

Section 1 — Multiple Choice Answers

Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	6	B	11	B	16	B
2	B	7	B	12	C	17	C
3	C	8	C	13	C	18	B
4	B	9	B	14	B	19	B
5	B	10	B	15	B	20	B

Section 2 — Short Response

Question 21 — Sample response (4 marks)

At rest, the neuron maintains a resting potential, with the inside of the membrane negatively charged relative to the outside.

When a stimulus causes the membrane to depolarise and reach threshold, voltage-gated sodium channels open and Na^+ ions rush into the cell, reversing the membrane potential (depolarisation).

Voltage-gated potassium channels then open and K^+ ions move out of the cell, restoring the negative charge inside (repolarisation), briefly overshooting before the membrane returns to its resting potential.

Marking criteria:

- Describes the resting potential (inside negative relative to outside). [1 mark]
- Describes depolarisation reaching threshold and Na^+ influx. [1 mark]
- Describes repolarisation and K^+ efflux restoring the negative charge. [1 mark]
- Notes the return to (or brief overshoot of) resting potential. [1 mark]

Question 22 — Sample response (3 marks)

The action potential reaches the axon terminal of the presynaptic neuron, causing vesicles containing neurotransmitter to fuse with the presynaptic membrane and release their contents into the synaptic cleft.

The neurotransmitter diffuses across the synaptic cleft and binds to specific receptors on the postsynaptic membrane, which can trigger a new action potential or response in the postsynaptic neuron.

Marking criteria:

- Describes vesicle release of neurotransmitter at the presynaptic terminal. [1 mark]
- Describes diffusion of neurotransmitter across the synaptic cleft. [1 mark]
- Describes binding to receptors on the postsynaptic membrane, triggering a response. [1 mark]

Question 23 — Sample response (4 marks)

Receptor: osmoreceptors (in the hypothalamus), which detect the increase in blood solute concentration.

Control centre: the hypothalamus, which coordinates the response and stimulates the pituitary gland to release ADH.

Effector: the kidney (collecting duct and distal tubule).

Response: ADH increases the permeability of the collecting duct to water, increasing water reabsorption, producing more concentrated urine and restoring blood water content toward normal.

Marking criteria:

- Correctly identifies the receptor (osmoreceptors). [1 mark]
- Correctly identifies the control centre (hypothalamus, triggering ADH release). [1 mark]
- Correctly identifies the effector (kidney / collecting duct). [1 mark]
- Correctly describes the response (increased water reabsorption, concentrated urine, restored blood water content). [1 mark]

Question 24 — Sample response (3 marks)

Hibernation is a prolonged reduction in metabolic rate and activity used by some endotherms to survive cold periods when food is scarce, allowing them to conserve energy.

Aestivation is a similar reduction in metabolic rate and activity, but is used during hot and/or dry conditions to avoid overheating and desiccation.

Both strategies involve a significant drop in metabolic rate compared to normal activity, but they are triggered by opposite environmental conditions (cold versus heat/dryness).

Marking criteria:

- Describes hibernation as reduced metabolism/activity during cold conditions. [1 mark]
- Describes aestivation as reduced metabolism/activity during hot/dry conditions. [1 mark]
- Identifies a similarity (reduced metabolic rate) and/or the key difference (triggering environmental conditions) between the two. [1 mark]

Question 25 — Sample response (4 marks)

First line of defence: physical and chemical barriers such as the skin and mucous membranes, which prevent pathogens from entering the body (e.g. the keratinised outer layer of the skin).

Second line of defence: the innate, non-specific internal response, such as the inflammatory response and complement system, which act quickly against any pathogen without targeting a specific one (e.g. neutrophils engulfing bacteria at a wound site).

Third line of defence: the adaptive, specific immune response, carried out by B and T lymphocytes, which target specific antigens and can form memory cells (e.g. B cells producing antibodies against a particular virus).

Marking criteria:

- Describes the first line of defence with a correct example. [1 mark]
- Describes the second line of defence with a correct example. [1 mark]
- Describes the third line of defence with a correct example. [1 mark]
- Correctly distinguishes the third line as specific/targeted and/or able to form memory, unlike the first two lines. [1 mark]

Question 26 — Sample response (2 marks)

Active immunity occurs when an individual's own immune system produces antibodies in response to exposure to an antigen (e.g. through natural infection or vaccination), and typically provides long-lasting protection because memory cells are formed.

Passive immunity occurs when antibodies are transferred into an individual from an external source (e.g. antibodies passed from mother to baby via breast milk, or antibody injections), providing immediate but short-term protection since no memory cells are formed.

Marking criteria:

- Describes active immunity (own immune system produces antibodies, long-lasting, memory formed) with a correct example. [1 mark]

- Describes passive immunity (antibodies received from an external source, short-term, no memory formed) with a correct example. [1 mark]