and state how the substitution mutation alters the genome. (2 marks)

Description	Marks
X	1
Substitution is a type of mutation where one base pair is replaced by a different base pair.	1
Total	2

(d) To examine the SCN9A mutation in patients, DNA sequencing needs to be carried out. For the following bacterial enzymes, state the biotechnological technique they are used in and describe their role in that technique. (4 marks)

Description	Marks
Restriction enzymes	
gel electrophoresis	1
cuts DNA into fragments	1
DNA polymerase	
PCR	1
makes repeated copies of the DNA	1
Total	4

2021
Section 2
Question
31

Central and
peripheral
nervous
system

The following question refers to the diagram of the brain shown below.

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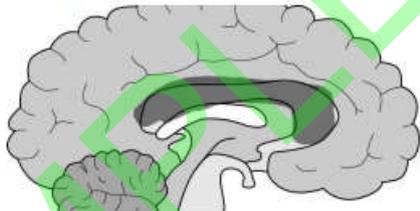
(a) (i) Identify structure 'Z'. (1 mark)

Description	Marks
Hypothalamus	1
Total	1

(ii) State one function of structure 'Y'. (1 mark)

Description	Marks
Control breathing rate/heart rate/blood pressure/diameter of blood vessels/expulsion reflex	1
Total	1

(iii) Indicate on the diagram, with a line and label, where the corpus callosum would be located. (1 mark)

Description	Marks
Indicates with a line and label in any of the region highlighted below	1
	
Total	1

(b) (i) Which region, A or B, shows structures that would be found in the outer layer of structure 'X'? (1 mark)

Description	Marks
B	1
Total	1

(ii) Justify your decision in part (b)(i). (2 marks)

Description	Marks
Grey matter is made up of unmyelinated nerve fibres/cell bodies	1
The outer region of the cerebrum contains only grey matter	1
Total	2

A man injured his back in a diving accident. Doctors were concerned there was damage to his spine and neural pathways. They touched different areas of his skin with a sharp point and asked him to indicate each time if he felt a sharp point. The sharp point should be felt in two ways, one of which would be pain.

(c) (i) What other sensation would be experienced by the man? (1 mark)

Description	Marks
Pressure/touch	1
Total	1

(ii) Describe how this sensation would be detected and registered by the man. (2 marks)

Description	Marks
Pressure/mechanoreceptors/touch receptors detect stimuli	1
Send (impulse) along sensory neurons to CNS/brain	1
Total	2

The man felt the sharp point when the point touched his arms, but not when the point touched his legs.

(d) Suggest what this information could tell the doctors about the damage to the man's spinal cord. Explain your answer. (3 marks)

Description	Marks
Damage must be between arms and legs/below arms/below waist/lower region of spinal cord	1
Information from nerves in arms still reaches the brain/ascending tracts from the arms are still functioning	1
Information from the legs doesn't reach the brain/ascending tracts from the legs are damaged	1
Total	3

**2020
Section 2
Question
34**

**Central and
peripheral
nervous
system**

Opponents of the sport of boxing are often concerned with the incidence of traumatic brain injury that occurs among individuals who box on a regular basis. Punches that force the head up and back may cause damage to the cerebellum, as the brain is squashed up against the back of the skull.

(a) (i) List **three** structures that would normally assist in protecting the brain against injury. (3 marks)

Description	Marks
Cranium/skull/bone	1
meninges	1
cerebrospinal fluid/CSF	1
Total	3

(ii) Suggest **two** symptoms a boxer might display if the cerebellum was damaged. (2 marks)

Description	Marks
slurred speech	1-2
loss of balance	
lack of coordination/clumsy movements/reduce fine motor control	
involuntary shaking	
Total	2

Muhammad Ali, a former boxer, developed Parkinson's disease. Although not conclusively linked to his boxing career, in his case it was associated with head trauma.

