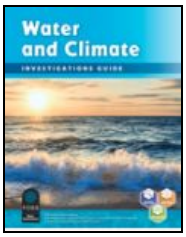
Investigation 1 - Water Observations



Students are introduced to the phenomenon that rocks are not all the same. They investigate several kinds of volcanic rocks and begin to understand the properties of rocks. Students observe rocks (using hand lenses), rub rocks, wash rocks, sort rocks, and describe rocks. After rubbing two samples together, students find that rock is hard but also susceptible to weathering. Students also begin to organize a class rock collection.

Standards - 3-ESS3-1, 2-ESS2-3

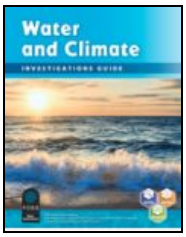
Investigation 1	Summary of Lesson	Priority
Part 1: Drops of Water	Students conduct investigations to observe the properties of water, an important earth material. They compare how water drops interact with four materials; paper towel, waxed paper, aluminum foil, and writing paper. Students observe that water soaks into absorbent materials and forms dome-shaped beads on waterproof materials. *Read, "A Report from the Blue Planet".* *Video, "All about climate and seasons".* *FQ - What happens when water falls on different surfaces?*	High Introduction to content vocabulary. Introduces anchor phenomenon
Part 2: Water on a Slope	Students use droppers to make water domes and observe the domes' behavior on a sloped surface. During a series of investigations, students observe that water domes always move downhill, and that size and angle of slope affect the speed at which domes move down a slope. *Read, "Surface Tension" and "Which Way does it go?"* Video, " Water Striders" Activity, "Surface Tension" and "Drops of Water on a Slope". *FQ - How does water move on a slope?*	High Introduction to new content vocabulary and concepts. Disciplinary Core Idea, ESS2.C; role of water on Earth's surface is introduced and builds on throughout the Investigation.
Part 3: Soaking Sponges	Students are challenged to measure how much water a dry sponge can soak up. This can be determined by measuring mass, volume, or both. Students develop their own procedures to answer this question. *FQ - How much water can a dry sponge soak up?*	High This lesson is a nice lesson on weight measurement/connections with math. Concepts of 3-ESS2-2 are found here as well.
Part 4: Water in Nature	Students go outdoors to collect small samples of natural materials, including living and dead plant material and earth materials. They put drops of water on the materials to simulate rain and observe what happens. *FQ - What is the effect of rain on natural surfaces?*	Medium This lesson reinforces the 3-ESS2-2 standard. Instead of planning a separate trip outside, you could collect a couple of samples on the way in from recess, while the teacher models the water drops.
Assessment	i-Check	

3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Investigation 2 - Hot Water, Cold Water

Students continue to investigate properties of water and observe the phenomenon of how temperature affects water's state and density. Students use standard metric units to measure temperature and observe the properties of water as it is heated, cooled, and frozen. They construct a thermometer and find that water expands as it is heated. Students compare the density of water at different temperatures and find that warm water is less dense than cool water, and that ice is less dense than liquid water. They go outdoors to investigate melting of ice in different conditions.



Standards - 3-ESS2-2, 2-ESS2-3, 2-PS-1

Investigation 2	Summary of Lesson	Priority
Part 1: Measuring Temperature	Students compare the temperature of three cups of water, using their fingers as gauges. They realize that a standard is needed, as well as a more accurate device to measure temperature. Students are introduced to the tool used for measuring temperature, the thermometer. *Read, "Vacation Aggravation" and "Celsius and Fahrenheit".* *Activity, "Measuring Temperature" and "Reading and Thermometer"* *FQ - How can you measure temperature accurately?*	High Students are introduced to the concept of temperature and how a thermometer works.
Part 2: Build a Thermometer	Students build a bottle thermometer and conduct investigations to find out what happens when the thermometer is placed first in hot water and then in cold water. They learn that water expands when it is heated and contracts when it is cooled. *Activity, "Bottle Thermometer"* *FQ - What is the effect on water when it gets hot or cold?*	High This lesson is the introduction to the concept that as water gets warmer, it expands. A building block concept for later investigations. Good example of SEP, Developing and Using Models. *** Assemble tube system prior to activity.*
Part 3: Sinking and Floating Water	After observing that some objects sink in water and some float, students are given an operational definition: objects float if they are less dense than water; objects sink if they are more dense. Students lower a vial of hot water and then a vial of cold water into a cup of room-temperature water. They observe that the less-dense warm water rises (floats), and the more-dense cold water sinks. *Read, "Water: Hot and Cold"* *Activity, "Density of Hot and Cold Water" and "Hot and Cold Water Density"* *FQ - What happens when hot or cold water is put into room-temperature water?*	High Introduces the concept of density. A building block concept for later investigations. Nice examples of DCI - PS1.A, Structures and Properties of Matter and CCC, Cause and Effect.

