

EDUCATOR'S GUIDE
TWIN CITIES MUSEUMS COLLABORATIVE (TCMC)
Water is Life

Roger and Nancy McCabe
Foundation



Science
Museum
of Minnesota®

Mia
Minneapolis Institute of Art



Minnesota Landscape
ARBORETUM

Water is Life

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WATER IS LIFE

- **Plants, animals, and people need clean water to live.**
- **Water has special properties. It changes forms.**
- **People around the world create ways to interact with water in their lives.**

A series of 3 programs presented by Mia, MLA & SMM will engage students in powerful, real-world learning experiences that stimulate scientific discovery, critical thinking, and language development, supporting academic standards in science, social studies, English/language arts, and visual arts. During each program, students will practice making observations and using evidence to describe and support their ideas.

A student journal will be used in the classroom to engage students' curiosity, provide writing opportunities for reflection and synthesis, and provide insight into student learning.

“WATER CHANGES”

(IN-SCHOOL ASSEMBLY AND RESIDENCY)

Science Museum of Minnesota

- Make observations about water and how water changes.
- Conduct experiments to explore the processes that move water through the water cycle.
- Learn the differences between precipitation, evaporation, and condensation.
- Race against the “sun” to evaporate water from puddles.
- Hold a cloud in your hands.
- ~~Condense water to make rain right in the classroom.~~

“WORLD OF WATER” (FIELD TRIP)

Minneapolis Institute of Art

A two-hour field trip comprising of three 35-minute activities

- Observe and discuss images or objects depicting how humans from different times and cultures capture, move, and depend upon water for personal and community use on a conversational tour.
- Create a watercolor painting using diverse materials and techniques in a studio art activity.
- Sketch ideas from global artworks on a treasure hunt and design an original water container.

“PLANTWORKS, WATERWORKS”

(FIELD TRIP)

Minnesota Landscape Arboretum

- Explore how plants use water, and how people use that information to grow plants during a 2-hour field trip program at the Arboretum's Marion Andrus Learning Center.
- Students participate in hands-on learning through four 30-minute blocks, including Introduction, Discovery Lab, Greenhouse Visit and Planting Investigation.

Evaluation

- Led by Science Museum of Minnesota Staff

STUDENT JOURNAL NOTES

The journal was designed to be used by the students in the classroom after each experience.

After the Arboretum field trip, some time should be set aside for writing and reflection.

The final activity, writing a “water story” should be done after all three experiences are done. The vocabulary list and the discoveries can be done as a running list or after all three experiences.

Since students in grade 2 and 3 are often still developing reading and writing skills, teachers should use the journal to reinforce the English/Language Arts curriculum they are working on. We have included space for both drawing and writing, used fairly simple language and added “icons” for beginning readers.



Observations

Students can document any sensory observations, things they saw, heard, felt.



Wondering Ideas


Students write about what they would like to know more about.




“I noticed”


Students write about great ideas they had while observing, inferences about what they observed.


SAMPLE PAGES

 **Water Change**

Describe and show how water changed.

 I observed:


 I wonder:


 **World of Water**

Draw a favorite work of art that you saw on your tour of the museum.


How do people use water?

How do they move it around?

 I noticed:

 **Water and Plants**

What did you discover about plants and water?

 I noticed:

Water Changes - Assembly and Residency Grades 2, 3

- Experience water in liquid and solid forms, as water is found in nature.
- Compare how animals, plants, and humans use water.
- Race against the “sun” to evaporate water from puddles.
- Hold a cloud in your hands.
- ~~Condense water to make rain right in the classroom.~~

For questions about program content, contact: [Maija Sedzielarz, maija@smm.org](mailto:maiya@smm.org).

WATER ASSEMBLY PROGRAM (50 minutes)

Ice Columns - small and really big - and a cool experiment

Water changes in observable patterns during the changes in our Minnesota seasons. Students make observations about ice and how it changes with the addition of heat.

How is liquid water different from ice?

Observations about how liquids change shape or need a container to hold it gives students a way to tell the difference between water - a liquid, and ice - a solid, which doesn't necessarily need a container to hold it.

