THE UNIVERSITY OF ARIZONA
Cooperative Extension

ARIZONA
project WET
WATER EDUCATION TODAY

Arizona Water Festival Curriculum Unit, 6th ed.

Revised to assist 4th grade teachers in meeting the 3-dimensional learning requirements of the Arizona Science Standards (adopted October 2018).

Developed by Arizona Project WET using the *Foundations of Water Education*, 1st edition, 2024, *Project WET Curriculum and Activity Guide 2.0,* 2011, *Project WET Activity Guide,* 1st edition, 1995, and *Arizona Conserve Water Educators Guide*, 2007.

Arizona Water Festival Curriculum Unit

INTRODUCTION

During the Arizona Project WET – Water Festival Unit of Study, 4th grade students explore the Arizona water cycle, map our regional watersheds, unearth the connection between groundwater and surface water, and learn how their behaviors impact water availability in Arizona. Students use this knowledge to develop accessible, community-focused solutions that simultaneously conserve water and promote sustainable decision-making.

The Unit of Study is designed to help teachers meet the 4th grade science standards using student-centered, 3-dimensional learning. This focuses on doing science: asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data and constructing explanations and designing solutions. Emphasis also falls on recognizing relationships that connect all sciences and other fields of study. Specifically, the Arizona Water Festival Curriculum Unit puts students at the center of their own water cycle observing the phenomena that relate to the environment in which they live. Launching the unit, an interactive demonstration deconstructs the processes driving the water cycle and builds clear relationships between them. This “anchor phenomena” for the unit is accompanied by investigative phenomena for each lesson.

UNIT GUIDING QUESTIONS:

Where is Arizona’s water? How does water move through urban, desert, and forest ecosystems?

What are the connections between people, water, and heat in the environment?

What are the challenges we face around access, conservation, and care for our water resources in Arizona? How can we design systems to protect water resources and protect people and other living things from the hazards of drought, flood, and high-humidity heat waves?

FOUR FIELDS OF STUDY | OBJECTIVES:

WATER CYCLE – Model the movement of water molecules through the Arizona water cycle. Find evidence to support the argument that energy and matter interact in Earth's systems to create the water cycle.

GROUNDWATER – Model aquifer recharge and extraction connecting water availability to human behavior.

WATERSHED – Use a system's model to learn how water moves through a watershed and demonstrate the human impact of changes to that natural system; city surfaces affect the

movement of water, and those changes can be observed/measured. Identify the cause-and-effect interactions between matter and energy in the hydrosphere, biosphere, atmosphere, and geosphere.

SUSTAINABILITY – Act as environmental stewards, conserving water through both behaviors and available technologies, supporting resilient solutions that benefit the (biodiverse) community. Design a solution for water savings and safety.

ARIZONA SCIENCE STANDARDS

- 4.E1U1.6/7 Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.
- 4.E1U3.9 Construct and support an evidence-based argument about the availability of water and its impact on life.
- 4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards (in the context of droughts and water scarcity).

Excellent source for free graphic organizers and many other valuable resources:
https://thewonderofscience.com/graphics

STUDENT PRE and POST ASSESSMENT – https://projectwet.arizona.edu/arizona-water-festival/teacher-resources/student-survey

***Before**: Please administer the survey before students start any of the lessons. It is not a test and please feel free to facilitate reading the questions as a class.*

ANCHOR PHENOMENA: CLOUDS

https://youtu.be/68A_Azsqqg4?feature=shared

Engage: Pause the video at 0:55 to have the students try it for themselves. You can end the video at 2:28.

Take some time to discuss what you saw in the video. Give the students a chance to think about how water moves and changes form. Ask them to write down three questions that they have about the phenomena. If you are able to give the students sticky notes - create a public board of questions to refer back to during the unit.

Explore: Invite students to observe clouds, and participate in a Cloud Scavenger Hunt over the course of the unit.

Explain: Use the linked websites to learn about clouds, investigate how they are formed and which ones we see most often in the Arizona sky. Use Clouds Notes organizer to obtain, evaluate and use information to make an argument from evidence.

