# Water Under Pressure

Read how water helps the body keep conditions stable.

**BIO.4.b** "Construct an explanation of how the unique properties of water are vital to maintaining homeostasis in organisms."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline three properties of water in the passage, then number the explanation of how each one helps maintain stable conditions in the body.

### The Last Mile

1. At the last mile of a summer road race, a runner's muscles release heat as they work. Yet the runner's internal temperature usually stays within a narrow range. Water helps because it takes a large amount of energy to raise its temperature. Much of the body is water, so blood and other fluids absorb heat without warming as rapidly as many other materials would. Blood carries some of that heat from working muscles toward the skin. This thermal buffering buys time for the body to release heat instead of allowing a sudden rise in core temperature.

2. At the skin, sweat provides another way to lose heat. Water molecules attract one another strongly, so separating them into vapor takes substantial energy. When sweat evaporates, it takes that energy from the skin, cooling the body. Sweat that drips off without evaporating removes far less heat. Meanwhile, water's uneven electrical charge lets it surround and dissolve charged particles, including sodium ions. In blood plasma, liquid water carries dissolved sodium and glucose to places that need them. Losing sweat without replacing fluid reduces the water available for transport and can change the concentration of dissolved particles in body fluids.

3. The concentration of those particles matters to cells. Their membranes let water move across more easily than many dissolved particles. If fluid outside cells becomes more concentrated after water loss, water tends to move out of cells, which can shrink. If someone instead drinks an extreme amount of plain water in a short time, fluid outside cells can become too dilute, and water may move into cells, making them swell. Kidneys help stabilize these conditions by adjusting how much water and dissolved material leave in urine. Homeostasis depends on balancing water loss, water intake, and dissolved particles, not simply on drinking as much water as possible.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. How does water's resistance to temperature change help the runner maintain a stable core temperature?

2. Why does evaporating sweat cool the runner more than sweat that drips off?

3. How does water's uneven electrical charge help blood transport substances, and how could fluid loss disrupt that role?

4. If the runner drinks an extreme amount of plain water in a short time, how might the change in fluid outside the cells affect the cells?

## 3 YOUR TURN

Your own words

In a seedling, water evaporates from leaves, and root cell membranes allow water to cross. The soil becomes hotter and saltier during the day. In four or five sentences, explain how two properties of water affect the seedling's temperature and cells, then predict what could happen if its roots cannot replace the water lost from its leaves.

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## PART 1 · READ AND MARK

Underline three properties of water in the passage, then number the explanation of how each one helps maintain stable conditions in the body. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | How does water's resistance to temperature change help the runner maintain a stable core temperature? | **Body fluids absorb heat from working muscles without warming rapidly, giving the body time to release heat.** |
| 2 | Why does evaporating sweat cool the runner more than sweat that drips off? | **Turning water into vapor takes substantial energy. Evaporating sweat takes that energy from the skin, while dripping sweat removes far less heat.** |
| 3 | How does water's uneven electrical charge help blood transport substances, and how could fluid loss disrupt that role? | **Water's uneven charge lets it surround and dissolve substances such as sodium ions and glucose, which blood plasma carries through the body. Fluid loss leaves less water available for transport.** |
| 4 | If the runner drinks an extreme amount of plain water in a short time, how might the change in fluid outside the cells affect the cells? | **Fluid outside the cells may become too dilute. Water may then move into the cells and make them swell.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

Water in the seedling absorbs a lot of heat before its temperature rises much, slowing temperature changes. As water evaporates from leaves, it takes heat away and cools the plant. If the soil becomes saltier than the fluid inside root cells, water tends to move out of those cells through their membranes. Without enough water from its roots to replace what leaves lose, the seedling's cells may lose water and the plant may wilt. These changes make it harder for the seedling to keep its temperature and cells stable.

Accept explanations that correctly connect water's resistance to warming or the energy required for evaporation to temperature stability. For the seedling, accept a conditional prediction about water leaving root cells when the surrounding soil has a higher solute concentration.