Lakes in summer and winter

A tabletop diorama helps students imagine water use by animals living in a Minnesota lake, and the changes between summer when the water is a liquid and winter when the water can freeze to a solid. Plants also get into the story as “water” moves through a model of a plant during the summer, and get covered by snow during the winter.

People at the Lake

Human activities change between summer and winter. But people also need clean water at all times of the year. Everyone can help keep our lakes clean by recycling or composting whenever possible.

RESIDENCY OVERVIEW

~~Group Discussion: Introduce the Water Cycle (5 MINUTES)~~

Activity: Evaporation Experiment

~~Water goes into the air by evaporating (10 MINUTES)~~

Think of a puddle on the sidewalk. The sun comes out and the wind is blowing. What happens to the puddle? Where does the water go? How could we find out? Do an experiment.

- Evaporation Experiment: Students in pairs work at tables using fans to produce wind to evaporate water from chalkboards. They “race” against water evaporating from chalkboards placed in front of an electric fan or a heat lamp.

Program Length

Assembly: 50 minutes for up to 150 students; Residency: 1 hour per classroom

Vocabulary Introduced

- Evaporation
- Precipitation
- Condensation
- ~~Hail~~
- ~~Water Cycle~~
- ~~Groundwater~~

Session Preparation

- Preferable to have a separate room for the presentation, e.g., multipurpose room, cafeteria, gym; this will be discussed during scheduling.
- Need one table for demonstrations, 4 tables for students, sink or access to water.
- Demonstrations will include an electric fan, heat lamp, dry ice, hot plate and teakettle; will need access to electrical outlet.

SMM Instructor brings all equipment and materials needed. Students will work in pairs, as well as participate in whole group discussions.

Student Expectations

Normal classrooms norms, including respecting self, others and equipment. Please have students wear visible nametags, so instructor can use names.

Activity: Condensation Experiment

When water in the air cools, it condenses (~~10 MINUTES~~)

Instead of adding heat to the water (energy), we'll make something cold to collect water in the air. Show plastic cup with water in it.

- Condensation Experiment: Students in pairs at tables.
- Experiment discussion: What happened to the outside of the cup? What color was the water? Where did the water come from? Water condenses when it touches something cold.
- Home and school examples of condensation - bathroom mirror after showering, cold can of pop, breathing on a cold window.

Cloud Demonstration (~~10 MINUTES~~)

Have you ever seen your breath outside? Was the air warm or cold? (another example of condensation) Did it look like a cloud?

- Discuss ingredients needed to make a cloud: cold temperature (Air temperature drops with distance to Earth's surface), water vapor, particles for condensation.
- "Make a cloud" demonstration.

Materials Used by SMM Instructor only:

- Dry ice pellets
- Insulated bucket with lid
- Hot water
- Leather gloves

Students sit in a large circle for demonstration. After demonstration, discuss observations, cold and condensation.

Precipitation Demonstration (~~5-10 MINUTES~~)

If a cloud has enough water condensing on dust or smoke to make water droplets, some drops will become so large they are too heavy and will fall.

