

The Water Cycle

Reflect

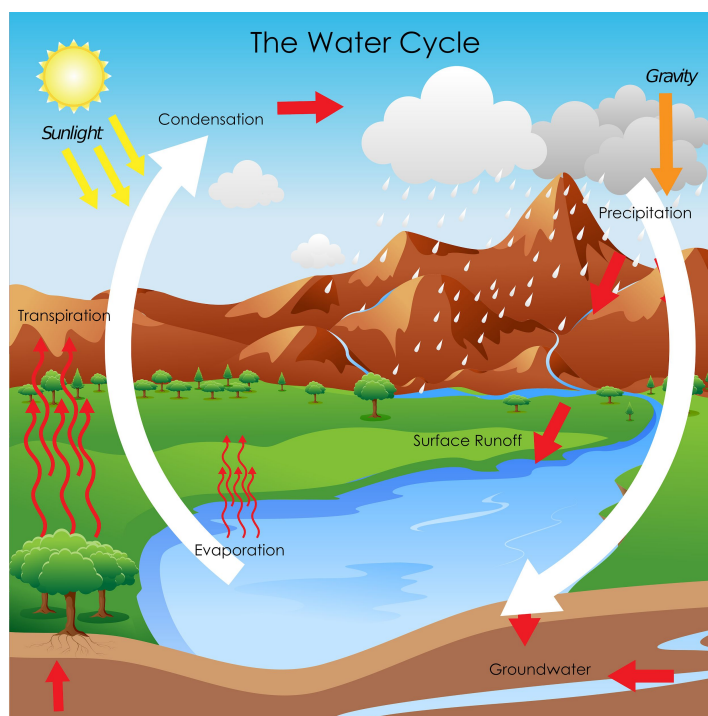
Why do you think Earth is called the Blue Planet? Could the reason be that about 75% of its surface is covered with water? Those white clouds you see are filled with water too. Earth is the only planet where water exists as a liquid, solid, and gas (water vapor). This amazing substance, essential for life, is found practically everywhere: in our bodies; in lakes, river, and oceans; in plants and animals; in the air; and in the ground. Ever changing, water switches form and location throughout our Earth systems in a process called the **water cycle**.



water cycle – the constant movement of water through land, air, oceans, and living things

What Do You Think?

Where do you think the energy comes from that drives the water cycle? The model of the water cycle below shows that both *energy from light* and the *force of gravity* move water between oceans, the atmosphere, living organisms, and the land. The Sun's energy heats surface water and changes it to water vapor through *evaporation*. In the atmosphere, the water vapor cools through *condensation* into clouds or crystallizes into snow or ice. This *precipitation* falls to the ground by the force of gravity and becomes *surface runoff*. Plants absorb water and then release water vapor back into the air through *transpiration*. Animals use water and then release the water vapor through *respiration*. Other surface water freezes (*crystallization*) or is stored in land, in bodies of water, or in underground aquifers. The water cycle has no beginning or end. Water moves continuously from one stage to the next.



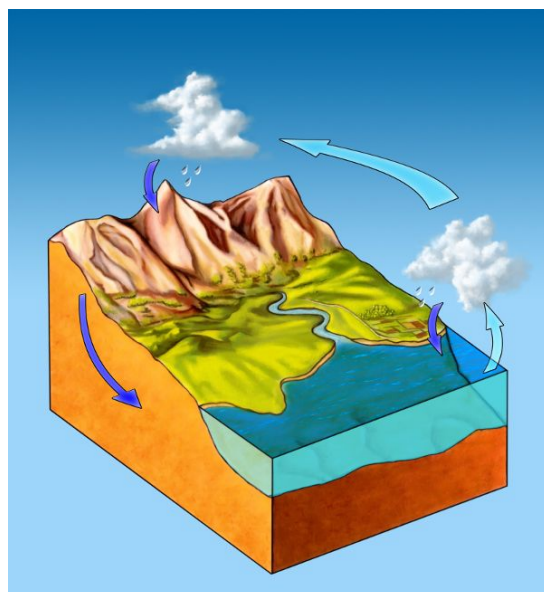
Look Out!



The last time you took a shower, did you think about where the water came from? The water you used to wash could have spent time in the South China Sea. Maybe it was part of an ancient glacier at the South Pole. The water in your shower could have come from anywhere in the world, because all of Earth's water is recycled in the water cycle. So just how does water from a glacier halfway around the world find its way to your bathroom?

Water around the Globe for Millennia

When water moves through the water cycle, it changes among the states of matter over and over again. The Sun's energy and Earth's gravity move water among land, oceans, and the atmosphere by driving different processes in the water cycle. The Sun's energy drives melting and evaporation, and Earth's gravity drives precipitation, groundwater penetration, and downhill flow. The water created on Earth billions of years ago when the young planet was forming has continually been cycled from surface water to other forms of water on our globe. Water flows down rivers and slopes into oceans with currents that carry water around the globe. When water evaporates and then condenses into clouds, the rain that falls in your yard or comes through your faucet could be water molecules that cycled their way around the world.