Part 4: Water as Ice	Students freeze water in vials and in syringes to observe that water expands when it freezes. They observe that a volume of liquid water has a greater mass than an equal volume of ice. They predict the behavior of ice in water, and explain the observation that ice floats in liquid water because ice is less dense than water. *Read, "Ice is Everywhere".* *Activity, "Expansion and Contraction of Water".* *FQ - How does water change when it gets really cold?*	High This activity introduces the concept of mass. Nice example of SEP, Constructing Explanations. Reinforces the idea that cold water expands and warm water contracts.
Part 5: Ice Outdoors	Students place one ice cube in the sunshine, place a second ice cube in the shade, and bury a third ice cube. They monitor the ice cubes and, by extension, determine the best place for an animal to go to stay warm and to stay cool. Students compare above-ground melting to underground melting. In cold-weather locations (temperatures below freezing), students do an alternative activity with water to determine how an animal can keep from freezing. *FQ- Where should an animal go to stay warm or to stay cool?*	Low This outdoor lesson could be skipped and could be a topic of discussion, even during another time of the day.
Assessment	i-Check	

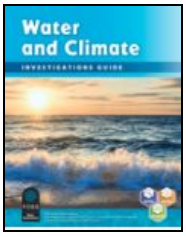
Investigation 2 cont. - Hot Water, Cold Water

3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.

2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.

2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Investigation 3 - Weather and Water



Students compare local weather data that they observe and collect to meteorologists' forecasts and historical weather data. Students explore the phenomena of evaporation and condensation, which account for the transformations of water between liquid to gas. Students find out how these transformations are the key drivers of the water cycle, the mechanism that redistributes water over the whole planet.

Standards - 3-ESS2-1, 2-ESS2-3

Investigation 3	Summary of Lesson	Priority
Part 1: Measuring Weather	Students compare weather data that they observe and collect to meteorologists' forecasts and historical data. Students watch a short video about how meteorologists make their forecasts'. They review local weather, forecasts, and records set in previous years. Students take turns collecting local weather data to compare to the forecasts and records.. *Read, "Studying Weather"* *Activity, "Weather Grapher"* *Video, "Importance of Meteorologist and Meteorology".* *FQ - What does the weather forecasts tell us?*	High This lesson introduces content vocabulary and concepts. It also requires introduction to data collection that will be required for further investigations.
Part 2: Evaporation	Students observe a demonstration in which two paper towels are soaked with equal amounts of water and then put in cups on a balance. One cup is open to air, and the other is closed. A day later, the towel in the open cup is dry. Students learn that things dry because of evaporation. *Read, "Drying Up".* *FQ - What happens to wet paper towels overnight?*	High This lesson introduces the concept of evaporation and water vapor (gas). Nice example of CCC, Cause and Effect.
Part 3: Surface Area	Students measure equal amounts of water into four containers with different surface areas. After 4 days, students measure the amount of water remaining in each container to discover that the greater the surface area exposed to air, the greater the amount of evaporation. *Read, "Surface-Area Experiment".* *FQ - How does surface area affect evaporation?*	High This lesson introduces the concept of surface area and models evaporation. Nice example of SEP, Planning and Carrying out Investigations.
Part 4: Evaporation Locations	Students measure equal amounts of water into four cups, place the cups in four different locations, and monitor temperatures for 4 days. They measure the amount of water remaining in the cups to discover that warmer environments promote more evaporation. *Activity, "Evaporation Experiment".* *FQ - What else affects how fast water evaporates?*	Medium Nice example of SEP, Asking Questions. This could take a lot of time to organize. To minimize time spent on this lesson, you could have a class set that is monitored, instead of group sets. Does meet standard 3-ESS2-1 and 3-ESS2-2.

Part 5: Condensation	Students set up cups of ice water and room-temperature water, and observe condensation on the ice-water cup. They learn that water vapor in the air condenses into a liquid on cold surfaces. The water cycle is introduced. *Read, "Condensation" and "The Water Cycle"* *Video, "Water Cycle - Chapter 2 and 3"* *Activity, "Water Cycle"* *FQ - What causes moisture to form on the side of a cup?*	High This lesson introduces the concept of condensation.
Assessment	i-Check	

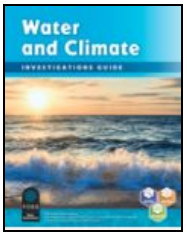
Investigation 3 cont. - Weather and Water

3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Investigation 4 - Seasons and Climate

Students analyze weather data, the everyday observable phenomena in the local atmosphere - temperature, wind, and precipitation - and think about the long-term patterns of weather in a place or region, the phenomenon known as climate. They work in groups to organize and analyze local daily weather data for 4 months of the previous year (January, April, July, and October). This leads students to think about the difference between weather (condition of the atmosphere now) and climate (typical weather that can be expected to occur in a region). Through media, students are introduced to ways that people manage the problems associated with floods. They discuss engineering methods to mitigate these weather-related hazards.



