

Travels of the Water Molecules on George Washington's Boots*

Teacher Master: Changes of State Highlighted in Yellow

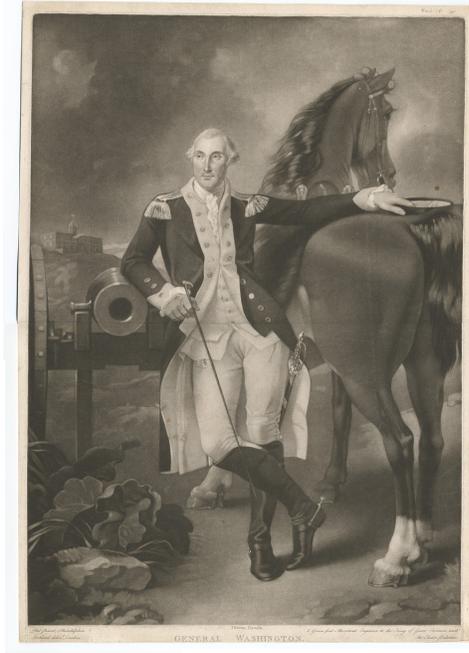


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Imagine that in 1776, George Washington stood under a cherry tree and washed his boots with water. Some of the water molecules slid off his boots and soaked into the ground. These water molecules were then taken into the roots of the cherry tree. The water molecules traveled up the stem of the tree to the leaves. The Sun gave the (1) water molecules in the leaves the energy to speed up and change to water-vapor molecules. The water-vapor molecules evaporated out of little holes in the leaves and rose into the air.



Photo courtesy of Pexels.com

*Written by Kathleen Roth (2016). Inspired by Berkheimer, G. D., Anderson, C. W., Lee, O., & Blakeslee, T. D. (1988). *Matter and molecules teacher's guide* (p. 68). East Lansing, MI: Michigan State University.

The water-vapor molecules from George Washington's boots ended up high in the sky where the air is much cooler. Up in the cool air, (2) **these water-vapor molecules lost energy, slowed down, and condensed to form a tiny liquid-water droplet** in a cloud. The cloud blew far out across the Atlantic Ocean. The tiny droplet of water molecules that came from George Washington's boots joined together with other water molecules in the cloud to form big liquid-water drops that were so heavy, they fell from the sky as rain and landed in the Atlantic Ocean.



Photo courtesy of Pexels.com

In the ocean, the liquid-water molecules from George Washington's boots were constantly moving like all the other molecules of water in the ocean, and the other water molecules were constantly bumping into them. Eventually, some of the (3) **water molecules from George Washington's boots moved fast enough to escape into the air, where they moved around freely as water-vapor molecules**. As they rose into the cooler air, (4) **they started losing a lot of heat energy and once again condensed into a tiny liquid-water droplet** that was part of a big cloud.

The cloud moved across the ocean to France. By then, the water molecules from George Washington's boots had joined together with other water molecules in the cloud to form a big, heavy drop of liquid water. This big drop then fell from the sky as rain that landed in the soil near some beautiful grapevines in France. The grapevines took in the water molecules from George Washington's boots through their roots. The water molecules traveled up the stems to the leaves, where (5) they evaporated and rose into the air as water-vapor molecules.



STOP AND THINK: What do you think happened next?



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Yes! As the (6) water-vapor molecules rose into the air, they lost speed and energy and condensed into a tiny liquid-water droplet that was part of a big cloud.

This process kept happening over and over again for 240 years. Recently the water molecules from George Washington's boots soaked into the ground near here. Many cities get their water from this groundwater. So the water molecules you drank this morning might just be some of the very same molecules that helped wash George Washington's boots in 1776!

The purpose of this fictitious story is to show that the amount of water on Earth remains the same. It's just recycled over and over through evaporation, condensation, and precipitation. This repeated process is called the **water cycle**.

The water molecules on Earth are very, very old. They've been through many, many water cycles, evaporating, condensing, and precipitating over and over again.