- Discuss rain, hail and snow.
- ~~Precipitation demonstration.~~

~~Materials Used by SMM Instructor only:~~

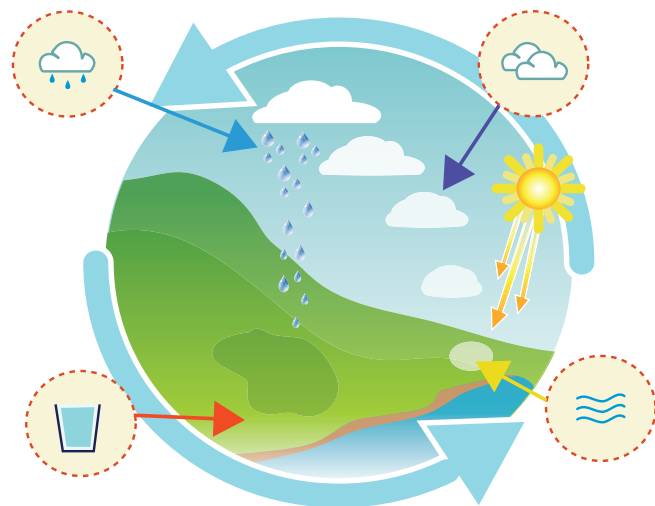
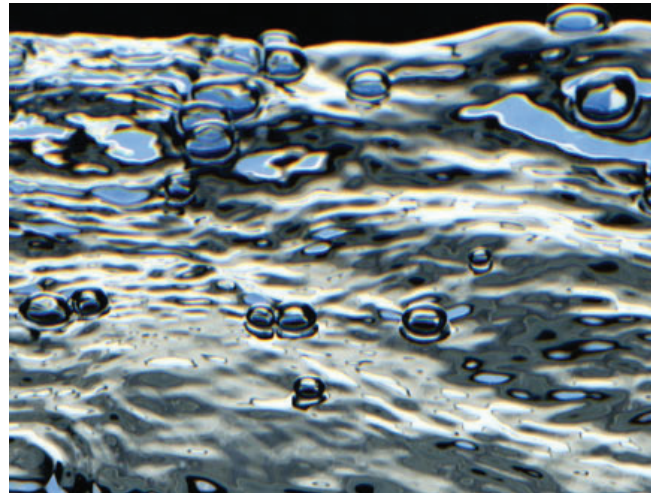
- ~~• Hot plate~~
- ~~• Teakettle~~
- ~~• Water~~
- ~~• Frying pan of ice~~
- ~~• Gloves~~

- ~~• What happens when water vapor rises high into the air?~~

~~Whole class activity to re-create formation of hailstones.~~

Discussion: Wrap up (~~5 MINUTES~~)

- Review forms of water seen in session (water vapor - cloud, liquid - rain, solid - ice).



Minneapolis Institute of Art - Field Trip

World of Water Grades 2, 3

- Explore how artists make careful observations of the natural world to create images of water.
- Look closely at artworks and learn stories about how people around the world use water and its importance to sustain life.
- Create a watercolor painting and observe how water reacts differently when mixed with diverse materials.
- Learn how artists make choices about materials and visual elements (line, color, shape, and pattern) when designing artworks.
- Sketch ideas from global artworks on a treasure hunt and design an original water container.

For questions about program content, contact: Sheila McGuire, Head of School and Teacher Programs, smcguire@artsmia.org, (612) 870-3206.

MUSEUM EXPERIENCE OVERVIEW

At Mia students engage in three water-related activities that explore the importance of water to humans, including artists, around the world. Students divide into three groups and rotate through the three experiences.

Gallery Tour (35 MINUTES)

On a museum tour students observe and discuss images or objects depicting how humans from different times and cultures use and depend upon water to sustain life. Works of art from around the world tell stories of humans' relationship with water, highlighting issues related to the need for clean water and its preservation. A museum tour guide facilitates learner-centered discussions about water using authentic objects on display in the galleries. The tour emphasizes how artists and scientists both use careful looking and observation skills to better understand the properties of water.

Design Treasure Hunt and Activity (35 MINUTES)

On a fast-paced treasure hunt, students search for water containers from around the globe that will inspire their own original design of a water bottle, flower vase, or pet water bowl. In the galleries students make sketches of design ideas and discuss the pros and cons of different materials for the product they will design. Students gain an understanding of how people around the world value water so much they make beautiful artworks to contain it for many purposes.

Watercolor Studio Experience (35 MINUTES)

In the studio students become artists as they explore watercolor painting with traditional and nontraditional techniques to create artworks filled with a variety of textures. During this creative process, they learn about water's unique properties. They write about what they observe during this experimental and surprise filled activity. Students will receive instructions on how to transform their watercolors into weavings after they have dried.

Program Length

2 Hours

Vocabulary Introduced

- Culture
- Engineering
- Liquid/Solid
- Observe
- Preserve/conserve
- Vessels
- Watercolor
- Wet on dry
- Wet on wet

Student Expectations

Students respect selves, others and the art. They understand that they must not touch the art or run in the galleries. Please have at least one chaperone per 15 students. Please have students wear visible nametags.



Minnesota Landscape Arboretum - Field Trip

PLANTWORKS, WATERWORKS Grades 2, 3

- Trace the flow as water enters a plant through its roots.
- Discover how it moves upward and often escapes as a gas.
- Use microscopes to see plant plumbing systems, including how water vapor leaks from leaves.
- Compare how plants from wet and dry places store water differently.
- Set up a growing investigation that challenges plants to grow new roots.

For questions about program content, contact: Arboretum Education Office

Arbtrips@umn.edu, (612) 301-1210

PRESENTATION OVERVIEW

It's a real-world experience in how plants use water. "Step into the shoes" of a greenhouse manager and discover how a growing plant is like a living fountain. Trace the flow as water enters a plant through its roots, moves upward, and often escapes as a gas, through tiny pores on leaves. Use microscopes for a close-up look at plant plumbing system. Compare how plants from wet and dry places use and store water differently. Set up a take-home investigation that challenges plants to grow new roots, comparing how two different humidity levels influence success.

Introduction:

Plants take in liquid water and release it as a gas (30 MINUTES)

With a puppet show that features two talking plants, discover how a growing plant is like a living fountain. Find out how people can take a few plants and multiply them into many, so you can try it for yourself. How does water flow through plants? How can you keep plant cuttings without roots from wilting? At the close of the Introduction for the larger group, students divide into their classroom size units to rotate through 3 half-hour learning stations.

- Discover how people propagate plants.
- Review that water can be a liquid or a gas.
- Practice measuring humidity, water vapor in the air.
- Take a look at the inside structure of a leaf.

Program Length

2 Hours

Vocabulary Introduced

- Evaporate
- Root hair
- Humidity
- Transpiration
- Liquid
- Gas

Student Expectations

Standard classroom norms, including respecting self, others, equipment and living plants. Please have students wear visible nametags, so instructors can use names.

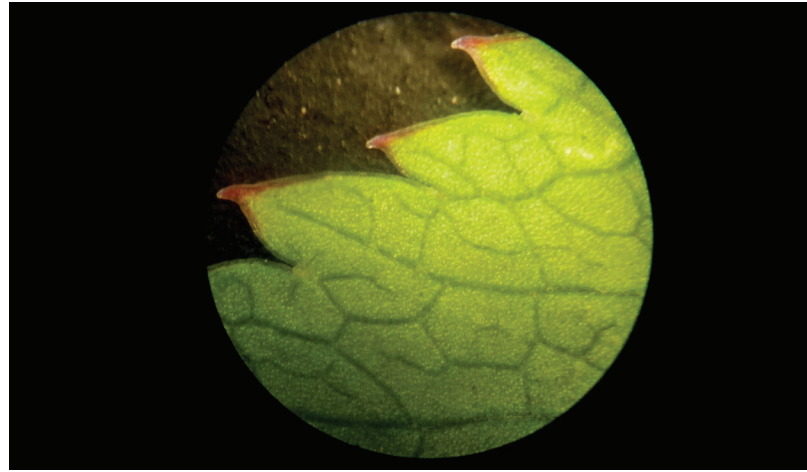
Follow-up Investigation Option

Each student will start a plant of their own to take home. Each class will start a set of "Investigation plants" to take to school. After 3 weeks, these will be ready for students to take apart and compare results to see which treatment grew better.

Activity: Microscope Lab
Plants have their own internal plumbing systems
(30 MINUTES)

From bottom to top, the plumbing system of a plant includes its roots and root hairs, the vessels in its stems, and veins and pores on its leaves.

- Take a close-up look at all of these plant parts through your own microscope and using a big screen "Scope on a Rope".
- Check out cloud forest plants that can "drink water" as water vapor from the air.
- Watch a Plant Smash-up that lets you compare how much water is stored inside the leaves of plants from the desert and the rainforest.



Activity: Greenhouse Visit
Plants vary; each kind has a unique shape and plumbing pattern (30 MINUTES)

Experience how much plants can differ, in the sizes and shapes of their stems, leaves and flowers. Notice the humidity difference between Classroom and Greenhouse.

- Hunt for plants with "the biggest vein", "no visible veins", "the thickest leaf with the most water inside" etc.
- Measure humidity in the Greenhouse.
- Focus on vein patterns of different leaves; draw your favorite.



Activity: Planting Investigation
People who understand how plants use water can propagate them (30 MINUTES)

Everyone starts a plant from a cutting to take home. The class also prepares an "take-to-school" investigation to find out how well one set of cuttings will root in the drier "room air" of their classroom compared with a second set of cuttings growing in more humid "greenhouse air" (created by placing the planted cuttings in a plastic bag). After three weeks, groups of students may unearth both sets to check for and measure root growth.

