

5E Lesson Plan

Center: The River Center
Program Name: Water Properties Lab
Date Offered: Year-round
Subject/Grade Level: Science/3-5

Benchmarks:

3rd Grade Standards

SC.3.L.15.1, SC.3.P.8.3, SC.3.P.9.1, SC.3.N.1.1, SC.3.N.1.2, SC.3.N.1.5, SC.3.N.1.6, LAFS.3.SL.1.1, LAFS.3.SL.1.3, LAFS.3.RI.1.3, MAFS.3.MD.2.4

4th Grade Standards

SC.4.L.17.2, SC.4.L.17.3, SC.4.L.17.4, SC.4.P.8.1, SC.4.P.8.2, SC.4.N.1.1, SC.4.N.1.2, SC.4.N.1.4, SC.4.N.1.5, SC.4.N.2.1, LAFS.4.RI.1.3, LAFS.4.RI.3.7, LAFS.4.SL.1.1, LAFS.4.SL.1.3, LAFS.4.SL.2.4, MAFS.4.MD.1.1, MAFS.4.MD.2.4

5th Grade Standards

SC.5.L.17.1, SC.5.P.8.1, SC.5.P.8.2, SC.5.P.7.2, SC.5.P.7.4, SC.5.N.1.1, SC.5.N.1.6, LAFS.5.RL.2.6, LAFS.5.RI.2.6, LAFS.5.W.3.8, LAFS.5.SL.1.1, MAFS.5.MD.1.1, MAFS.5.MD.2.2

Lesson Targets:

- I can work together with team members to conduct experiments.
- I can compare density in saltwater to freshwater.
- I understand how surface area and surface tension are related to density.
- I know the phases of water and the properties of water.
- I can make connections to salt, fresh, and brackish water in experiments and the ecosystems of the Loxahatchee River watershed.

Differentiation strategies to meet the needs of all students:

- Working in a group setting to explain vocabulary
- Use of open-ended questions
- Relate topic to their everyday life
- Hands-on instruction
- Tutor/Peer Buddy activities
- Use of visuals
- Modification of text or curriculum

Background:

Water is everywhere and found in many different forms. It is in the air we breathe, our sink faucets, and in every cell of our body. Living in Florida, we have all seen boats floating on fresh and saltwater. We know some items can float on the water's surface, some partially float, and others sink. Discuss potential reasons for why this happens (i.e. some items are heavier or lighter than water). Discuss the different places where water can be found, the three states of water (solid/liquid/gas), and the different types of water (saltwater/freshwater/brackish).

1. Why is water so important?
2. What is density?
3. Does water in different states have different densities?
4. Do different types of water have different densities?
5. Do submarines sink or float? (Both/neither) While underwater they have neutral buoyancy.

Vocabulary:

Water cycle, water properties, characteristics of water, phases of water, the conservation of mass, observation, hypothesis, prediction, molecules, physical change, chemical change, volume, mass, experiment, precipitation, condensation, evaporation, percolation, freshwater, saltwater, brackish water, solid, liquid, gas, opposing forces, density, buoyancy, surface area, surface tension, cohesion

Engage: (Completed in classroom before visiting)

Welcome to Earth's Ocean! It is filled with some of the most incredible, amazing, and fantastic creatures, plants, and geologic formations any human has ever seen. The ocean covers nearly 70% of the earth's surface and contains nearly 97% of the planet's entire water supply.

Discuss the five major sections of earth's ocean (Pacific, Atlantic, Indian, Arctic, and Southern) distinguishing characteristics and features. Explain the differences between oceans, seas, estuaries, lagoons, and gulfs. Teachers will pose the question "Why is the ocean salty?" and ask the students to write down their response based on experiences, observations, the water cycle, and previous knowledge.

