Fuel and Fluid

Trace how body systems respond when food and water enter the blood.

HAP.10.b "Construct an explanation of the relationships between the digestive system and other organ systems, including the body's mechanisms for maintaining homeostasis."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline where glucose or water enters or leaves the blood, circle organs that change their activity in response to a signal, and number two chains of events that help keep glucose or water in a useful range.

A Walk After Breakfast

1. Before a long walk to school, Maya eats toast and drinks a glass of water. In her small intestine, digestive enzymes break starch in the toast into glucose. Cells lining the intestine absorb glucose into the blood. Most nutrients travel first to the liver, which can store some glucose as glycogen and release it later. The intestine also absorbs water. Blood carries the absorbed glucose and water throughout the body, including to muscle cells. Digestion does not power Maya's steps by itself. Her circulatory system delivers fuel, and her muscles use glucose in cellular respiration to release usable energy.

2. When glucose from the toast raises Maya's blood glucose level, the pancreas releases insulin into the blood. Insulin signals muscle and other cells to take in more glucose. It also helps the liver store glucose as glycogen, so blood glucose moves back toward its usual range. Hours later, if no food enters her intestine, blood glucose may fall. The pancreas then releases more glucagon, which tells the liver to break down glycogen and release glucose into the blood. These opposite signals help keep a steady fuel supply for cells even though meals arrive only at certain times.

3. As Maya walks, she sweats, losing water from her body. Her brain senses when her blood becomes more concentrated. In response, the pituitary gland releases more antidiuretic hormone, or ADH, into the blood. ADH signals the kidneys to return more water to the blood instead of letting it leave as urine. Urine becomes smaller in volume and more concentrated. Water absorbed from Maya's drink helps restore the balance; as blood becomes less concentrated, ADH release falls and more water can leave in urine. The kidneys can conserve water, but they cannot replace water lost from the body.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the digestive and circulatory systems work together to supply Maya's muscles with usable energy?

2. After breakfast raises Maya's blood glucose, how do the pancreas, muscles, and liver help bring it back toward its usual range?

3. If Maya goes several hours without eating, how do the pancreas and liver help maintain a fuel supply for cells?

4. When Maya loses water by sweating, how does a signal from her brain change kidney activity, and how does that help?

3 YOUR TURN

Your own words

During a stomach illness, a student loses water in loose stools and then drinks water. In one paragraph, explain how the digestive, circulatory, brain and pituitary, and urinary systems respond to the water loss and the drink, including why kidney action cannot replace drinking.

Fuel and Fluid

PART 1 · READ AND MARK

Underline where glucose or water enters or leaves the blood, circle organs that change their activity in response to a signal, and number two chains of events that help keep glucose or water in a useful range. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the digestive and circulatory systems work together to supply Maya's muscles with usable energy?	**The small intestine absorbs glucose from digested toast into the blood. Blood delivers it to muscle cells, which use it in cellular respiration to release usable energy.**
2	After breakfast raises Maya's blood glucose, how do the pancreas, muscles, and liver help bring it back toward its usual range?	**The pancreas releases insulin. Insulin signals muscle and other cells to take in more glucose and helps the liver store glucose as glycogen.**
3	If Maya goes several hours without eating, how do the pancreas and liver help maintain a fuel supply for cells?	**The pancreas releases more glucagon, which signals the liver to break down glycogen and release glucose into the blood.**
4	When Maya loses water by sweating, how does a signal from her brain change kidney activity, and how does that help?	**The brain senses more concentrated blood, and the pituitary releases more ADH. The kidneys return more water to the blood, reducing water lost in urine.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Loose stools carry away water that the intestine did not absorb, so less water enters the blood. As the blood becomes more concentrated, the brain senses the change and the pituitary releases more ADH. The kidneys respond by returning more water to the blood, making less urine. Water from the drink is absorbed by the intestine and carried in the blood, helping restore balance. The kidneys only conserve water already in the body, so drinking helps replace water that was lost.

Accept explanations that connect intestinal absorption or water loss to changes in the blood and show how signals alter liver or kidney activity. For Part 3, students should distinguish conserving water from replacing lost water.