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

Experience 2: Water Cycle in a Bag Experiment

Grade 2 - Long Range Plan - Model 2

This series of learning experiences will introduce students to the concept that nature works in cycles (specifically the water cycle; with opportunities to connect to other science curriculum strands and learning from previous grades). Students will engage in a provocation to get them wondering about what happens to water as it evaporates, create their own water cycle in a bag experiment where they can observe the changes of state that water goes through as it moves through the water cycle, and create a model of those changes using coding. A variety of extensions and cross-curricular opportunities will allow teachers to customize these experiences to suit their students' needs and learning styles while allowing for authentic assessment for, as, and of learning.

In the real world, scientists and engineers need to record their thinking and keep records of their scientific processes and engineering designs for a number of reasons. In these experiences, students will be using a science journal as a way of tracking their scientific thinking as they emulate scientists and engineers while engaging in the learning to make predictions, record processes, and observations, and draw conclusions about scientific phenomena. The journal will also be used during STEM investigations as a place for solving solutions to real-world problems (brainstorming, describing plans, and drawing designs for prototypes) and will be an evidence-based source of assessment information.

Overview of learning experiences – why these activities	In this learning experience, students will have the opportunity to participate in the scientific experimentation process by working through a co-created experiment which will allow students to observe the changes of state of water as it moves through a mini water cycle. They will be making a hypothesis and recording the materials, procedure, and observations. At the end of the experiment, they will be drawing conclusions that connect what they have observed to what they have learned about the water cycle. There will be an opportunity to connect this learning to other cycles in nature through a discussion at the conclusion of the learning experience.

	These learning experiences link to the Grade 2 Long Range Plan Model 2, found in March/April.
Prior Knowledge / Prior Skill Set(s)	Teachers may wish to use or continue using the science journal for students to record the steps of the experiment, and their observations and share their conclusions and connections. Depending on their students the teacher may wish to continue using a modelled or shared approach to completing the journal until the students are able to complete a journal activity on their own. The journal can then be used as a form of assessment throughout the lesson series. See Appendix A: Water Cycle In A Bag Experiment. From the previous learning experience, students should be familiar with the process of the water cycle and the terms evaporation, condensation, precipitation, and collection. Consider reviewing the vocabulary board or sheet prior to the investigation.
Strand A - STEM Investigation and Communication Skills	**A1.2 Scientific Experimentation** -use a scientific experimentation process and associated skills to conduct investigations **A1.4 Safety** - follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials **A1.5 Communication** -communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes **A3.1 Applications, Connections and Contributions** - describe practical applications of science and technology concepts in their home and community, and how these applications address real-world problems

Overview / Big Ideas/Fundamental Concepts	The water cycle involves the continuous movement of water in different phases (evaporation, condensation, precipitation, and collection). In this investigation, students will use the scientific experimentation process to observe “where water goes” as it moves through the phases of the water cycle and the three states of matter that occur in the natural environment (solid, liquid, and gas) including how heating and cooling contribute to the changes in state.
Learning Goals / Success Criteria	By the end of this learning experience students will: ● Use a journal to record ideas, and observations and to communicate ideas associated with inquiry and investigation ● Observe, through investigation, the changes of state in water during different stages of the water cycle ● Record their findings using science vocabulary ● Draw conclusions about what they observed ● Make connections between their own experiences and new learning Educators are encouraged to co-create success criteria with students and share “I Can Statements” based on the curricular expectations. Sharing options can include: ● I can write or draw my ideas to show my thinking. ● I can follow the steps of the Scientific Method to conduct my experiment ● I can observe with my eyes the changes of state of water in the water cycle experiment. ● I can record my findings and make conclusions about what is happening in the experiment using science vocabulary ● I can use the materials safely and responsibly to conduct the experiment. **Ministry of Education Key Points:** ● STEM Skills & Connections ● Engineering Design Process ● Hands-On Experiential Learning ● Climate change