- See a demonstration of ways people multiply ("propagate") plants, by seeds, division and cuttings.
- Make and plant your own stem cutting.
- Discover how to set up a controlled investigation.



Minnesota Academic Standards

Grade 2

Science

NATURE OF SCIENCE AND ENGINEERING

2.1.1.2.1 Raise questions about the natural world and seek answers by making careful observations, noting what happens when you interact with an object, and sharing the answers with others. *(SMM, MLA, Mia)*

2.1.2.2.3 Explain how engineered or designed items from everyday life benefit people. *(Mia)*

2.2.1.1.1 Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object. *(Mia)*

PHYSICAL SCIENCE

2.2.1.2.1 Matter. Observe, record and recognize that water can be a solid or a liquid and can change from one state to another. *(SMM, MLA)*

EARTH AND SPACE SCIENCE

2.3.2.2.1 Measure, record and describe weather conditions using common tools. *(SMM)*

LIFE SCIENCE

2.4.1.1.1 Structure and function of living systems. Living things are diverse with many different observable characteristics. Describe and sort plants into groups in many ways, according to their physical characteristics and behaviors. *(MLA)*

2.4.2.1.1 Natural systems have many components that interact to maintain the system. Recognize that plants need space, water, nutrients and air, and that they fulfill these needs in different ways. *(MLA)*

English/Language Arts

WRITING (JOURNAL ASSIGNMENT)

2.6.3.3 Write narratives and other creative texts in which they recount a well-elaborated event or short sequence of events, include details to describe actions, thoughts and feelings, use temporal words to signal event order, and provide a sense of closure. *(JOURNAL)*

2.6.8.8 Recall information from experiences or gather information from provided sources to answer a question. *(SMM, MLA, Mia)*

2.8.4.4 Tell a story or recount an experience with appropriate facts and relevant, descriptive details, avoid plagiarism by identifying sources. *(SMM, Mia)*

SPEAKING, VIEWING, LISTENING AND MEDIA LITERACY

2.8.1.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups. *(SMM, MLA, Mia)*

2.8.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. *(SMM)*

2.8.3.3 Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issues. *(SMM, MLA, Mia)*

Visual Arts

0.1.1.5.1 Identify the elements of visual art including color, line, shape, texture and space. *(Mia)*

0.1.2.5.1 Identify the tools, materials and techniques from a variety of two- and three-dimensional media such as drawing, printmaking, ceramics or sculpture. *(Mia)*

0.1.3.5.1 Identify the characteristics of visual artworks from a variety of cultures including the contributions of Minnesota American Indian tribes and communities. *(Mia)*

0.2.1.5.1 Create original two- and three-dimensional artworks to express ideas, experiences or stories. *(Mia)*

0.2.1.5.2 Revise an artwork based on the feedback of others. *(Mia)*

0.3.1.5.1 Share and describe a personal artwork. *(Mia)*

0.3.1.5.2 Reflect on a presentation based on the feedback of others. *(Mia)*

0.4.1.5.1 Compare and contrast the characteristics of a variety of works of visual art. *(Mia)*

Social Studies

ECONOMICS

2.2.3.5.1 Classify materials that come from nature as natural resources (or raw materials); tools, equipment and factories as capital resources; and workers as human resources. *(Mia)*

GEOGRAPHY

2.3.4.9.1 Identify causes and consequences of human impact on the environment and ways that the environment influences people. *(SMM, Mia)*

HISTORY

2.4.1.2.1 Use historical records and artifacts to describe how people's lives have changed over time. *(Mia)*

2.4.2.4.2 Describe how the culture of a community reflects the history, daily life or beliefs of its people. *(Mia)*

Minnesota Academic Standards Grade 3

Science

NATURE OF SCIENCE AND ENGINEERING

3.1.1.1.1 Provide evidence to support claims other than saying “Everyone knows that,” or “I just know,” and question such reasons when given by others *(SMM, Mia)*

3.1.1.2.1 Generate questions that can be answered when scientific knowledge is combined with knowledge gained from one’s own observations or investigations. *(SMM, Mia)*

