Signals in Motion

How the nervous system coordinates movement, cooling, and water balance

HAP.6.1 "Describe and evaluate how the nervous system functions and interconnects with all other body systems."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Read the passage. Underline three places where the nervous system sends or receives information, circle the body systems involved, and number each connection to show what happens first and next.

The Final Minutes

1. The final minutes of a summer basketball game are loud and hot. Your eyes track the ball, while receptors in your joints and muscles report where your arms and legs are. Sensory signals travel to your brain and spinal cord, which combine that information before sending commands to muscles. Muscles pull on bones to turn, jump, and catch a pass. If another player suddenly crosses your path, rapid nervous signals help you change direction. Without this exchange between sensory organs, nerves, muscles, and bones, a fast movement would be much less accurate.

2. As play continues, working muscles need more oxygen and release more carbon dioxide. The brain stem adjusts breathing rate, helping the lungs bring in oxygen and remove carbon dioxide. Nerve signals also help increase heart rate, so the circulatory system can deliver more blood to active muscles. Meanwhile, temperature sensors in the body and skin send information to the hypothalamus in the brain. It promotes sweating and sends signals that widen blood vessels in the skin. These responses move heat toward the surface, where evaporating sweat can cool you. In humid air, sweat evaporates slowly, so cooling is less effective.

3. Sweat carries water out of the body, creating another problem during a long game. When the blood becomes more concentrated, sensors in the hypothalamus detect the change. The hypothalamus stimulates thirst and signals the posterior pituitary to release antidiuretic hormone, or ADH, into the blood. ADH tells the kidneys to return more water to the blood, reducing water lost in urine. Drinking water lets the digestive system absorb replacement fluid. Kidney conservation helps, but it cannot replace water already lost. As play stops and body temperature falls, the brain reduces its signals for heavy sweating.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace the signals that help a player change direction when someone crosses their path. Why does this connection make the movement more accurate?

2. How do nervous system signals involve both the respiratory and circulatory systems during play? Why are both responses useful to working muscles?

3. Trace the body's response from water loss in sweat to water conservation in the kidneys. Why is drinking water still necessary?

4. A player is sweating heavily, but the air is humid. Evaluate how well this response can cool the player, using evidence from the passage.

3 YOUR TURN

Your own words

On a hot day, you are walking home when a bicycle swerves toward you. In five or six sentences, explain how your nervous system works with at least three other body systems to dodge it and manage heat, then evaluate why one body response alone is not enough.

ANSWER KEY

Signals in Motion

PART 1 · READ AND MARK

Read the passage. Underline three places where the nervous system sends or receives information, circle the body systems involved, and number each connection to show what happens first and next. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace the signals that help a player change direction when someone crosses their path. Why does this connection make the movement more accurate?	**Eyes and receptors in muscles and joints send information to the brain and spinal cord. These send commands to muscles, which pull on bones. Using sensory information helps the player change direction accurately.**
2	How do nervous system signals involve both the respiratory and circulatory systems during play? Why are both responses useful to working muscles?	**The brain stem increases breathing to bring in oxygen and remove carbon dioxide. Nerve signals help increase heart rate, delivering more oxygen-rich blood to active muscles.**
3	Trace the body's response from water loss in sweat to water conservation in the kidneys. Why is drinking water still necessary?	**As blood becomes more concentrated, the hypothalamus detects the change and signals the posterior pituitary to release ADH. ADH makes the kidneys return more water to the blood. Drinking is still needed because conserving water cannot replace what was lost.**
4	A player is sweating heavily, but the air is humid. Evaluate how well this response can cool the player, using evidence from the passage.	**Sweating is less effective in humid air because sweat evaporates slowly, and evaporation is what cools the body.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My eyes detect the bicycle, and sensory nerves carry that information to my brain. My brain sends signals to leg muscles, which pull on bones so I can step aside. As I move quickly, my brain stem increases breathing, and nerve signals help my heart pump faster to supply my muscles. My hypothalamus responds to rising body temperature by promoting sweat and widening blood vessels in my skin. Sweating alone cannot keep me safe because it cannot help me dodge the bicycle, and it works less well when the air is humid.

Accept accurate pathways that name at least three body systems besides the nervous system and explain their roles. The evaluation must identify a specific limit of one response, not just state that several systems are needed.