Learning Experience(s)  **A1.2, A1.4, A1.5**	**Minds On (5 - 10 min.)** Quickly review the water cycle and the vocabulary from the previous learning experience. The teacher could read out a vocabulary word and 'popcorn out' their definitions. (Popcorn is a learning strategy where students crouch down while the teacher asks the questions and then pops up and shouts out their answer. Students can "pop" whenever they have thought of an answer, or listen to the answers of others making it an inclusive strategy to use for knowledge-based questions) **Action (2 class periods)** **Water Cycle in a Bag Experiment** **What the teacher does:** 1. From the provocation learning experience students generated questions around what happened to the water from their water art. Explain to students that they will be creating an experiment to show what happened to the water. Write the big question "Where does water go?" on the board. Water in a Bag Experiment (pg. 17) 2. Display the materials (sandwich bag, small plastic cup, blue-coloured water, permanent marker) and co-construct the experiment with the students by explaining that you will use the materials to create an experiment that allows you to observe what happens to water over time using the scientific method. If students are unfamiliar with the steps, take some time to walk them through the steps before conducting the experiment. 3. As a class, generate a hypothesis about what will happen to the water in the bag when it is placed on the warm window. Have students record the hypothesis in their journals. 4. List the materials on the board and have students copy them into their journals under 'Hypothesis'. 5. As a class, design the procedure for putting together the water cycle in a bag. It can be completed as outlined in the above link or place the water in a small plastic cup and mark the water

level. Place the cup in the bottom corner of the bag and seal the sandwich bag. Tape the bag to the window in a warm spot and observe. In Model A the water will condense on the bag and collect at the bottom of the bag, in Model B with the cup students will observe that the water evaporates from the cup and collects in the bottom corner of the bag. This method allows students to see the water level drop in the cup and the water appear in the collection at the bottom of the bag. Have students record the procedure.

6. Allow students time to set up their experiment. Teachers may wish to have students work in small groups.

7. Have students observe the bag the next day. Ask “What do you notice?” Students observe what has happened to the water in the bag and, if chosen, the water level in the cup. Record their observations in their journal using diagrams with labels.

8. Pose the big question “Where does water go” and have students answer based on what they observed during the experiment. What conclusions can they draw about the water cycle from the experiment? Have students record the conclusions in their journals or use the Water Cycle Experiment Student Activity Guide (see Appendix A: Water Cycle in a Bag Experiment Activity Guide).

What the students do:

Initiating and planning

- Generate a hypothesis or prediction about where water goes
- Participate in the co-creation of an experiment designed to answer the question

Performing and Recording

- Set up and perform the experiment
- Write and record the steps of the experiment and their observations

Analysing and Interpreting

A3	• Make observations and draw conclusions about what happened to the water in the bag. • Ask questions related to the initial big idea of “Where does water go?” • Connect what they observed in the experiment to how the water cycle works. **Communicating** • Share their observations, conclusions, and further wonderings in their science journal **Consolidation** (**15 – 20 min.)** 1. Link the experiment to the water cycle and explain that what they observed in the bag happens in the natural world. The water from the bottom of the bag or cup represents a body of water (river, ocean, lake, etc.) and evaporates into the bag due to the heat from the sun. Evaporation is the process of water converting to vapour, which then collects to form clouds during condensation. This is represented by the water droplets on the plastic bag. The droplets then drip down the side of the bag and collect at the bottom due to gravity and the weight of the droplets. This represents precipitation, which can be in the form of rain, snow, hail, etc. The water will then evaporate again to continue the cycle. 2. Pose the question “Why is it important that water moves through this cycle?” Guide students to the understanding that without the water cycle all of our water would disappear. Remind students that water is essential for the survival of all living things. 3. Pose the question “Where else do we see cycles in nature?” If required, guide students to life cycles and seasonal cycles. Discuss how cycles are important to sustain our environment. Life cycles keep animals and plants populated on Earth, the water cycle keeps water available to sustain life, seasonal changes affect the weather, and how humans and animals change their behaviour to adapt to the changing temperatures and available food. 4. Help students to connect the learning to their own experiences