Elaborate:

Make a Cloud in a Bottle
https://www.jpl.nasa.gov/edu/resources/project/make-a-cloud-in-a-bottle/

Anchoring Phenomena: Clouds Lesson Plan

Investigative Question:

What are clouds?

How and why do clouds form?

Reference:

https://www.noaa.gov/jetstream/clouds

https://scied.ucar.edu/learning-zone/clouds/cloud-types

https://www.weather.gov/source/zhu/ZHU_Training_Page/clouds/cloud_development/clouds.htm

Time Frame: 50 minutes

Cross Cutting Concepts Demonstrated:

Cause and effect

Matter and energy

Stability and change

Science and Engineering Practices Integrated:

Ask questions and define Problems

Obtain, evaluate, and communicate information

Engage in argument from evidence

Materials Needed:

Clouds scavenger hunt

Clouds Notes Page

Websites

LESSON 1: THE WATER CYCLE

ARIZONA SCIENCE STANDARD: 4.E1U3.9 *Construct and support an evidence-based argument about the availability of water and its impact on life.*

LESSON 1.1: Where is the water?

> ***Investigative Question: How does water move and change form in the Earth's natural system? What are the forces that drive the water cycle?***

Engage: Give students the desert/forest coloring sheet and ask them to create a color or symbol code to show where the water is. Prompt students to think about where water can be found outside of lakes, rivers and oceans. Where is the liquid form of water? Where is the gaseous form of water? Where is the solid form of water? What causes water (matter) to change from a solid to a liquid to a gas? - (Energy from the sun). What causes water vapor to precipitate and fall from the sky and percolate into the ground? (Gravity). Ask students to share their ideas and discuss in small groups. Generate a class list on the board/smartboard/poster board.

Explore: Ask students to commit to a position on the following questions: Is there more water in the desert or in the forest? Why? Ask students to generate a list of evidence to support their answer to the above questions.

Explain:

1. Introduce the AWF Science Notebook Water Notes pages and use these pages to take notes.
2. Learn key vocabulary. Play the Gimkit for review.

Elaborate: Ask early finishers to choose an organism in the desert side of the picture and research and describe how it is able to survive with less water in the desert.

Evaluate: Ask students to write a one-paragraph evidence-based argument responding to the question: Is there more water available for living organisms in a desert or in a forest?

Cross Cutting Concepts Demonstrated:

- Cause and effect
- Matter and Energy
- Systems and system models

Science and Engineering Practices Integrated:

- Ask questions and define Problems
- Analyze and interpret data
- Engage in argument from evidence

Materials Needed:

Biome coloring pages

Vocabulary organizer

Cause and Effect Page
Question, Evidence, Explanation Organizer

LESSON 1.2: MOLECULES IN MOTION

Investigative Question: What are the relationships between matter and energy in the movement of water in the water cycle?

Explore:

1. Students use colored water to explore the behavior of liquid water at different temperatures. This can be done in small groups, as a demonstration, or using the following video: https://www.youtube.com/watch?v=NI1h1ZcQ7_E&t=145s Students construct an explanation for what they observed using sentence starters: I see, I think, I wonder...
2. Students can do a whole-body simulation on the movement and phase changes of water in the water cycle due to the addition or loss of heat (energy).
3. Students use a simulation to visualize relationships between water molecules and heat energy.

Explain: Review the phases of matter, and relationship between matter and energy. Introduce the water cycle diagram and vocabulary. Use the Cause and Effect Matter and Energy organizer to identify how and why water moves and changes form.

Elaborate:
https://phet.colorado.edu/sims/html/states-of-matter-basics/latest/states-of-matter-basics_en.html

Evaluate: Quiz on vocabulary and diagram.

LESSON 2: WATER MOVEMENT BETWEEN EARTH SYSTEMS

ARIZONA SCIENCE STANDARD: 4.E1U1.6/7 *Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.*

Investigative Questions: How and why does water move between Earth's systems? What are some of the consequences of water movement (cause and effect)?