3.1.1.2.3 Maintain a record of observations, procedures and explanations, being careful to distinguish between actual observations and ideas about what was observed. *(JOURNAL)*

3.1.1.2.4 Construct reasonable explanations based on evidence collected from observations and experiments. *(SMM, MLA, Mia)*

3.1.3.2.1 Understand that everybody can use evidence to learn about the natural world, identify patterns in nature, and develop tools. *(SMM, MLA, Mia)*

3.1.3.4.1 Use tools, including rulers, thermometers, magnifiers and simple balance, to improve observations and keep a record of observations made. *(MLA)*

LIFE SCIENCE

3.4.1.1.1 Compare how the different structures of plants and animals serve various functions of growth, survival and reproduction. *(MLA)*

English/Language Arts

WRITING (JOURNAL ASSIGNMENT)

3.6.3.3 Write narratives and other creative texts to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences. *(JOURNAL)*

3.6.8.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. *(SMM, Mia)*

3.6.10.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. *(Mia)*

SPEAKING, VIEWING, LISTENING AND MEDIA LITERACY

3.8.1.1 Engage effectively in a arrange of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly. *(SMM, Mia)*

3.8.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. *(SMM, MLA, Mia)*

Visual Arts

0.1.1.5.1 Identify the elements of visual art including color, line, shape, texture and space. *(Mia)*

0.1.2.5.1 Identify the tools, materials and techniques from a variety of two-and three-dimensional media such as drawing, printmaking, ceramics or sculpture. *(Mia)*

0.1.3.5.1 Identify the characteristics of visual artworks from a variety of cultures including the contributions of Minnesota American Indian tribes and communities. *(Mia)*

0.2.1.5.1 Create original two-and three-dimensional artworks to express ideas, experiences or stories. *(Mia)*

0.2.1.5.2 Revise an artwork based on the feedback of others. *(Mia)*

0.3.1.5.1 Share and describe a personal artwork. *(Mia)*

0.3.1.5.2 Reflect on a presentation based on the feedback of others. *(Mia)*

0.4.1.5.1 Compare and contrast the characteristics of a variety of works of visual art. *(Mia)*

Social Studies

CITIZEN AND GOVERNMENT

3.1.1.1.1 Identify ways people make a difference in the civic life of their communities, state, nation or world by working as individuals or groups to address a specific problem or need. *(Mia)*

ECONOMICS

3.2.1.1.1 Identify possible short-and long-term consequences (costs and benefits) of different choices. *(Mia)*

3.2.3.5.1 Explain that producing any good or service requires resources; describe the resources needed to produce a specific good or service; explain why it is not possible to produce an unlimited amount of a good or service. *(Mia)*

GEOGRAPHY

3.3.1.1.1 Use maps and concepts of location (relative location words and cardinal and intermediate directions) to describe places in one’s community, the state of Minnesota, the United States or the world. *(SMM, Mia)*

HISTORY

3.4.1.2.1 Examine historical records, maps and artifacts to answer basic questions about times and events in history, both ancient and more recent. *(Mia)*

3.4.1.3.1 Explain how an invention of the past changed life at that time, including positive, negative and unintended outcomes. *(Mia)*

3.4.3.7.1 Explain how the environment influenced the settlement of ancient peoples in three different regions of the world. (Early Civilizations and the Emergence of Pastoral Peoples: 8000 BCE-2000 BCE) *(Mia)*

3.4.3.9.1 Compare and contrast daily life for people living in ancient times in at least three different regions of the world. (Post-Classical and Medieval Civilizations and Expanding Zones of Exchange: 600 CE-1450 CE) *(Mia)*

VOCABULARY

Following is a list of vocabulary that will be used throughout the 3 experiences. We do not expect students to come to the programs with knowledge of these terms or definitions. Students will learn about the concepts through their experiences in this program.

- Condensation
- Culture
- Engineering
- Evaporate/Evaporation
- Evidence
- Gas
- Humid; humidity
- Liquid
- Observe
- Precipitation
- Preserve/conserve
- Root hair
- Solid
- Transpiration
- Vessels
- Water Cycle
- Watercolor
- Wet on dry
- Wet on wet