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Division of Water Supply Protection
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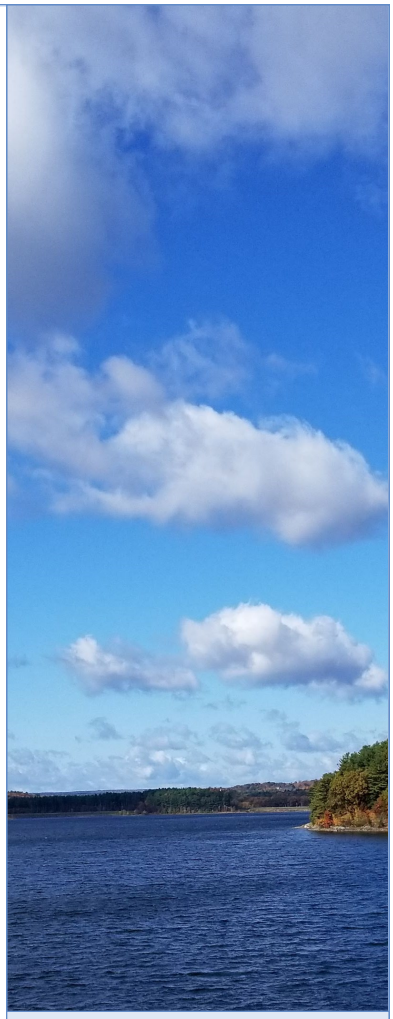


THE WATER CYCLE ACTIVITY GUIDE

The Water Cycle, or Hydrologic Cycle, is nature's recycling system of moving water molecules to cycle from the land, to air, and back again.

As the sun's energy warms the water in oceans, rivers, and on land, it changes to water vapor and evaporates into the atmosphere.

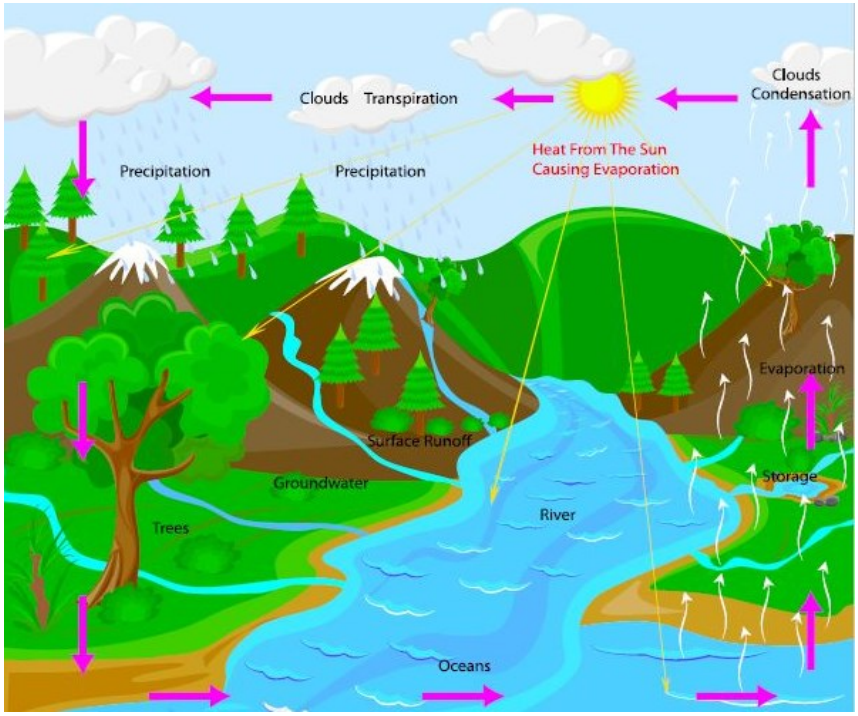
Tiny droplets of water vapor form clouds, and are carried by weather patterns.

As the vapor cools, it condenses and falls back to Earth as precipitation to collect on surface waters, seep into soil, or be taken up by plant roots.

Most of the water in plants is released back to the atmosphere by transpiration, a process of evaporation through tiny pores in leaves.

Water is the ultimate in recycling: it transpires, evaporates, condenses, and returns back to the atmosphere by precipitation.

The Earth's water supply is constantly moving!



INSIDE THIS ISSUE

MATERIALS:

- Any recycled container that can hold water. Try cream cartons or yogurt containers.
- Natural materials gathered on a nature walk: pinecones, grasses, pebbles, leaves.

REFLECTIONS

Did anything float to the top?

How long will it take to melt?

How long will it take to completely evaporate?

Predict and record your results!

ICE BLOCK SCULPTURE

1. Collect small interesting items and add them to the container.
2. Fill your container up with water and put in the freezer until solid.
3. Remove the ice block from container. Warm water will loosen it.

Make a few ice blocks and display your temporary sculptures outside.

	Prediction	Observed Results
Melted		
Evaporated		

Earth's water is always in movement and is always changing states, from liquid to vapor to ice and back again.

MATERIALS:

- Zip style bag,

Or

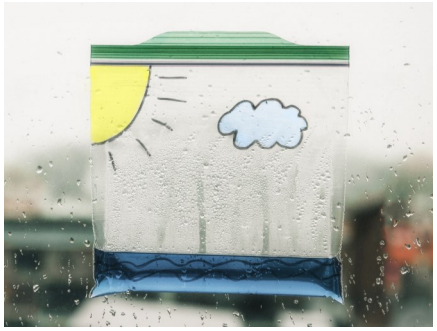
- Clear jar with lid, Such as a mayonnaise, applesauce, or peanut butter jar
- Permanent markers or crayons and paper
- Optional: drop of blue food coloring
- Tape
- Sunny window

Depending on how sunny it is, the cycling of water by evaporation and condensation may take two hours or two days.

Check out your weather forecast and predict how long it will take!

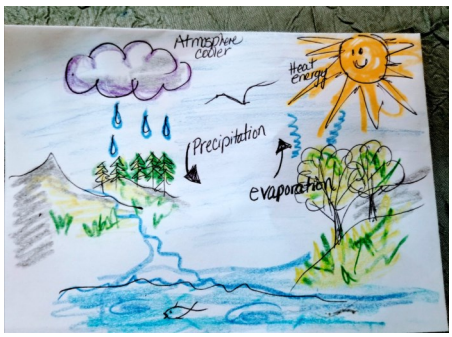
WATER CYCLE IN A BAG OR JAR

1. Decorate a zip bag or jar with permanent markers by drawing a diagram of the water cycle. Add as many details as you like.
2. If you do not have permanent markers, crayons will work, but will show up on the jar or bag very lightly. Use crayons to color your diagram on a piece of paper and hang near your bag or jar. Just be careful to not block the sunlight.
3. Mix just a drop of blue food coloring in a cup of water. (Optional.)
4. Pour water into bag or jar. Zip tightly closed or put the lid on.
5. Tape bag to a sunny window, place jar in a sunny spot.
6. Watch and wait for some evaporation and condensation!



As the sun heats the water, it will turn to vapor and evaporate. Since the bag or jar is sealed shut, the vapor can't continue to the atmosphere.

The vapor sticks to the top and sides and turns back to water by condensation. The water drops will eventually drip down as precipitation back to the bottom, and the cycle continues.



FILL A RESERVOIR

Water moves in a cycle between the air, land, plants and animals.

Human activity can influence many parts of the water cycle. A reservoir is one example. A reservoir is an artificial lake where water is stored that becomes part of the water cycle. This activity shows one way a reservoir fills with water to provide a reliable drinking water supply.

1. Line your box with rocks, pebbles and sand.

2. Add a layer of soil over the sand.

3. Add a layer of crushed up leaves over the soil.

4. In the middle push away the soil and sand to create a low area– this will represent a reservoir.

5. Make it rain by spraying water in the corners. If you don't have a spray bottle, drop water by tablespoon in the corners.

6. Keep adding water in the corners until you see it pool in the center and your reservoir is full.

What is happening to the soil?

As the rain falls, water is absorbed and naturally filtered through the soil and sand. The soil becomes saturated and the water seeps through to the reservoir.

Did any soil run into the reservoir and make it muddy? Let your model reservoir sit undisturbed for an hour or more and check to see if it cleared up, and try the activity below.

MATERIALS:

- Any plastic container that you can get dirty. For example: large food storage container, plastic shoe box, dish pan, recycled take out box
- Pebbles or small rocks
- Sand
- Soil
- Leaves
- Spray bottle or cup and tablespoon with water

REFLECTIONS

What are other ways a reservoir is filled?

The Wachusett Reservoir is fed by precipitation, runoff, the Quinapoxet and Stillwater Rivers, and periodically by the Quabbin Aqueduct.

SETTLE DOWN SEDIMENT

MATERIALS:

· Jar
· Sand and soil
· Grass/leaves
· Water

Sediment comes from the Latin word **sedere,** meaning **sit down** or **settle**. Tiny pieces of solids that are carried into the water sink to the bottom.

1. Add about a handful of sand and soil to a jar. Add some bits of leaves or grass. To find sand and soil, get permission to dig a small hole outside. Most soils have a mix of clay and sand. Experiment with soils from different locations.

2. Fill the jar at least 1/2 full of water.

3. Cover with lid and shake.

4. Set the jar down in a place that it won't be disturbed for about a week

5. Check it often to see what happens to the muddy water. Sketch the results each day.

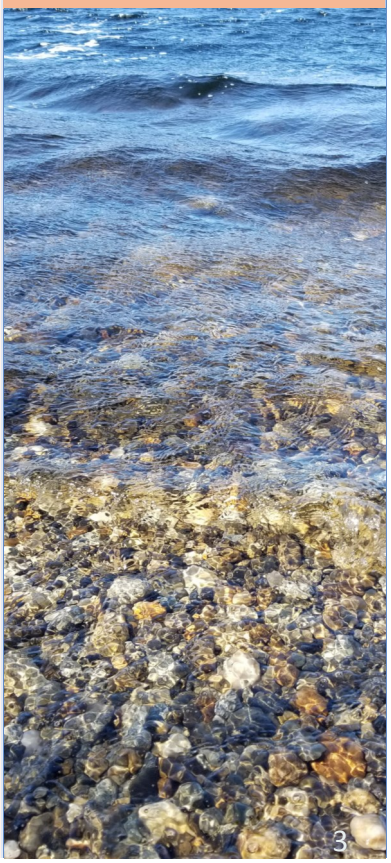
The sediments settle, or fall out of, the water and form layers at the bottom of the jar. The largest sediments will fall first, and more and more particles will fall out of the water over time.

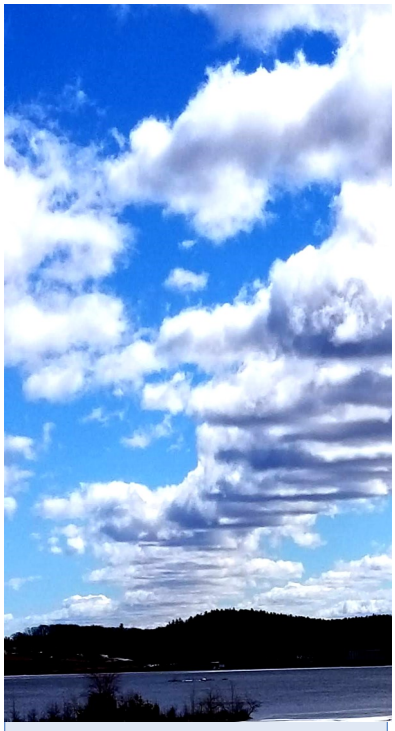
Day 1

Day 2

Day 7

During construction of the Wachusett Reservoir, topsoil was removed. The rocky sandy bottom ensures clean clear water.





BE A WEATHER WATCHER

Be curious about something you may see every day– clouds! Learn the basic cloud formations and what type of weather they bring. Can you predict the weather?

A cloud is a large collection of tiny droplets of water or ice crystals that are so small and light that they can float in the air.

There are four basic cloud types:

1. Cumulus: Clouds that look like fluffy heaps of cotton are fair weather clouds. These clouds indicate good weather, until they grow large and anvil shaped with dark bottoms.

