Teacher Overview and Preparation

Overview

The TVA Virtual Water Monitoring Lab includes 9 videos, roughly 3 - 5 minutes each, which walk students through the lab experience. Separating the videos into short segments allows teachers to deliver the program at their own pace.

The program is designed so that students can work individually or in groups of (up to) 3. If students are working in groups, it will be helpful to assign each student a video: Water Temperature, Dissolved Oxygen, and pH. The Turbidity video students work together.

Preparation

Supplies you provide:

- Buckets for water sample.
- Water sample from nearby pond, creek, river, or lake.
- Copy of Test Directions
- Stopwatch or timer for dissolved oxygen test
- Old towels or paper towels for cleanup.
- One data sheet with clipboard for each team of up to 3 students.
- Disposable gloves - one per group.

Optional supplies:

- basket/box/bowl to organize the supplies for each group.
- disposal container for chemical water after tests are completed.

Equipment you need:

- projector/computer and screen to show a picture of the water source for visual observations.
- white board and markers for recording results.
- teacher test kit for personal use and demonstration purposes (provided).
- one test kit for each team of three students (provided).

Day before:

Organize lab materials/supplies for all classes conducting the lab; using a basket to contain supplies helps:

1. Beaker
2. Test tube
3. Vial
4. Comparison card
5. Single bubble pH tablet*
6. Double bubble Dissolved Oxygen tablets*
7. Data sheet on clipboard with pencil
8. One glove for each team of three students (optional)

*It helps to cut the tablet packets and only provide enough for one test at a time. Students can have trouble opening the foil packets, so it also helps to pierce the back of the foil and semi open for the students prior to the lab (WARNING tablets are fragile and crumble easily).

Morning of:

- Collect water for testing and complete a round of tests onsite (Can be done the afternoon before. see Water Collection instructions)
- Pierce the back of all the foil bubbles or start peeling the foil for the dissolved oxygen and pH tablets as these tablets are easily broken
- Arrange desks so that students have a large work surface
- At the start of each class period, assign student roles: Water Temperature test, Dissolved Oxygen test, pH test

During:

Photos made of the students completing the experiments are good for the school paper, social media and administration as well as sharing with TVA!

VIDEO ONE: What is TVA? (2 minutes)

What you will learn:

- TVA uses the Tennessee River to generate electricity.
- The ways TVA creates electricity using renewable and non-renewable natural resources.
    - Hydroelectric dams
    - Fossil fuel power plants
    - Nuclear power plants
    - Solar power plants
    - Wind farms
- TVA manages the Tennessee River for flood control, navigation, and recreation.

Discussion/Journal questions:

- What is a watershed?
- What watershed do you live in?
- What is the difference between renewable and non-renewable resources?
- What do you like to do on the water?

Vocabulary:

- Watershed - an area of land where all the water on the surface drains to one central body of water
- Renewable resource - a resource that can be used repeatedly and never run out because it is naturally replaced

External resources:

- www.currentsofchange.net/
    - Social Studies/History lessons of the Great Depression, New Deal, & TVA.
- https://river-runner.samlearner.com/
    - A raindrops path, you can drop it anywhere in the US and see where it ends up!
- www.tva.com/kids/
    - There are virtual tours of the dams. We touch on hydroelectric dams and it's usually something the students ask questions about.
    - There is also a tab: Making Electricity. It has videos that go into more detail about how each plant generates electricity.

- www.tva.com/stem/teachers
    - Project based lesson plans for all grade levels.

VIDEO TWO: What is Aquatic Life? (3 minutes)
What you will learn:
- What is an environmental scientist?
- What is aquatic life?
- Step one of the science and engineering process.
    - Ask the question: Will this water source support aquatic life?
- How to make a visual observation

Discussion/Journal questions:
- What 4 things do aquatic life need to survive?
- What visual observations do you see for your water source?
    - Examples: water has a color and/or clearness, water has movement/no movement, signs of erosion, signs of vegetation on bank, signs of human impacts: dock, bridge, trash, signs of aquatic life.
- What types of aquatic life would you find at your water source?
    - Examples: fish, turtles, frogs, ducks, lily pads, eel grass, duck weed, mosquitoes, dragonflies.

Vocabulary:
- Aquatic life - any plant, animal, or insect that uses water as a home for at least part of its life cycle
- Visual observation - data gathered by researchers of what they can see with their eyes

External resources:
- www.stemexplore.org/
    - Cabinet of Curiosities explores STEM career paths.

