Michelle was a healthy 25-year-old running in her first marathon. The hot and humid weather had made all the runners sweat profusely, so Michelle made sure she drank water at every opportunity. Gradually, she began to feel weak and confused. At the end of the marathon, Michelle staggered into a medical tent. Complaining of headache and nausea, she collapsed onto the floor. Volunteers quickly gave Michelle water for dehydration. Soon, her condition worsened and Michelle was rushed to the hospital, where she was gripped by a seizure and went into a coma. Why did treating Michelle with water make her condition worse?

The following are some clues to help you predict how water made Michelle sick. Can you solve the mystery?

Clue #1: At the hospital a sample of Michelle’s blood was drawn and examined. The red blood cells appeared swollen. At this point, what do you think has happened to Michelle’s cells?

Clue #2: As Michelle ran, she perspired, losing salts from her bloodstream. And as she drank more and more water during the race, the concentration of dissolved salts and minerals in her bloodstream decreased. How do you think these things made Michelle’s condition worse?

Solve the Mystery: During the race, Michelle drank plenty of water, but she didn’t replace the salts she lost due to sweating. As a result, her blood became hypotonic, and osmotic pressure led the cells in her brain (and throughout her body) to swell.

As Michelle’s blood became less concentrated, cells in her brain sent chemical signals to her kidneys to stop removing sodium chloride and other salts from her bloodstream. However, as she continued to sweat, she continued to lose salt through her skin.

By the end of the race, Michelle had lost a large quantity of salt and minerals. She had taken in so much water that homeostasis had broken down. Her cells were damaged by osmotic pressure that was unbalanced.

When Michelle was rushed to the hospital, the doctors discovered that she was suffering from hyponatremia, or water intoxication. Left untreated, this condition can lead to death.

1. Relate Cause and Effect: When a person sweats, water and essential solutes called electrolytes are lost from the body. Michelle drank lots of water but did not replace lost electrolytes. What effect did this have on her cells?

2. Infer: Imagine that Michelle drank both water and sports drinks containing the electrolytes she lost. Would her condition be the same? Explain.

3. Infer: Do you think that hyponatremia happens because of osmosis or active transport? Explain your reasoning.