	by asking “Why is it important to have cycles in nature?” You may wish to write the question on chart paper and record their answers to create an anchor chart.
Science and Technology Expectations	**Earth and Space Systems: Air and Water in the Environment** **Overall Expectations** **E2**: demonstrate an understanding of the properties of air and water, including water in various states, and of ways in which living things depend on air and water for their survival **Specific Expectations** **E2.1** demonstrate an understanding of the key properties of air and water **E2.3** describe the stages of the water cycle, including evaporation, condensation, precipitation, and collection **E2.4** identify the three states of water in the environment, and describe how temperature changes affect the state of water within the water cycle **E2.5** describe ways in which living things, including humans, depend on air and water **Matter and Energy: Properties of Liquids and Solids** **Overall Expectations** **C2**: demonstrate an understanding of the properties and physical changes of liquids and solids **Specific Expectations** **C2.3** describe properties of liquid water and solid water, and identify the conditions that cause changes from one state to the other
Science and Technology Vocabulary	**Evaporation:** This is when heat energy from the sun causes water from bodies of water to rise into the air and turn into water vapour (gas). **Condensation:** This is when water vapour in the air cools down and turns back into liquid water. **Precipitation:** This is when water (in the form of rain, snow, hail, or sleet) falls from clouds in the sky. **Collection:** This is when water that falls from the clouds as rain,

	snow, hail, or sleet, collects in the oceans, rivers, lakes, and streams. **Solid:** matter with a definite shape and volume. Particles are densely packed. **Liquid:** matter with a definite volume but takes the shape of the container it is in. Particles have more space between them allowing the matter to flow and pour. **Gas:** matter with no definite shape or volume. Particles are widely spaced so that they will fill any space that it is in. **Cycle**: a series of events that repeat in a pattern with regularity such as seasons, and life cycles
Equipment and Materials	• Journal notebook or Water Cycle Experiment Student Activity Guide (see Appendix A: Water Cycle in a Bag Experiment) • resealable sandwich bags • permanent markers • water with blue food colouring • small plastic cups (method B)
Timeline and Preparation	**Lesson Preparation should take approximately 20 - 30 min.** **First Steps** To prepare for the experiment gather the required materials, create a jug of blue-coloured water by adding a few drops of blue food colouring (students will use this for their experiment), and print the Water Cycle experiment sheet if you are using it. **Lesson Timeline:** **Minds On** 5-10 min. **Action** 2 class periods **Consolidation** 15-20 min. **Next Steps** To prepare for the next learning experience (Coding) sign out or reserve the programmable robots in your school (i.e. Dash or Ozobot) if that is available to you. If choosing the unplugged version of the learning experience you will need to print the paper coding

	blocks and laminate them for durability (see Experience 3 for these blocks).
Safety Considerations	**What does the teacher do?** Remind students that water in experimentation should not be consumed. Monitor for spills and be sure that the floor remains free of water which may create a slipping hazard. **What do the students do?** Take care when working with the water to ensure it does not spill. If spills occur, make sure they use paper towels to wipe it up or alert the teacher if it is a large spill. Refer to these safety resources: ● Safety in Elementary Science and Technology (STAO) ● Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE) ● Ontario Curriculum Program Planning – Health and Safety
Opportunities For Assessment	The water cycle experiment is designed to allow students to observe and draw conclusions about the natural world around them. Assessment **FOR** Learning: During the discussion, observe students' answers to the big idea questions. From the class discussions, you can assess students' understanding of the concept of water moving through the water cycle in different states. Use the checklist (see Appendix B: Success Criteria Checklist) to record your observations and evaluate what students already know and which direction the learning will take after this initial inquiry. Assessment **AS** Learning: Students can reflect on their learning using the self-evaluation exit ticket. (see Appendix C - Water Cycle Experiment Exit Ticket)