2. Cirrus: Clouds with a wispy, feathery appearance and made of ice crystals. Immediate fair weather, but expect a change in the weather within a day.

3. Stratus: Clouds that form layers and are spread out. Stratus covering the whole sky could mean stormy weather is on the way.

4. Nimbus: Dark rain clouds are related to any type of precipitation. Typically gray with a dark flat bottom.

MATERIALS:

- Jar
- Water
- Blue food coloring
- Pipette, dropper, or small spoon
- Shaving cream or liquid dish soap and a whisk

If you don't have shaving cream on hand, whisk together
1 Tablespoon of liquid dish soap or hand soap and 1 Tablespoon of water until fluffy and light.

REFLECTIONS

Why is the blue falling through like rain?

When the droplets in a cloud get heavy enough, they fall to earth as precipitation.

Can you use something other than food coloring to make this happen?

Make the cloud saturated and heavy by diluting the food color with more water.

RAINFALL IN A JAR

Precipitation can be more than rain. Precipitation includes all forms of water, liquid or solid, that falls from clouds and reaches the ground. This includes drizzle, freezing drizzle, freezing rain, ice crystals, ice pellets, rain, hail, snow, snow pellets, and snow grains.

Create a rainstorm in a jar with this quick fun activity.

1. Gather materials listed to the left.
   Make your own "shaving cream" if you don't have any on hand.
2. Fill a jar at least 3/4 of the way full with water.
3. Cover the top of the jar with shaving cream– this is your cloud. A cloud is a large collection of tiny droplets of water or ice crystals that are so small and light that they can float in the air.
4. Carefully add some drops of blue food coloring to the top of the cloud.
5. Wait for the food color to drop through the cloud – it is "raining" in your jar!

Whipped dish soap cloud

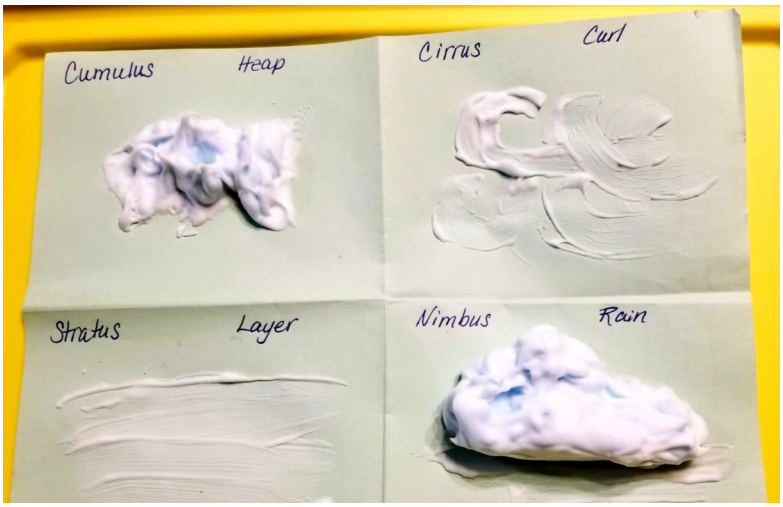
Shaving cream cloud

MAKE A CLOUD CHART

Make your own cloud chart and learn some Latin at the same time!

1. Fold your paper in half, then in half again to make four sections.
2. Label each quarter of the paper with one of the four main cloud types.
3. Paint each cloud shape according to the Latin meaning of its name.

Cumulus: Heap piles of shaving cream on.
Cirrus: Brush on thin curls of shaving cream. Cirrus are made of delicate ice crystals.
Stratus: Spread out layers of shaving cream.
Nimbus: Heap piles of shaving cream for these rain clouds. Paint them bigger than cumulus with a flat heavy bottom.



MATERIALS:

- Colored paper
- Shaving cream
- Paint brush
- Pen, marker, or crayon

No shaving cream? Just whisk 1 Tablespoon liquid soap with 1 Tablespoon of water until light and fluffy.

The four main cloud types:

Cloud	Latin Meaning
Cumulus	Heap, pile
Cirrus	Curl, fringe
Stratus	Layer
Nimbus	Rain

Clouds are formed when water in the air condenses onto tiny particles of dust. Millions of these droplets group together to form a visible cloud.