VIDEO THREE: How to Start an Experiment (5 minutes)
What you will learn:
- Science and Engineering Process
    - Plan and Carry Out Investigations
- How to fill out a data sheet like a scientist
    - Why it's important
    - Record Date
    - Record Location
- Using degrees Fahrenheit and Celsius
    - Record Air temperature
- What units of measurement to use
    - PPM - parts per million
    - JTU - Jackson Turbidity Unit
- How to check your equipment
    - It's important to make sure everything is there and works

Discussion/Journal questions:
- How does a thermometer work?
- Why do scientists use Celsius?
- Why are units of measurement important?

Vocabulary:

- Data sheet - document where we record information on the subject we are studying
- Parameter - characteristic or feature that can be measured
- Measurement - description of what we are studying
    - unit of measurement - standard used for reference and comparison
- Beaker - a piece of science equipment used to hold fluids and chemicals
- Secchi Disk - black and white disk, used to measure transparency or turbidity of water
- Test tube - cylindrical container that holds a small amount of a substance used for laboratory tests and experiments
- Vial - small vessel or bottle that usually holds liquids
- Thermometer - used to measure the amount of heat in an object or substance

VIDEO FOUR: Water Temperature Test (3 minutes)
What you will learn:
- How water temperature affects aquatic life
- Water temperature is important to aquatic life
- How to properly take the temperature of water
- Organisms migrate to conditions that better suit them
- Predator/Prey relationships

Discussion/Journal questions:
- Why is water temperature important to aquatic life?

Vocabulary:
- Adaptation - the evolutionary process where an organism becomes better suited to its habitat; process that takes place over several generations

VIDEO FIVE: Dissolved Oxygen Test (4 minutes)
What you will learn:
- What is dissolved oxygen?
- How is oxygen infused into water?
- Dissolved oxygen is important to aquatic life
- Steps for the D.O. test

Discussion/Journal questions:
- Why is dissolved oxygen important to aquatic life?
- Examples of a chemical reaction?

Vocabulary:
- Chemical reaction - the process where a set of substances undergo a chemical change to form a different substance

VIDEO SIX: pH Test (3.5 minutes)
What you will learn:
- pH scale
- How the pH or acidity in the water affects aquatic life
    - Range of 6.5-9.0 is best for most aquatic life
- Steps for the pH test

Discussion/Journal questions:
- Examples of how pH affects water quality and aquatic life?

VIDEO SEVEN: Turbidity Test (3 minutes)
What we will learn:

- What is turbidity?
- Turbidity is important to aquatic life
    - Animals need to see to find food or avoid predators
    - Plants need sunlight for photosynthesis
- Steps for turbidity test

Discussion/Journal questions:

- Why is turbidity important to aquatic life?
- What are possible causes for increased turbidity?

Vocabulary:

- Turbidity - the measure of waters transparency or clarity
- Photosynthesis - the process by which plants use sunlight to make their food

VIDEO EIGHT: Analyze and Interpret Results (6 minutes)

What you will learn:

- Record your data
- What does your data mean
- Answer the question: Will your local water source support aquatic life?
    - Give evidence to support your answer

Discussion/Journal questions:

- Why will your local water source support aquatic life?

VIDEO NINE: What Does It All Mean (2:30)

What you will learn:

- Human Impacts
- Distribution of water on Earth
    - Almost 75% of Earth is water
    - 97% Saltwater, 2% Ice, 1% Freshwater
- Importance of protecting freshwater resources
    - 1% we must share with all aquatic life, worldwide

Discussion/Journal questions:

- What could change your water quality parameters?
    - Examples: pollution like trash and chemicals in our storm water.
    - Examples: Erosion from flooding or construction
    - Examples: pH changes from agriculture runoff or oil spills
- How can we protect and conserve our water sources?

External resources:

- www.monitorwater.org/
    - See test results from all over the world.
- iScience Program - Discover Life in America (dlia.org)
    - This free 3-year program is available for grades 5-8 and is a partnership between DLiA and TVA.

Lab cleanup:

Solutions from test tubes and vials are safe to dump down the drain - you may want to provide a bucket for the waste liquids and dispose down the drain later. Unused water in the beakers can be emptied back into the buckets from which the water came, for use by the next class of students.