Reflect



A Close Look at Evaporation

With enough solar energy increasing temperatures, the molecules of liquid water change into water vapor and move into the atmosphere. This process is called *evaporation*. Ocean water is *salt water*, a mixture of salt and water. When evaporation occurs, only the water evaporates and the salt is left behind. This process makes the salt become more concentrated. This is why the oceans are salty.

Water also evaporates from our bodies. When sweat dries on your skin, it is because the water in your sweat has evaporated into the air. You might have noticed that when sweat evaporates off you, your skin feels and tastes salty. Similar to the ocean, sweat is composed of salt water. The water evaporates and the salt is left behind on your dry skin.

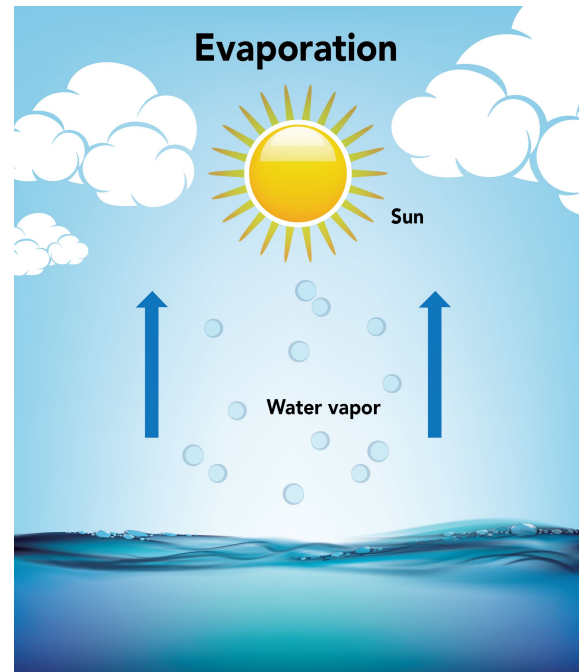
Reflect

A Close Look at Condensation

After water evaporates from the surface of the land, it rises in the **atmosphere**. The higher it rises, the more energy it loses because of the lower temperatures. As water vapor loses energy and cools, the molecules change state from gas to liquid and form small droplets of water. This process is known as *condensation*. Condensation is the opposite of evaporation.

atmosphere – the layer of gases that surrounds Earth; commonly called the air

Water vapor molecules are too small to condense into liquid water themselves. Instead, they grab onto tiny particles of dust, dirt, or smoke in the air called *condensation nuclei*.



Try Now

Fresh drinking water is a vital resource that has become scarce in recent years. In coastal regions, some cities are planning to start processing salt water into fresh water for human consumption. This process is called desalination. When the Sun's energy evaporates salt water, the salt is left behind. When the water vapor condenses, it is fresh water. You can build a simple desalination system. For this activity, you will need the following:

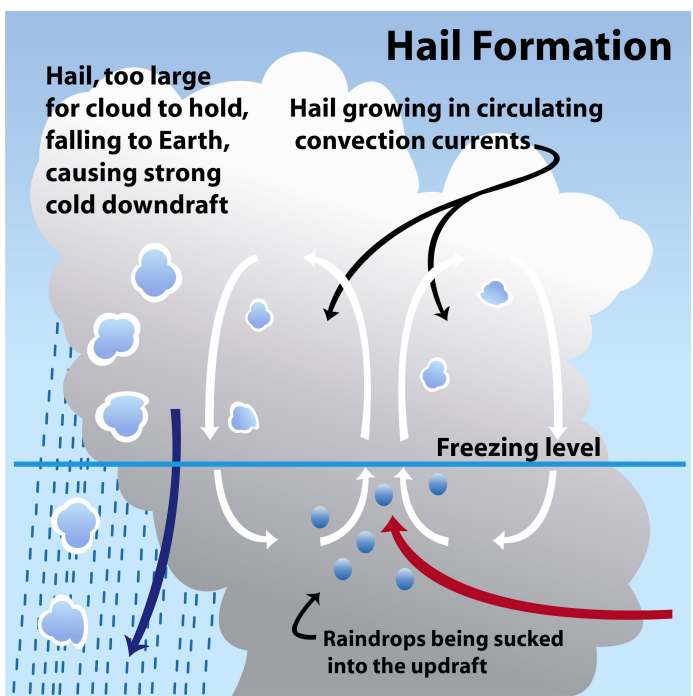
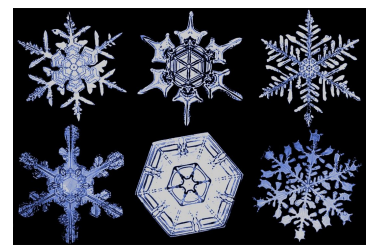
- 1 Large glass or plastic bowl, preferably clear, definitely not white
- 1 Small, heavy cup, such as a coffee mug that will easily fit completely in the bowl.
- Plastic wrap or any clear, flexible material
- 1 Marble or small rock
- 8 grams Salt
- 150 milliliters Water
- 1 Plastic spoon



Reflect

A Close Look at Crystallization and Precipitation

If the liquid water molecules lose energy and cool further, they will eventually change into a solid as they freeze. A more scientific way of explaining this is called the process of *crystallization*, where liquid molecules form an orderly, geometric solid. This is otherwise known as *snow*. The geometric shape of the water molecule when it freezes is hexagonal, or six-sided. As the molecules combine, they form snowflakes, and no two are alike! Gravity then acts to pull the snow down to Earth.