CLOUD JOURNAL

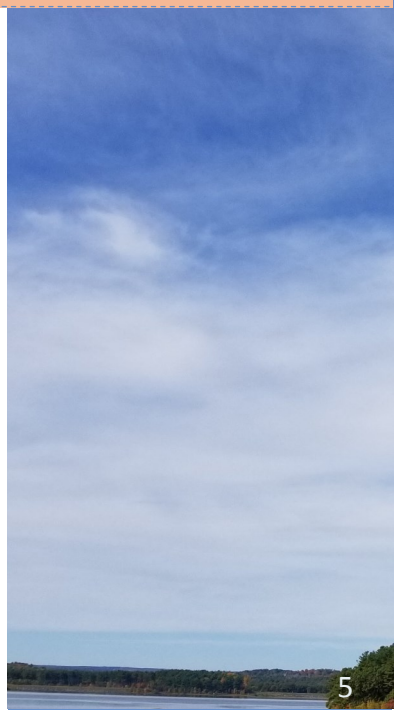
Now that you can identify the basic cloud shapes, try keeping a cloud journal for at least a week. See the water cycle in action while looking at weather patterns.

Be a Citizen Scientist and help record cloud observations that are compared with NASA satellite data. Observe the clouds from below, while NASA records from above, giving a complete picture.

More information at: https://observer.globe.gov/do-globe-observer/clouds

What are you curious about?
We want to hear from you! Send us a photo of your activity results, and any questions or thoughts you may have!

Contact Watershed Education Staff :
Kathryn.Parent@mass.gov



GLOSSARY:

CIRRUS: Clouds with a wispy, feathery appearance and made of ice crystals. Usually means fair weather, but expect a change in the weather within a day.

CONDENSATION: The process of water vapor changing back into liquid water. Condensation is responsible for cloud formation.

CUMULUS: Clouds that look like fluffy heaps of cotton. These clouds indicate good weather, until they grow large and anvil shaped with dark bottoms.

EVAPORATION: Evaporation takes place when liquid turns into gas. Water leaves the Earth's surface and enters the atmosphere as a gas or water vapor.

HYDROLOGIC CYCLE: The Water Cycle. The process of water moving from place to place above, on, and below the Earth's surface.

NIMBUS: Dark rain clouds that are related to any type of precipitation. Typically gray and anvil shaped with a flat bottom.

PRECIPITATION: Any liquid or frozen water that forms in the atmosphere and falls back to the Earth. Precipitation forms in the clouds when water vapor condenses into bigger droplets of water. When the drops are heavy enough, they fall to the Earth.

RESERVOIR: A large natural or artificial lake used as a source of water supply.

SEDIMENT: The material from a liquid that settles to the bottom.

STRATUS: Clouds that form layers and are spread out. Stratus covering the whole sky could mean stormy weather is on the way.

TRANSPIRATION: The process where plants absorb water through the roots and then give off water vapor through pores in their leaves.

WORD SEARCH

CIRRUS

CONDENSATION

CUMULUS

CYCLE

EVAPORATION

HYDROLOGIC

NIMBUS

PRECIPITATION

RESERVOIR

SEDIMENT

STRATUS

TRANSPIRATION

DEPARTMENT OF CONSERVATION AND RECREATION

DIVISION OF WATER SUPPLY PROTECTION

The Division of Water Supply Protection offers education programs to teach the public about the importance of protecting public drinking water supplies and resources. These programs are offered at the Quabbin and Wachusett Reservoirs where staff, exhibits, and materials help teach people about the history and important features of our watersheds. These programs are provided for the general public, school groups and special interest groups.

www.mass.gov/watershed-education-programs

DISTANCE LEARNING RESOURCES

Project WET
www.projectwet.org/distancelearning

The National Environmental Education Foundation
www.neefusa.org/resource/water-quality-backyard-activity-guide

Scientific Explanations of Weather Lore
learn.weatherstem.com/modules/learn/lessons/72/index.html

USGS Water Science School
www.usgs.gov/special-topic/water-science-school

Globe Cloud Observer
observer.globe.gov/do-globe-observer/clouds

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