

Designation: Ontario Curriculum: Science and Technology



Earth and Space Systems: Grade 2 – Air and Water in the Environment

Written by:
Andrea Schultz-Allison,
Department of Earth
Sciences,
The University of
Western Ontario

Specific Expectations Addressed:

Understanding Basic Concepts – identify and describe forms of moisture in the environment (e.g., dew, snow, fog, frost, rain)

Developing Skills of Inquiry, Design, and Communication – use appropriate vocabulary in describing their explorations, investigations, and observations (e.g. use words such as solid, liquid, vapour; use the correct terms of describe quantities of water in standard (metric) and non-standard units of measure)

Relating Science and Technology to the World Outside the School – predict and describe how local weather conditions affect living things, including themselves (e.g. effect of wind on trees on autumn, effect of snowfall on humans’ ability to travel)

Background:

Waterworld

To sustain life on earth, water is an integral part of the air / atmosphere and air (oxygen) is an integral part of water. They are components of each other as they are components of the Earth system itself. The physical evidence provides proof of this: a single water molecule consists of two hydrogen atoms and one oxygen atom (H₂O); and the air or atmosphere is constantly transporting water (in different forms) throughout the water cycle. They cannot be regarded as *separate entities* because they are actually *symbiotic elements* of our environment.

Students in grade two should understand that these two resources are part of each other as they are part of the environment, and yet they are also recognizable as different parts of the whole environment: lakes, rivers, oceans, steam, water vapour, rain, snow, frost, fog, and dew, as well as breezes, winds, hurricanes, tornadoes, and oxygen.

The oceans cover 70% of the globe just as water composes approximately 70% of the human body. Water is an invaluable resource and a large component of all living entities. The oceans which cover such a vast portion of the globe also hold 97% of the earth’s water. The other 3% of earth’s water supply is fresh water. Of this percentage, just over 2% of the earth’s total water is contained in freshwater ice sheets and glaciers, and less than 1% is in aquifers, or ground water. Finally, it’s only a small fraction of a percent that is contained in lakes, rivers, and the atmosphere. But this water in the atmosphere is crucial: water is continually cycling or transferring between the oceans, lands, plants and the atmosphere in the hydrologic cycle, or water cycle.

Understanding the water cycle in the primary grades is as simple as the explanation that water may go from being liquid (like the ocean) to being a gas (evaporated water off the ocean) to being a solid in cold air (snow, ice, frost). Water just continues to cycle or circle around and around in any one of those 3 forms all over the earth. The Earth cannot create more water; it just “recycles” the water it already has. Studying the different states that water exists in is a good beginning for grade two.

Procedure:

Part 1

Understanding Basic Concepts – identify and describe forms of moisture in the environment (.e.g., dew, snow, fog, frost, rain)

Developing Skills of Inquiry, Design, and Communication – use appropriate vocabulary in describing their explorations, investigations, and observations (e.g. use words such as solid, liquid, vapour; use the correct terms of describe quantities of water in standard (metric) and non-standard units of measure)

Three Stages of the Water Cycle: making Evaporation, Condensation, and Precipitation

Materials Needed For Activity:

- water tap
- electric kettle
- electrical outlet
- white plate
- potted green plant
- sticky tape
- clear plastic bag

- 1) Have students observe running water in LIQUID form at tap; fill kettle.
- 2) Plug kettle in and explain that the water is going to change into something new, with the heat of the kettle. This is similar to what happens to the water on the surface of the ocean when the sun heats it.
- 3) When the steam rises from the boiling kettle, explain that heat causes water to EVAPORATE into water VAPOUR, which is a GAS. This warm vapour rises high into the air or sky because it is lighter than cold air. We don't see the water that evaporates off the ocean; that water vapour is an invisible gas. (The sun doesn't boil the ocean's surface, so there's less / slower evaporation and we can't see it)
- 4) "Float" your white plate across the top of the kettle, through the steam. Pause to collect the evaporation. Explain that when the water vapour rises it cools and changes back into tiny drops of LIQUID water. All the drops gather together and form clouds. This represents a cloud forming over the ocean, collecting all that water vapour.
- 5) Continue to "float" the plate in the air, but raise it to arm's length above the activity so that students may observe underneath the plate where the water vapour has cooled and turned back into LIQUID. This is called CONDENSATION. When this condensation becomes too heavy, it will change again.
- 6) Send the heavy storm cloud to rest above the potted plant.
- 7) Watch how a few drops of water fall off the plate and water the plant. This is the PRECIPITATION stage. The water that evaporates off the ocean becomes a gas vapour and then cools at condensation back into a heavier form, or precipitation. If the air around is very cold, precipitation may fall from the clouds as snow, if the air is mild it will fall as rain.
- 8) Cover the newly watered potted plant with the clear plastic bag and seal the bag around the pot with the tape. Set the plant aside on a window ledge / direct sunlight for two hours OR return to this theme at next Science class, after having covered the plant for just 2 hours prior.