Standards - 3-ESS2-1, 2-ESS2-2, 3-ESS3-1

Investigation 4	Summary of Lesson	Priority
Part 1: Seasonal Weather	The class analyzes local daily weather data for 4 months of the previous year (January, April, July, and October). Each group works with a 2-week period in one of those 4 months to come up with a description for the weather during that period. The data categories for each day include condition, high temperature, low temperature, and precipitation. The average data for that day are also presented. Students grapple with what data to use and how to organize the data to extract meaning from them. *FQ - What are typical weather conditions in our region?*	High This lesson meets the standards 3-ESS2-1 and 3-ESS2-2. Students learn how to read a graph and table, and transfer data into new tables.
Part 2: Describing Climate	Students are introduced to climate and suggest schemes for describing world climate regions, based on their understanding of weather. They view a video to gather information on climate and compare their climate-region scheme to those of climatologists. *Read, "Climate Regions".* *Video, "All about climate and seasons".* *Activity, "Interactive Climate Map".* *FQ - How do we describe different climates?*	High This lesson involves a lot of different pieces of learning; video, activity and reading. All important to the overall application and learning of standards 3-ESS2-1 AND 3-ESS2-2.
Part 3: Weather-Related Natural Hazards	Through video and readings, students are introduced to ways that people manage the natural hazards associated with floods. Students discuss engineering methods to deal with floods and droughts. *Read, "Wetlands for flood control" and "Conserving water during drought".* *Video, "Come a Tide" and "Floods".* *FQ- How do people deal with natural hazards such as floods?*	Low Although this ties in nicely with extreme weather and changing climate and how engineers design structures and resources for these changes, this lesson could be skipped for time purposes.
Assessment		

Investigation 4 cont. - Seasons and Climate

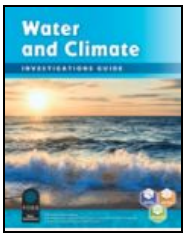
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.

3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

Investigation 5 - Waterworks

Students investigate how water, a renewable resource, percolates (drains) down through soils. This phenomenon prevents water from standing in pools everywhere and replenishes groundwater. STudents compare what happens when water is poured through two different earth materials, soil and gravel. Students test soil in a number of locations on the schoolyard to compare the drainage rates. They construct a water wheel and use it to lift objects, learning about the power of moving water. Students are introduced to renewable natural resources and ways to conserve them.



Standards - 3-ESS3-1, 3-5 ETS1-1, 3-5 ETS1-2, 3-5 ETS1-3

Investigation 5	Summary of Lesson	Priority
Part 1: Water in Earth Materials	Students pour equal amounts of water through equal masses of two earth materials, soil and gravel. They measure the amount of water that drains through the earth materials and compare the resulting masses of soil and gravel, using a balance. *Read, "Water. A Vital Resource" and "Natural Resources".* *FQ - What happens when water is mixed with other earth materials?*	Low Although this lesson teaches indirectly about watersheds, it doesn't directly meet the 3rd grade standards and could be skipped. The important piece of the lesson is the reading.
Part 2: Water in Soil	Students test the soil in a number of locations in the schoolyard to find out how long it takes each soil to absorb equal amounts of water. Students dig small holes in the ground and fit them with perforated filter cups. They time how long it takes for 100 mL of water to drain into the soil. Students consider which soils are best for plant growth. *Read, "Ellen Swallow Richards: An Early Ecologist" and "Making Drinking Water Safe".* *FQ - Do soils in the schoolyard drain water at the same rate?*	Low This lesson doesn't directly meet the 3rd grade standards and could be skipped.
Part 3: Waterwheels	Students are presented with an engineering challenge to design and construct simple waterwheels. They use water to power their water wheels to lift of pull objects. Students consider which features are necessary to make the waterwheel work, and what the function of each part of the system serves. They refine their designs with each trial and determine how many syringes of water it takes to move an object a specified distance. *Read, "Using the Energy of Water".* *FQ - What is needed to make a waterwheel system function well?*	Low This lesson doesn't directly meet the 3rd grade standards, except in Engineering, and could be skipped. *** Students love this lesson, and if time, should be done.*
Assessment		

Investigation 5 cont. - Waterworks

3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

3-5 ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5 ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5 ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.