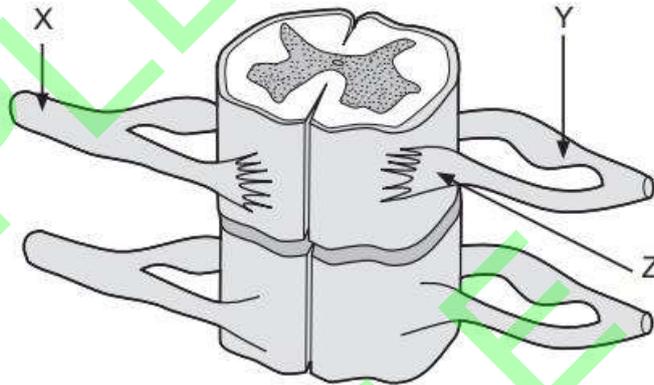
(b) (i) Describe the cause of Parkinson's disease. (2 marks)

Description	Marks
damage/degeneration to nerve cells in the brain (substantia nigra/basal ganglia)	1-2
reduced dopamine levels	
dopamine is required for smooth control of muscles and movement	
Total	2

(ii) Describe how cell replacement therapy could be used to treat Parkinson's disease. (2 marks)

Description	Marks
For copyright reasons this text cannot be reproduced in the online version of this document, but may be viewed at the link listed on the acknowledgements page.	1
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Total	2

The following questions refer to the diagram below, which shows a cross section of the spinal cord.



(c) (i) If 'X' is injured, it can lead to paralysis of part/s of the body and loss of sensation, depending on how high up the spinal cord the injury is. Why does this occur? (2 marks)

Description	Marks
X is a spinal nerve/mixed nerve/it contains both sensory and motor neurons	1
damage effects both neurons/both pathways to and from the brain	1
Total	2

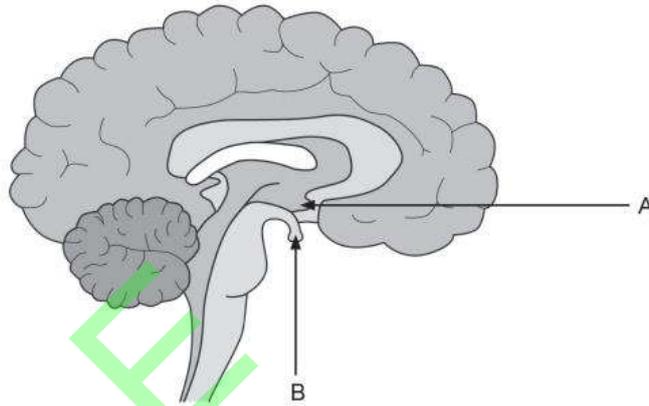
(ii) If Y is damaged, there will be a loss of feeling, but movement can still occur. Injury to Z leads to paralysis, but there will still be a sense of feeling. Explain why this difference occurs. (4 marks)

Description	Marks
if Y is damaged it effects the sensory neuron	1
impulses will not travel into the spinal cord but messages can still be sent out	1
if Z is damaged it effects the motor neuron	1
impulses still travel into the spinal cord but messages cannot be sent out	1
Total	4

**2019
Section 2
Question
32**

**Central and
peripheral
nervous
system**

(a) The following question refers to the diagram of the brain shown below.



(i) Identify structure A. (1 mark)

Description	Marks
hypothalamus	1
Total	1

(ii) State one function of structure B. (1 mark)

Description	Marks
Any one of the following:	
<ul style="list-style-type: none"> • master gland to control thyroid/adrenals/ovaries/testes • secretes hormones produced by the hypothalamus • produces hormones to control kidneys/uterus/mammary glands/growth/immune system/melanin production/pain/mood 	1
Total	1

(b) Contrast the role of the cerebellum and the medulla oblongata. (2 marks)

Description	Marks
Cerebellum = unconscious control of movement/for posture and balance/fine coordination	1
Medulla oblongata = automatically adjusting body functions/specific examples	1
Total	2

Multiple sclerosis (MS) is a disease that destroys Schwann cells in the central nervous system.