	Assessment **OF** Learning: The student's journal pages, or Water Cycle Experiment BLM can be used as an example of student thinking and understanding. The completed water cycle experiment report can be an assessment of learning. Students should be able to complete each section along with the class as well as communicate their own conclusions and understanding. (see Appendix D – Water Cycle Experiment Rubric)
Instructional Strategies and Adaptability	This learning experience makes use of a variety of instructional strategies. You may wish to adapt or change the strategy as indicated in the instructions section of this document. You may wish to scribe ideas or journal for students who require extra support. Some students may benefit from having the vocabulary and definitions on a handout sheet as well as being able to see and refer to them on a bulletin board.
Additional Supporting Resources	Let's Go Exploring! Ici On Explore! – page 17 **The Water Walker** by Joanne Robertson **Nokomis et la marche pour l'eau** by Joanne Robertson
Cross-Curricular Opportunities	**Language** **Writing: procedural writing** ● generate, gather, and organize ideas and information to write for an intended purpose and audience **The Arts** **Visual Arts: create art with a water theme** ● Creating and Presenting: apply the creative process to produce a variety of two- and three-dimensional art works, using elements, principles, and techniques of visual arts to communicate feelings, ideas, and understandings **Music: create a song about the water cycle**

	● Creating and Performing: apply the creative process to create and perform music for a variety of purposes, using the elements and techniques of music
Future Opportunities / Next Steps	After exploring and observing the water cycle in action students will use that knowledge to write a program (or unplugged version of a program) that takes a water drop through the water cycle to model what they learned in this experiment. **Extension Opportunities** You may wish to incorporate Indigenous teaching around water being sure that you consult with the First Nations, Metis, and Inuit consultants within your board to be sure your teaching is culturally responsive. The picture book **The Water Walker by Joanne Robertson** is also available in French (Nokomis et la marche pour l'eau) and highlights the need for us to conserve and protect water for future generations and for all life on the planet.

Appendix A: Water Cycle in a Bag Experiment Activity Guide

Name: Date:

Experiment: Let's Make a Water Cycle in A Bag!

Purpose (Why are we doing this experiment?):

To see how water changes state as it moves through the water cycle.

Hypothesis (What do we think will happen?):

Materials (What will we need to conduct the experiment?):

Procedure (A list of instructions so that other people can do the experiment the way we did.):

Observations: (What we saw happening in the bag):

When we write observations we use describing words.

What do you notice is happening to the water?

Where in the bag do you see changes?

Draw a picture of the bag and label all the parts of the experiment. Do you see any of the water cycle stages happening in the bag? Where do you see them?

Conclusions (After the experiment what have we learned?):

Does water change state as it moves through the stages of the water cycle?

What two things are needed for the water to change state?

Why do you think we need a water cycle in nature?

Appendix B: Success Criteria Checklist

Success Criteria Checklist

Name: Date:

I can	Met	Not Yet	Observations
I can write or draw my ideas to show my thinking.			
I can follow the steps of the Scientific Method to conduct my experiment			
I can observe with my eyes the changes of state of water in the water cycle experiment.			
I can record my findings and make conclusions about what is happening in the experiment using science vocabulary			

Name: Date:

I can	Met	Not Yet	Observations
I can write or draw my ideas to show my thinking.			
I can follow the steps of the Scientific Method to conduct my experiment			
I can observe with my eyes the changes of			

state of water in the water cycle experiment.			
I can record my findings and make conclusions about what is happening in the experiment using science vocabulary			

Appendix C: Water Cycle Experiment Exit Ticket

Water Cycle Experiment Exit Ticket

Name:

I could explain to someone how water moves through a cycle.	
I used my eyes and saw how the water changed as it moved through the cycle	
I was able to write down what I saw clearly using science words	

Appendix D: Water Cycle in a Bag Rubric

Water Cycle in a Bag Rubric

Expectations	Level 4	Level 3	Level 2	Level 1
A1.2 use a scientific experimentation process and associated skills to conduct investigations		-the learner listens and contributes to discussions about the process to conduct the water cycle experiment -the learner accurately completed all the sections of the written report -the learner made accurate observations and conclusions during the investigation		
A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials		-the learner always considered the safety advice of the teacher and used all the materials safely		
A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes		-the learner used unit vocabulary to communicate their findings		
E2.3 describe the stages of the water cycle, including evaporation, condensation, precipitation, and collection		-the learner accurately and independently described the stages of the water cycle using correct unit vocabulary		
E2.4 identify the three states of water in the environment, and		-the learner was able to identify the threes states of matter that water is in as it moves through the water cycle		

describe how temperature changes affect the state of water within the water cycle		-the learner was able to accurately and independently explain how temperature changes affect the state of water with in the water cycle		

Comments: