

The Nervous System

This worksheet reviews the structure and function of neurons, the organization of the central and peripheral nervous systems, and the composition of reflex arcs, in line with Biology 30 Unit A outcomes ([Outcome](#), [Outcome](#), [Outcome](#)). Allow approximately 40 to 50 minutes to complete all six exercises.

Exercises

1. Matching: Structures of the Central Nervous System

Match each structure on the left with its primary function on the right by writing the correct letter in the blank. Each letter is used only once ([Outcome](#)).

Structure	Blank	Function
Cerebellum	_____	A) Regulates heart rate, breathing rate, and blood pressure
Medulla oblongata	_____	B) Coordinates balance, posture, and voluntary muscle movement
Hypothalamus	_____	C) Relays nerve impulses between the brain and the rest of the body
Pons	_____	D) Maintains homeostasis by linking the nervous and endocrine systems
Spinal cord	_____	E) Relays signals between the medulla and higher brain centres; involved in regulating breathing

2. Fill in the Blanks: Neuron Structure and the Action Potential

Complete each sentence using a term from your notes ([Outcome](#)).

- The fatty covering that insulates the axon and increases the speed of impulse conduction is called the _____.
- At rest, the inside of a neuron's membrane is negatively charged relative to the outside; this condition is called the _____.
- When a stimulus reaches threshold, sodium ion channels open and sodium ions flow into the cell, a process called _____.
- A neuron either fires a full action potential or does not fire at all, regardless of the strength of the stimulus above threshold. This principle is called the _____ response.
- A stronger stimulus is perceived by the brain as more intense because it increases the _____ of action potentials fired, not the size of any single impulse.

3. Multiple Choice: Synaptic Transmission

Circle the letter of the best answer for each question ([Outcome](#)).

- Which neurotransmitter is released at the neuromuscular junction and at many synapses of the parasympathetic nervous system?
 - Norepinephrine
 - Acetylcholine
 - Cholinesterase
 - Dopamine

2. What is the function of cholinesterase at a synapse?
 - A) It transmits the signal across the synaptic cleft
 - B) It breaks down acetylcholine, ending the signal
 - C) It stores calcium ions in the presynaptic terminal
 - D) It generates the resting membrane potential
3. Norepinephrine is most closely associated with which division of the nervous system?
 - A) Sympathetic nervous system
 - B) Parasympathetic nervous system
 - C) Somatic sensory system
 - D) Cerebellar control of movement

4. Short Answer: Sympathetic and Parasympathetic Divisions

Using complete sentences, explain how the sympathetic and parasympathetic divisions of the autonomic nervous system act on the body during a stress response and during rest ([Outcome](#)).

Sympathetic division:

Parasympathetic division:

5. Reflex Arc: Structure and Example

Using the patellar reflex as your example, list the five components of a reflex arc in the order that a nerve impulse travels through them, and describe the role of each component ([Outcome](#)).

Order	Component	Role in the reflex arc
1		
2		
3		
4		
5		

6. Applied Question: Voluntary and Involuntary Control

A physician taps a patient's knee with a reflex hammer, and the patient's leg kicks out before the patient consciously registers the tap. Explain, in terms of the somatic and autonomic nervous systems and the structures involved, why this response occurs so quickly and without conscious input from the cerebral hemispheres ([Outcome](#), [Outcome](#)).

Answer Key

1. Cerebellum: B; Medulla oblongata: A; Hypothalamus: D; Pons: E; Spinal cord: C
2. a) myelin sheath; b) resting potential; c) depolarization; d) all-or-none; e) frequency

3. 1. B; 2) B; 3) A
4. Sympathetic division: prepares the body for stress or activity, e.g., increases heart rate, redirects blood flow to skeletal muscles, releases norepinephrine. Parasympathetic division: returns the body to a resting state, e.g., slows heart rate, stimulates digestion, relies mainly on acetylcholine.
5. 1. Receptor (the muscle spindle in the quadriceps, stretched when the patellar tendon is tapped); 2) Sensory (afferent) neuron (carries the impulse to the dorsal root of the spinal cord); 3) Integrating centre in the grey matter of the spinal cord (in this monosynaptic reflex the sensory neuron synapses directly with the motor neuron; in most other reflex arcs an interneuron relays the signal); 4) Motor (efferent) neuron (carries the impulse from the spinal cord to the effector); 5) Effector (the quadriceps muscle, which contracts to produce the leg kick).
6. The patellar reflex is a somatic reflex, since it involves a skeletal muscle (the quadriceps) acting under the control of a motor neuron of the somatic nervous system, rather than smooth muscle, cardiac muscle, or a gland controlled by the autonomic nervous system. The reflex arc bypasses the cerebral hemispheres because the sensory neuron synapses directly with a motor neuron in the spinal cord, allowing the muscle (effector) to respond before the signal travels up to the brain for conscious processing; this rapid, involuntary pathway is characteristic of a spinal reflex arc rather than voluntary somatic control.