Review: Have students take out their desert/forest coloring page. Ask them to think, pair, share about how water moves from one place to another in the picture. Ask them to generate a list of transfers using the Cause and Effect biome page.

Engage: Generate a list of cause-and-effect water transfers on the board/smart board. Ask students if they think water moves from plants into the air. Tell them that they are going to do an experiment to find out and ask them to write down their prediction.

Explore:

1. Students investigate transpiration by using a plastic bag to physically capture the water that leaves a plant and explore where that water comes from.
2. Students do a whole-body simulation to model the movement of liquid water through different earth materials.
3. Students experiment with different earth materials and how water moves through each.
3. Students use an online simulation to visualize how water moves through different materials.

Explain: Use slides to explain transpiration and review the Water Cycle Diagram. Students add new parts and processes to their water cycle diagram.

Evaluate: Check (or have students check each other's) water cycle diagrams for accuracy.

LESSON 3 WATERSHEDS

ARIZONA SCIENCE STANDARD: 4.E1U1.6/7 *Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.*

LESSON 3.1 WATERSHEDS WORK

Review: Have students take out their water cycle diagrams. Ask them to think, pair, share about how water moves from one place to another in the diagram. Ask them to generate a list of transfers using the Cause-and-Effect water cycle diagram page.

Engage: Students construct a model of the land surface to explore the parts of a watershed and observe the relationships between surface water and the land/environment in that watershed.

Explore:

1. Students do a gallery walk of each unique model and make claims based on evidence about what each demonstrated in relation to watersheds.

Explain: Use slides and discussion to explain key watershed ideas.

Evaluate: Write a one paragraph summary in response to the following prompt: Where is the water in our watershed?

LESSON 3.2: UNDERSTANDING URBAN WATERSHEDS

ARIZONA SCIENCE STANDARD: 4.E1U3.9 *Construct and support an evidence-based argument about the availability of water and its impact on life*

Investigative Question: How does human impact on the land affect water and heat within a watershed? How do the parts of an urban watershed interact with the water cycle? How do we manage a watershed to make sure our water is clean and sustainable? How do the parts of a watershed interact with the water cycle?

Engage: Revisit watershed models and ask students to consider, share, and list where they think water will be absorbed (permeable surfaces) and where they think it will remain on the surface (Impermeable surfaces). Ask them to make a prediction about where the surface will be warmer or colder using place locations – buildings, parking lots, farms, parks etc.

Explore:

1. Students explore the topics of permeable and impermeable surfaces, the urban heat island effect and pollutants from runoff to better understand how humans can impact the flow of water and the temperature within an urban watershed. Students investigate their school grounds during a scavenger hunt identifying different surfaces, possible pollutants and recording temperature of surfaces with a heat gun (or by touch).
2. Students participate in a whole-body simulation of urban runoff in a storm drain system and discuss what happens to the quality of water in an urban environment.

Explain: Have students share their findings with the class and generate a list of observations. Ask students to make a claim based on the evidence they have gathered to support or refute the claim: Human choices can affect the amount of heat and pollution in a watershed.

Elaborate:

1. Ask students to design an investigation to explore something else they would like to learn about watersheds.

2. Ask students to design a solution to reduce increases in heat absorption or pollution in watersheds.

Evaluate: Evidence-based arguments for and against the claim: Human choices can affect the amount of heat and pollution in a watershed.

Play vocabulary Gimkit and/or give vocabulary quiz.

LINK TO VOCABULARY

ATTEND THE FESTIVAL

Anchoring Phenomena: Sustainability and Stewardship

PBL Opportunity - If you have time to do a solutions project, choose the phenomena you think best suits your project. You could talk about droughts, floods, changes in the Colorado or local rivers, groundwater overuse or pollution, desalination, water reclamation, or water purification.

https://www.arizonawaterfacts.com/do-we-have-enough
https://www.arizonawaterfacts.com/tips-resources

LESSON 4: WATERSHED & SUSTAINABILITY - IT ALL ADDS UP

Investigative Questions: How do contaminants/pollutants travel downstream? What are the ways that pollution in a watershed is reduced or prevented?

