Systems in Motion

Trace how body systems meet the demands of exercise.

HAP.1.3 "Investigate the interdependence of the various body systems to each other and to the body as a whole."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline actions by different body systems, then number at least one chain of three linked actions to show how a change in one system affects another.

A Soccer Game in the Heat

1. During a summer soccer game, a midfielder sprints after the ball. Her leg muscles use more ATP, the molecule that powers contraction. To make ATP efficiently, muscle cells need oxygen and glucose. The respiratory system brings oxygen into the lungs, where it moves into the blood. The circulatory system carries that oxygen and glucose to the muscles and takes carbon dioxide back toward the lungs. Glucose entered the blood after digestion of her lunch. As muscle activity rises, the brainstem increases breathing rate and heart rate. Faster delivery supports continued movement, while faster removal keeps carbon dioxide from building up in the blood.

2. The same contractions also release heat. Sensors in the brain detect rising body temperature and signal blood vessels near the skin to widen. More warm blood reaches the surface, where heat can leave the body. Sweat glands release fluid onto the skin; as sweat evaporates, it carries away heat. In humid air, evaporation slows, so sweating may not cool her as well. These responses connect the nervous, circulatory, and integumentary systems. They protect muscle cells and the brain, which work best within a narrow temperature range. Cooling depends on blood flow and available water, not sweat alone.

3. After a long stretch of play, the midfielder has lost water in sweat. With less fluid in the blood, the heart has less blood to pump with each beat. Her heart may beat faster to keep oxygen moving to the muscles, but supplying the skin and muscles at once becomes harder. The kidneys respond by conserving water, so she produces less urine. If losses continue, reduced blood flow can limit muscle performance and cooling at the same time. Resting in shade and drinking water reduce heat production and help replace lost fluid; neither system can solve the problem alone.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace how three body systems supply materials the midfielder's muscles need to make ATP. How does a fourth system respond when muscle activity rises?

2. How do the nervous, circulatory, and integumentary systems work together to cool the midfielder?

3. Why might sweating cool the midfielder less effectively in humid air? Explain why this matters to both her muscles and her brain.

4. How can water lost through sweat make it harder for the heart to support both muscle movement and cooling? What do the kidneys do in response?

3 YOUR TURN

Your own words

Imagine a runner wearing a nonbreathable raincoat during a warm workout. In four sentences, predict how the coat could affect cooling, trace effects through at least three body systems, and suggest one action that would reduce the strain.

Systems in Motion

PART 1 · READ AND MARK

Underline actions by different body systems, then number at least one chain of three linked actions to show how a change in one system affects another. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace how three body systems supply materials the midfielder's muscles need to make ATP. How does a fourth system respond when muscle activity rises?	**The digestive system puts glucose into the blood, the respiratory system brings in oxygen, and the circulatory system delivers both to the muscles. The brainstem, part of the nervous system, increases breathing and heart rates.**
2	How do the nervous, circulatory, and integumentary systems work together to cool the midfielder?	**The brain detects rising temperature and signals skin blood vessels to widen. Blood carries heat toward the skin, and sweat glands release fluid that carries away heat as it evaporates.**
3	Why might sweating cool the midfielder less effectively in humid air? Explain why this matters to both her muscles and her brain.	**Humidity slows sweat evaporation, so less heat leaves her body. Muscle cells and the brain both work best within a narrow temperature range.**
4	How can water lost through sweat make it harder for the heart to support both muscle movement and cooling? What do the kidneys do in response?	**Less blood returns to the heart, so it pumps less with each beat. Supplying both the muscles and skin becomes harder, while the kidneys conserve water by producing less urine.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The raincoat traps moist air near the skin, slowing sweat evaporation and reducing cooling. The nervous system detects the rising temperature and signals blood vessels near the skin to widen. As sweating continues, the circulatory system has less fluid to supply both muscles and skin, while the kidneys conserve water by making less urine. Removing the coat and resting in shade would reduce the strain on these systems.

Accept other accurate four-sentence chains that connect at least three body systems to the runner's cooling and include a reasonable action. Students may identify the skin and sweat glands as parts of the integumentary system.