Procedure:**Part 2**

Understanding Basic Concepts – identify and describe forms of moisture in the environment (e.g., dew, snow, fog, frost, rain)

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Water Vapour from Plants: Creating Humidity by Transpiration
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Materials Needed For Activity:

- potted green plant
- sticky tape
- clear plastic bag

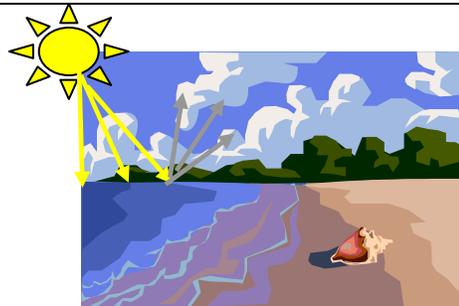
- 1) After the potted plant has been in direct sunlight for two hours, ask the students to describe what has happened.
- 2) They should be able to observe that the bag has drops of water inside, and it looks misty in the bag.
- 3) Explain that this is another way that water vapour is created. (Like our ocean activity). This time, the leaves of the plant have given off water vapour which has been “trapped” by our bag. When a plant gives off water vapour it’s called TRANSPIRATION.
- 4) Again, the heat of the sun has created a lot of vapour and therefore a lot of humidity – or, lots of water vapour in the air. This high level of water vapour, and humidity, will also turn back to liquid. When air is very humid (contains a lot of water vapour) there is a good chance it will rain.

At the conclusion of these two activities, you may wish to use HANDOUT #1 as a review.

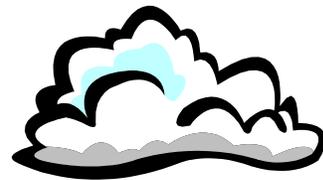
Use these words to describe what happened in each stage of our activity “The Water Cycle”

LIQUID	SUN	PRECIPITATION
EVAPORATE	CONDENSATION	VAPOUR

The heat from the kettle is like the heat from the _____. It causes water to _____ into the air and become a gas or _____.



Vapour rises high into the air, gets cooled and turns back into _____ water droplets. This water gathers together and becomes very heavy. This is called _____.



The water condensation gets so heavy that gravity makes it fall to the earth. If it is cold outside, it comes down as snow or sleet. If it is mild outside, it is rain. These are types of _____.



Procedure:**Part 3**

Understanding Basic Concepts – identify and describe forms of moisture in the environment (e.g., dew, snow, fog, frost, rain)

Developing Skills of Inquiry, Design, and Communication – use appropriate vocabulary in describing their explorations, investigations, and observations (e.g. use words such as solid, liquid, vapour; use the correct terms of describe quantities of water in standard (metric) and non-standard units of measure)

Other Forms of Moisture in the Environment: Creating Dew; Clouds; Frost

Materials Needed For Activity:

- crushed ice
 - aluminum foil
 - clear plastic cups (one per student / pair)
- 1) Pour crushed ice into plastic cups.
 - 2) Cover the tops of the cups with foil, seal, and set aside for observation in 5-10 minutes.
 - 3) Feel the outside of the cups. (should be covered with tiny droplets)

Some mornings, the grass and plants are wet even though it did not rain earlier that morning. This is called dew. Like our plastic cup activity, when the morning air is cold it cannot hold much water vapour. But our atmosphere always contains water vapour! Where does it go? If it is cold, but not yet freezing, the water vapour changes into tiny droplets of water. (Like our clouds over the ocean, the warm water vapour rises, cools, gathers, and becomes water again).

Materials Needed For Activity:

- bag of ice cubes / chunks
 - small (250ml) clear glass juice bottles (one per student / pair)
 - very hot water
- 1) Pour (very) hot water in the bottles, approximately $\frac{1}{4}$ or $\frac{1}{2}$ full.
 - 2) Have students immediately place a large ice chunk on top of the bottle, across the mouth of the bottle, so that the ice completely covers the opening.
 - 3) Observe the “cloud” formation in the jar.

Similar to our first activity and Handout #1, we have warm evaporation rising off the water and floating upwards to meet the cooler air of the atmosphere. Here, our ocean and atmosphere are very small, contained elements represented by hot water and an ice cube. When our warm vapours rise to meet the ice, they change into a cloud.

Materials Needed For Activity:

- bag of crushed ice
- dry, empty jar (one per student / pair)
- spoon
- rock salt

- 1) Fill jars with crushed ice
- 2) Pour some salt on top of the ice and “stir” into the ice
- 3) Observe jars over the next 10-15 minutes as they produce dew and then frost!

On very cold mornings, that same water vapour which creates dew in other seasons, will create frost in the late fall and winter seasons. Due to the same fact that creates dew (cold air cannot hold much water vapour) the cold winter air freezes the water vapour into tiny ice crystals. The water droplets still gather together but instead of forming dew, the freezing temperatures condense the water vapour into tiny ice crystals of frost.

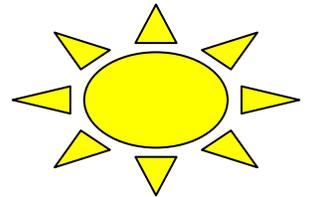
In our activity, we have the benefit of seeing a jar at room temperature create dew, first, and then frost when the glass temperature falls below freezing.

At the conclusion of these three activities, you may wish to use HANDOUT #2 as a review.

JUST A THOUGHT...

Ask students to write a journal entry or creative writing exercise where they imagine they are “living” inside the activities they created today. Some questions to answer:
*How are you affected by the temperature? *What will you need to wear? *What kind of plants will grow here? *What animals will survive here? *What activities will you be able to participate in? Will you play any sports? *What kind of foods will you eat in this climate? *Is this a safe place?

Match the words to their meanings



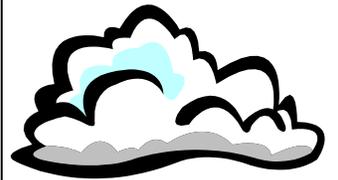
DEW •

•A gathering of billions and billions of tiny droplets of water or crystals of ice floating high in the sky

•Water vapour that has condensed at a temperature below 0°Celsius (freezing)

CLOUD•

• Water vapour that has condensed in cool air back into tiny droplets of water



FROST•