Review: Give students an opportunity to debrief after the water festival. What stood out to them? What do they know now that they didn't understand before the water festival? What do they still want to know? Generate a list of questions.

Engage: Students use a full body activity to create a systems model to illustrate the downstream effects of pollution sources. Sum of the Parts

Explain: Use slides to introduce point and non-point pollution.

Explore: Students differentiate between point and nonpoint source pollution and identify Best Management Practices to reduce pollution and explore ways communities can reduce urban heat.

Evaluate: Ask students to share their best solutions with a partner. Listen as you move around the class and then ask some students to share their solutions with the class.

LESSON 5: GROUNDWATER IN ARIZONA

Investigative Question: How does groundwater fit within the Arizona Water Cycle? What is the relationship between groundwater and surface water? Do we have an endless supply of groundwater?

Engage: Students review and identify the parts of the groundwater system that they explored during the water festival.

Explore: Use this simulator to experiment with surfaces, rainfall and types of groundwater wells. https://has.concord.org/groundwater-movement.html

Explain: Students review and identify the parts of the groundwater system that they explored during the water festival. Through videos and slides students dive deeper into how wells work and how groundwater plays a pivotal role as a water source to Arizona. Students explore how human behavior can alter the land, the groundwater system and impact the water we have available. Use slides to review key ideas about groundwater.

Evaluate: Check students Science Notebook summaries page.

LESSON 6: SUSTAINABILITY & STEWARDSHIP

ARIZONA SCIENCE STANDARD 4.E1U2.10 *Define problem(s) and design solution(s) to minimize the effects of natural hazards (in the context of droughts and water scarcity).*

LESSON 6.1: A DROP IN THE BUCKET

Investigative Question: How much water on Earth is available for our use? What is potable water? Does everyone have access to potable water?

Review: The process of evapotranspiration from lesson 2.

Engage: In small groups students take 1000ml of water and get to measure out how that water is represented on earth (ocean, frozen, fresh, potable, etc.). Through this activity students calculate the percentage of freshwater available for human use.

Explore: Find your county factsheet and discuss what it means in a small group.
https://wrrc.arizona.edu/resources/arizona-water-factsheets

Explain: Students discuss in small groups what they discovered during the activity and share with the class how the climate of Arizona and the water cycle are connected.

Evaluate: Claim, evidence, reasoning, graphic organizer.

LESSON 6.2: WATER WEB

Investigative Question: How do I use water both directly and indirectly? What are the water sources and who are the water users in my community?

Engage: Students discuss and identify the difference between direct and indirect water use. In groups students examine local industries in Arizona to see how they use water.

Explore: Participating in a full-body activity, students model a "water web" to simulate their dependence on water and the interdependence among water users, producers, and people in the community.

Explain: Give students a chance to ask questions about everything they have seen so far and do your best to answer their questions. If you don't know the answer to a good question, tell them you will find out and share what you learn.

https://www.watereducation.org/post/food-facts-how-much-water-does-it-take-produce

Evaluate: Students have a group discussion about what they witnessed during the activity demonstrating they can see the connection between multiple water users. Students brainstorm and share ways communities and different users can use less water.

LESSON 6.3: MY WATER FOOTPRINT

Investigative Question: How much water do I use daily? Why is water use called a water footprint? How can I be a better water steward?

Engage: Students define the term water footprint and begin to create and describe their personal water footprint. Students interpret a population growth graph and water usage over time graph, and brainstorm solutions (both behaviors and technologies) that can help to conserve and protect water.

Explore: Participating in a full-body game students role-play out different water use scenarios.

Explain: Students interpret a population growth graph and water usage over time graph and share conclusions about what the graph means.

Evaluate: Students brainstorm solutions (both behaviors and technologies) that can help to conserve and protect water. Standards-based assessment: 4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards (in the context of droughts and water scarcity).

Assessment:

STUDENT POST-ASSESSMENT -
https://projectwet.arizona.edu/arizona-water-festival/teacher-resources/student-survey
After: Please administer the same survey again after completing the unit. Ideally no more than four weeks after the water festival event. Thank you very much!