

9. The three states of water

Discussion topics and information

What are the three states of water?

Water exists in 3 forms

Liquid: water (as we see it from taps, in rivers etc.)

Solid: ice (icecaps, snow, hail, glaciers and in the freezer)

Gas: water vapour (invisible!)

How does water change states in the water cycle?

Water changes between these 3 states throughout the water cycle (see diagram). Solar energy (heat) from the sun causes water to become gas (water vapour) - this is called *evaporation*. As the earth's surface warms, rising currents of air carry the water vapour upwards. The gas cools as it rises, and *condenses* into droplets. These droplets join together in clouds and fall back to the earth as rain, hail or snow (*precipitation*).

Rainfall may (see diagram over page):

- run over land into waterways;
- evaporate directly from water, land or vegetation;
- soak into the ground, be used by plant roots and then returned to the air by *transpiration* from the leaves of plants; or
- soak deeper into the ground and become groundwater.

Evaporation - Is the process whereby water moves from the surface of the earth into the atmosphere. Heat from the sun soaks up water from the ocean and other bodies of water, such as rivers, lakes and puddles. The water vapour rises into the air and is then transported by the wind.

Transpiration - This is the other process whereby water moves from earth to the atmosphere. Trees, shrubs, grasses and other plants all need water to survive. They take up water from the soil by their roots so that they can grow. Just like in the process of evaporation the sun creates heat which transpires this water into the air through tiny holes in the underside of leaves.

Condensation - Under certain conditions the water vapour stored in the atmosphere begins to form tiny droplets of liquid water. These droplets are so small that they float in the sky and we see them as clouds. This process is called condensation. Another form of condensation is the formation of water droplets or ice crystals directly on cold surfaces. Examples of condensation on cold surfaces include: water droplets fogging up your bathroom mirror, and dew or frost forming on the ground.

Precipitation - Precipitation occurs when the water droplets in clouds begin to merge together and become too heavy to stay in the sky. They begin to fall as rain onto the Earth's surface or if it is cooler hail, sleet, or snow falling to the ground. The water cycle then begins over again.

Lesson ideas

- Complete the states of water cut and paste (included with this activity)
- Name where you might find the 3 states of water in a house
- List and draw examples of the 3 states of water (gas is very tricky!)
- Demonstrate condensation using a kettle near a window. Point out that for the first centimetre or so out of the kettle, the water vapour is invisible. As it reaches the cool air we can see the steam (which contains tiny water droplets). When the steam settles onto the window the tiny droplets merge together and become large enough to drip down the window. Explain this is what happens in the sky to create rain.

9. The three states of water, cont

Lesson ideas, cont

- Demonstrate evaporation by placing a shallow dish of water in the sun for a day. Measure (or mark) the depth of the water before and after to show how much has 'disappeared'. Do this on a warm sunny day and compare to results on a cooler day in the shade. Is there a difference?
- Demonstrate transpiration by tying a sturdy plastic bag over the end of a leafy tree/shrub branch. Leave for a day and night, then check to see the water collected in the bag. Where did it come from? Where would the water have gone if the bag wasn't there? Explain this trick is sometimes used to survive in the bush.

Recommended resources

www.yvw.com.au/newed/juniors.html "where your water comes from" - an interactive animated story on the water cycle starring Cloudia Raindrop

www.wrc.wa.gov.au/schools/water_cycle.html - an animated map of water cycle components scroll over features to find out about them.

www.wrc.wa.gov.au/public/waterfacts/7_water_cycle/index.html - water cycle fact sheet

- More links to water cycle related sites:

www.watercare.net/wl_cc/cw_water_cycle_copy1.htm

www.abc.net.au/tv/documentaries/stories/s766365.htm for details of an excellent video on the water cycle.