

Delaware Science Coalition



Promoting Scientific Literacy for All Students

Grade 3 Water Unit Template



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Preface: This unit has been created as a model for teachers in their designing or redesigning of course curricula. It is by no means intended to be inclusive; rather it is meant to be a springboard for teacher thought and creativity. The information we have included represents one possibility for developing a unit based on the Delaware content standards and the Understanding by Design framework and philosophy.

Brief Summary of Unit

The Water unit explores water through physical, earth, and life science. The unit begins with observations of the interaction of water with materials as water is absorbed or beads up on the material and the speed with which the beads of water flow on sloped surfaces. Next, students examine the properties of water at different temperatures as water changes state. The processes of evaporation and condensation and how the rate of these processes changes with temperature are investigated. Lastly, students examine how moving water can transfer energy to move other objects.

Stage 1: Desired Results **Delaware Science Content Standards**

Delaware Science Content Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1, 2, 3, 5 and 8 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1- Nature and Application of Science and Technology

Understanding and Abilities of Scientific Inquiry

Students should know and be able to:

1. Understand that: Scientific investigations, whether conducted by students or scientists, involve asking a question about the natural world.
 - Be able to: Generate questions and predictions using observations and exploration about the natural world.
3. Understand that: The purpose of accurate observations and data collection is to provide evidence. Scientists use tools to enhance their senses in order to obtain more evidence.
 - Be able to: Collect data using observations, simple tools and equipment. Record data in tables, charts, and bar graphs. Compare data with others to examine and question results.
4. Understand that: Scientists use observations from investigations and knowledge that is already known to develop an explanation.
 - Be able to: Construct a simple explanation by analyzing observational data. Revise the explanation when given new evidence or information gained from other resources or from further investigation.
5. Understand that: The purpose of communicating with others is to share evidence and conclusions. Scientists communicate the results

of their investigations to others.

- Be able to: Share simple plans, data, and explanations with an audience and justify the results using the evidence from the investigation.

6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries.

- Be able to: Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results.

Science, Technology, and Society

Students should know that:

1. People have invented new technologies to solve problems.

Students should be able to:

- Investigate and describe how moving water and air can be used to make objects and machines, such as a waterwheel and windmill, move.

2. Tools are useful in science to help gather data for observations and measurements and provide a safe means of conducting an investigation.

Standard 2: Materials and Their Properties

Properties and Structures of Materials

Students should know that:

2. Materials exist in one of three states – solid, liquid, or gas. Solids and liquids have easily observable properties and may change from one form to the other.

Students should be able to:

- Explore evaporation and condensation. Identify the changes of state from liquid to gas in evaporation and gas to liquid in condensation using water as an example.
- Observe and describe changes in the properties of water as it changes from solid to liquid to gas.

Standard 3: Energy and Its Effects

Forms and Sources of Energy

Students should know that:

2. Objects that move (i.e., moving air, moving water) have energy because of their motion.

3. Heat energy is a form of energy that makes things warmer.

Forces and the Transfer of Energy

Students should know that:

3. Energy of a moving object can be transferred to other objects (i.e., the energy of moving water can be used to turn a waterwheel).
 - Determine the effect of adding heat energy (warming) or removing heat energy (cooling) on the properties of water as it changes state (gas to liquid to solid, and vice versa).
 - Investigate and describe what happens when an object at a higher temperature is placed in direct contact with an object at a lower temperature. Record data and use the data to describe which way the heat energy is moving between the objects.

The Production, Consumption and Application of Energy

Students should know that:

1. Moving air, moving water, and sunlight contain energy that can be put to our use.

Students should be able to:

- Investigate and describe how moving water and air can be used to make objects and machines, such as a waterwheel and windmill, move.

Standard 5: Earth's Dynamic Systems

Strand 1 components of the Earth

Students should know that:

1. Components of Earth's system include minerals, rocks, soil, water and air. These materials can be observed, sorted and/or classified based on their physical properties.

Students should be able to:

- Describe water in terms of its observable properties (transparency, shapelessness, flow).
2. Water can exist as a solid, liquid or gas and in different forms such as rain, snow and ice.