If the cloud temperatures are not freezing and a water droplet falls into freezing temperatures closer to the ground, then the raindrop freezes into *sleet*. If ice pellets form in storm clouds and strong updrafts add more layers of ice, small balls called hail form. Gravity finally wins and the hail drops.



Reflect

As water droplets or ice in the atmosphere become larger, they get heavier. When they become too heavy, gravity pulls them from the cloud. They fall back to Earth from the force of gravity as *precipitation*. There are many types of precipitation, including rain, snow, hail, and sleet.



Look Out!



Fluffy, white clouds in the sky look like they are giant puffs of vapor floating in the air. Because they float high above the ground, many people think clouds are made of gas. Recall that clouds are actually small droplets of liquid water that have condensed on tiny particles floating in the atmosphere.

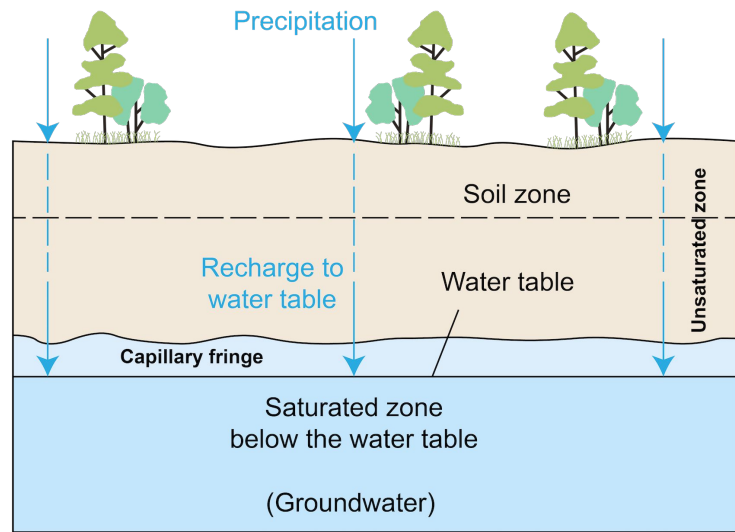
Hot deserts are not necessarily the driest places on Earth. That prize goes to the Dry Valleys in Antarctica, which, although covered with ice, have not seen rain for nearly 2 million years. The next-driest place on the planet is the Atacama Desert in Chile and Peru.



The Water Cycle

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Water that falls onto Earth's surface can take many pathways. Much of the water moves via downhill flow to return to the ocean, and the water cycle begins again. Some water may infiltrate the ground to help replenish *groundwater* and *aquifers*. The top of the surface, where groundwater occurs, is called the *water table*. In the diagram, you can see how the ground below the water table is saturated with water (the saturated zone). Aquifers are replenished by the seepage of precipitation.

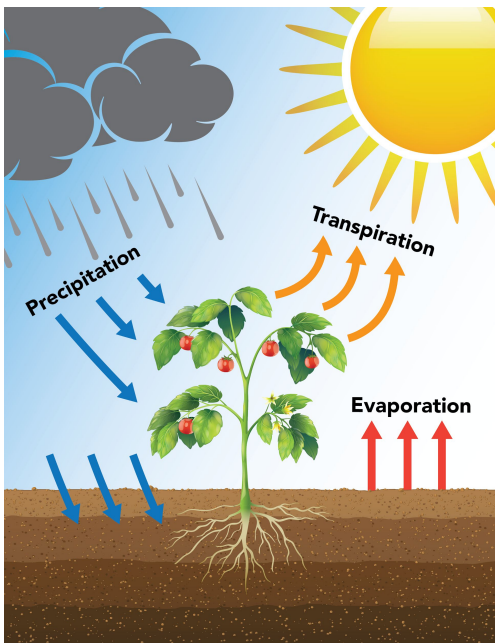


aquifer – a layer of permeable rock that retains and filters water

Look Out!

A Close Look at Transpiration

In the water cycle, not all water that evaporates into the air comes from bodies of water. For example, a plant might absorb water from the soil, or an animal might drink from a stream. Living things take in water and can release it as well. Plants release water into the atmosphere through their leaves, which is a process known as *transpiration*. Animals release it through sweat (perspiration) and urination. In both cases, the Sun's energy causes the water to evaporate, and the water cycle continues.



transpiration – evaporation of water through openings on the leaves of plants