(c) (i) State the effect of the loss of the Schwann cells on the transmission of nerve impulses and describe why this occurs. (3 marks)

Description	Marks
Effect of loss of schwann cells	
the impulses will travel slower	1
Subtotal	1
Describe why this occurs	
schwann cells make myelin	1
myelin speeds up transmission of impulses/loss of myelin causes impulses to be transmitted to be slower	1
Subtotal	2
Total	3

A person had a touch sensitivity test. This involved them having various areas of their skin touched very gently. In some areas, they were unable to feel the touches.

(ii) Explain how this inability to feel the very gentle touches might not be due to MS. (3 marks)

Description	Marks
the touches were not reaching a sufficient intensity/not strong enough	1
to pass the threshold intensity/trigger an action potential	1
'all or none' response	1
Total	3

**2019
Section 2
Question
35**

**Central and
peripheral
nervous
system**

Engineers at Johns Hopkins University have recently developed technology that allows the detection of external stimuli on the fingertips of prosthetic limbs. Called an 'e-dermis', the technology presents a revolutionary development for amputee patients.

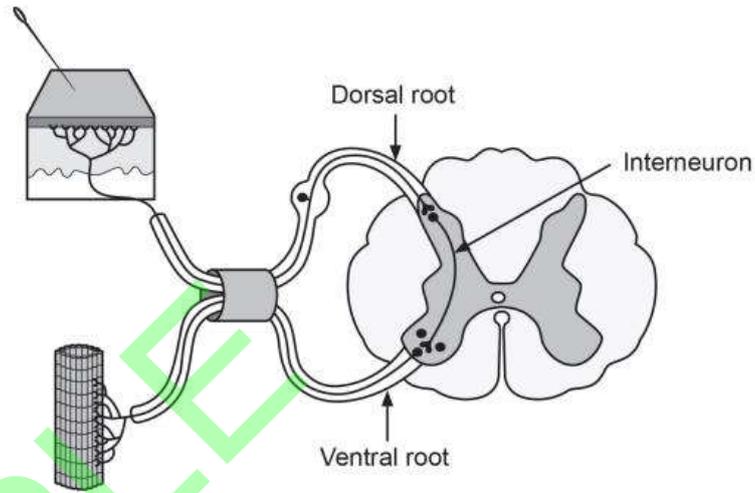
(a) (i) Name the type of receptors engineers would have to replicate into the e-dermis to allow the detection of a small distortion of the skin when it came into contact with an object. (1 mark)

Description	Marks
touch receptors/mechanoreceptors/pressure receptors/Merkel's disks/Meissner's corpuscles/Ruffini's corpuscles	1
Total	1

(ii) Engineers are also interested in making the e-dermis capable of detecting temperature. Explain how specific receptors found in human skin can detect external temperatures. (4 marks)

Description	Marks
tissues/blood of the skin changes temperature in response to environment/change in the environmental temperature detected by receptors	1-4
two types of thermoreceptors present/hot and cold receptors present	
low temperatures (below normal body temperature) triggers cold receptors	
high temperatures (above normal body temperature) triggers hot receptors	
Total	4

Question 35 (b) refers to the diagram of a spinal reflex arc show below.



(b) (i) Outline the purpose of a spinal reflex arc. (1 mark)

Description	Marks
protect body from harm or damage	1
Total	1

(ii) On the diagram of the reflex arc shown above, shade in the afferent pathway. (1 mark)

Description	Marks
shade pathway from receptor to start of grey matter	1
Total	1

For the spinal reflex arc to function, the interneuron shown in the diagram must be triggered at the synapse. This creates an action potential that propagates along the neuron to be passed to the next neuron.

(iii) Explain how an action potential continues along the interneuron. (4 marks)

Description	Marks
sodium channels open	1-4
sodium ion cells move into the cell/depolarisation inside the axon	
once the cell reaches the threshold the action potential will fire	
travels along the entire axon/does not jump between myelin	Total

Marking Guide – Section 3

<p>2021 Section 3 Question 39</p> <p>Central and peripheral nervous system</p>	<p>Flynn was standing at second base during a game of baseball. The batter hit the ball straight at him. Without thinking, Flynn put his baseball glove up to stop the ball from hitting his face and his face flinched (involuntarily turned) away from the incoming ball.</p>																																
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