Interactions throughout Earth's Systems

Students should know that:

3. Water from rain, lakes, and underground, is needed by plants, animals and people for their everyday activities.

Technology Applications

Students should know that::

1. Earth materials can be observed and described using simple tools (e.g., hand lens and balances).

Standard 8: Ecology

Interactions within the Environment

Students should know that:

1. An interconnectedness exists among the living and nonliving parts of an environment. This interconnectedness can be observed by the changes made by plants and animals in their environment.

Big Ideas

Observation and evidence(students observe the properties of water and collect data to form an explanation)

Investigation (students use tools to investigate the physical properties of water)

Properties of materials (physical properties of water)

Change (students observe the change of state of water in solid, liquid, and gaseous forms)

Processes (Students explore evaporation and condensation)

Cycles (students begin to learn about the water cycle on Earth)

Unit Enduring Understandings

Students will understand that...

Water has observable properties and interacts differently with different materials.

Water flows downhill.

Water can be a liquid, solid, or gas.

Solid water (ice) floats on liquid water and has a definite shape. Warmer water rises above colder water.

Liquid water changes to water vapor in the air through the process of evaporation.

Water vapor changes to liquid water through the process of condensation.

Moving water can transfer energy to other materials.

Unit Essential Question(s)

How does the property of a material determine the way in which it interacts with water?

How does the slope of the land determine the rate at which water flows?

What happens when hot water and cold water interact? Which way does the energy flow? How do you know?

What happens to liquid water when it freezes? Does the mass of the water increase?

How does air temperature and surface area affect the rate of evaporation?

Where does condensation come from? What is condensation?

Do all earth materials interact with water in the same way? Explain.

What factors affect the ability of water to transfer energy to other objects?

Knowledge & Skills

Students will know....

- Water is transparent, shapeless, and can flow.
- Surface tension causes water to dome on a penny. The surface tension can be broken by adding detergent.
- Water flows downhill.
- The greater the slope, the faster the water flows downhill.
- Water expands when it is heated and contracts when it cools.
- Warm water rises above cold water.
- Ice floats on liquid water and has a definite shape.
- The mass of water stays the same as it goes from a solid to a liquid and vice versa (conservation of mass).
- Evaporation is a process where water changes state from a liquid to a water vapor.
- Temperature affects the rate of evaporation.
- The surface area affects the rate of evaporation.

- Condensation is the change of state from water vapor to liquid water.
- Evaporation and condensation are part of the water cycle.
- Earth materials interact differently with water. Some absorb water quicker than others (pore space).
- Moving water can transfer energy to other objects.

Students will be able to...

- Investigate the interaction of water with different materials.
- Compare how water interacts with different materials.
- Investigate the number of drops of water that will fit on a penny.
- Change the surface tension of water by adding detergent.
- Observe water flow downhill. Investigate how water flows by changing the slope of the land.
- Build a thermometer.
- Investigate objects that sink and float in water.
- Observe warm water rise over top of cold water.
- Investigate water as it freezes and compare the mass of the liquid water to the ice.
- Investigate how factors such as exposure to the air, surface area, and temperature affect evaporation.
- Investigate and observe the process of condensation.
- Investigate how water flows through different earth materials.
- Design and construct water wheels.

Stage 2: Assessment Evidence
(Design Assessments To Guide Instruction)

Suggested Performance Task(s)

Water assessment for grade three can be found at:

http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Key Transfer Ideas:

- Water is a basic need for survival.

- Water exists as a solid, liquid and a gas depending on the temperature. Water in its various states has an impact on all life on Earth.
- For water to change from a solid to a liquid to a gas, energy must be added or removed.
- Moving water has energy that can be put to our use.
- Water is a limited resource. Conserving water is essential for maintaining a water supply.

Expectations of Students:

- List properties of liquid water, water vapor, and ice.
- Describe how energy can cause water to change state from a solid (ice) to a liquid.
- Recognize that energy comes from the Sun.
- Describe how energy can cause water to change state from a liquid to water vapor.
- Make a simple plan to investigate the change of state of water.
- Describe how moving water transfers energy.
- Describe how living things depend upon water and consequences of a drought upon living things.

Rubrics/checklists for Performance Tasks

Water assessment rubrics for grade three can be found at:

http://www.doe.k12.de.us/programs/sci_assess/default.shtml

Other Evidence

Formative Assessment

Rubric to use with student worksheets:

4: Student work is above and beyond the expectations.

3: Student work is complete and correct.

2: Student work is incomplete.

1: Student work is incorrect.

0: There is no student response.

Investigation #1:

- *Water on Surfaces* worksheet. Student drawings should be accurate and detailed. Descriptions should include whether the

water was absorbed (and the rate of this occurring) or beaded up.

- *Surface Tension Worksheet*: Student drawings of the water on the penny should be accurate and detailed. The description should include the shape of the drop as well as the number of drops.
- *Water on a Slope*: Student description should include the fact that the water ran downhill.
- *Water Observations*: This is a good formative assessment piece and can double as a letter writing ELA tool. The letter should include the flow of water downhill and the puddling of water at the base of the hill.

Investigation #2

- *Build a Thermometer*: Student descriptions should include that the warm water “floated” (we do not use the word density at third grade) above the cold water.
- *Sinking and Floating*: Do not focus on the word “density” as this concept is not the goal of the unit. Student worksheets should have an accurate drawing with warm water floating on cold and evidence being the color of the water.

Investigation 3:

- *Evaporation Location charts*: although this may set up a misconception for students (cold polar areas actually have great evaporation), the goal is for students to observe the water evaporating.
- *Water Vapor*: This is a good formative assessment. This assessment doubles as a writing tool for ELA. Look for the explanation to use the process of: evaporation correctly.
- *Surface Area chart*: Student explanation should include that the greater the surface area the greater the evaporation.
- *Condensation Observations*: Caution! Condensation is a difficult process for students to understand. A common misconception is that the water moves through the solid container. Look for an accurate drawing with the water vapor in the air condensing around the container. Be careful not to call the liquid water on the outside of the container “condensation”. This is incorrect. Condensation is a process- water on the outside of the container is liquid water.

Investigation #4:

- *Water in Earth Materials*: This is a good initial investigation and will be repeated in fourth grade in the Land and Water unit. Also, the Soils unit in second grade had a similar investigation. Students should follow procedures and accurately measure using a graduated cylinder.
- *Waterworks*: This is a good formative assessment piece and an good tie to ELA writing. The student response should have a step by step plan.
- *Putting Water to Work*: Again, look for a workable step by step plan from the students.

Stage 3: Learning Plan
(Design Learning Activities To Align with Goals and Assessments)

Key learning events needed to achieve unit goals

Resource: The Regents of the University of California. FOSS Water. Delta Education. 2000.

Investigation #1: Water Observations.

This investigation is divided into three parts. Students begin by observing the properties of water including transparency, shapelessness, and ability to flow. Investigations in surface tension and slope are conducted next.

Investigation #2: Hot water, Cold Water

This investigation is divided into three parts. Students begin by building a thermometer with hot and cold water. Next, students explore how objects sink and float and compare this with hot and cold water interactions. Lastly, students explore the mass of liquid water with the mass of the water as it freezes to learn that the mass stays the same.

Investigation #3: Water Vapor

This investigation is divided into four parts. Students begin by exploring evaporation and controlling the conditions under which water evaporates from paper towels, including exposure to air and air temperature. Next, students examine how surface area affects the rate of evaporation. Lastly, students explore condensation.

Investigation #4: Waterworks.

This investigation is divided into four parts. Students begin by conducting test to determine how water flows through different earth materials. Next, students design a waterwheel and conduct investigation to see how the waterwheel can transfer energy to make the shaft spin and lift the string. Lastly, students examine what from different areas and evaporate the water to see what is left behind, learning that clear water may contain contaminates.

Resources & Teaching Tips (Consider the two questions below when completing this section.)

- **What text/print/media/kit/web resources best support this unit?**

Resource: The Regents of the University of California. FOSS Water. Delta Education. 2000.

- **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

Accommodation/Differentiation ideas and tips (This should include a list or description of ways that you will differentiate instruction according to students' needs. This can include any curricular adaptations that are needed to meet special needs students. Ex: using reading materials at varying readability levels, putting text materials on tape, using spelling or vocabulary lists at readiness levels of students, meeting with small groups to re-teach an idea or skill for struggling learners, or to extend the thinking or skills of advanced learners.)