Materials:

- Water pitcher
 - Water
 - Salt
 - Wooden stirring spoon
 - String
 - Large glass jar (1 glass jar per 4-5 students)
 - Pencils
 - Paper clip
1. The teacher will prepare a saltwater solution before the lab begins by filling a pitcher full of water, adding several tablespoons of salt and stir until dissolved. Continue adding salt until no more can dissolve.
 2. Groups of 4-5 students will each get a glass jar, string, a paper clip, and a pencil
 3. Connect the paper clip to the middle of the pencil with the string. Rest the pencil horizontally across the jar allowing the paper clip to be suspended in the jar, but not allowing it to hit the bottom.
 4. Add the saltwater solution to the jar and place in a sunny spot by a window or outside.
 5. Over a week period, the water will evaporate out of the jar and salt will start to collect on the string.

What happened to the water? What happened to the salt? Why? As the water evaporates, the salt in the solution that is dissolved in the water will adhere to the surface of the paper clip and string and return to a solid state. You will be able to see the salt crystals on the bottom of the jar. Ocean water has a specific level of salinity that varies according to temperature, location, water currents, dissolved

minerals, and other factors. The students have witnessed a portion of the water cycle as well as specific properties and phases of water.

Explore: (Completed during visit with River Center staff)

- Welcome, introduction to the River Center, overview of today's field trip, and safety/rules talk
- Divide the students into 2 groups to rotate through 3 different activities
 - Lovin' the Loxahatchee River Tour – focusing on the different kinds of water found in the Loxahatchee River, water as a resource for animals and people, water quality and health of the ecosystems.
 - Water Properties Lab (See below)
 - Water resources discussion
 - Where does our water come from?
 - How we use water in our everyday lives?
 - Where it goes once it flows down the drain?
 - What is the process of wastewater treatment?
 - How can I help? Water conservation
- Touch tank demonstration

Explain: Water Properties Lab (Complete during visit with River Center staff)

1. Students will be divided into teams of 4 or 5, one group per table with two containers, one filled with saltwater and the other with freshwater.
2. Educators will demonstrate the concept of surface area and surface tension both in air and in water, as well as the concepts of buoyancy and density based on the two different water types.
3. Students will compare and identify the water in the containers based on experiments with chips, floating vessels, and a variety of items used to sink their boats.
4. Students will make connections to salt, fresh, and brackish water in their experiments to the ecosystems in the Loxahatchee River watershed.
5. Students will be scientists making predictions, performing experiments, making observations, recording their findings, evaluating, and sharing their findings with other teams.

Elaborate: Post-visit Reflection Lesson (completed in classroom after visiting)

Materials:

- Pennies
- Pipettes
- Container of saltwater
- Container of freshwater

Drop on a Penny Lab – See activity instructions and visuals in resources below.

1. Give each student a penny and small container of water.
2. Have each student use a pipette to put one drop of water on the penny at a time.
3. How many drops of water can the penny hold before the water falls off the penny? Why? A:
Surface tension

Evaluate:

- Participation in the activity
- Grade assessment of the pre and post activities described in the Engage and Elaborate sections.
- Grade assessment on vocabulary.

- The teacher will observe and guide the students to assess their own learning.

Creating STEM Connections:

Science – See standards above

Technology

- Density Column Experiment (see below in resources)
- River Center’s Virtual Education
 - Science with Sam: Volume 1 Water Reclamation and Recycling
<https://www.youtube.com/watch?v=alzH3Cx4AEM&list=PLA39R2PcEo32OY-s6Wp9bJE3ysTXj-Dqq&index=2>
 - Science with Sam: Volume 2 All About Clouds
<https://www.youtube.com/watch?v=Mo4LNsCmsxw&list=PLA39R2PcEo32OY-s6Wp9bJE3ysTXj-Dqq&index=1>

Engineering

- Bottled-up Buoyancy by Science Buddies -
Submarines can go underwater and surface again. How is it possible for submarines to both float and sink? In this project you will investigate how submarines dive and surface by changing their buoyancy in the water.
https://www.sciencebuddies.org/science-fair-projects/project-ideas/Aero_p034/aerodynamics-hydrodynamics/submarine-buoyancy?from=Blog

Mathematics – See standards above.

Resources:

- Penny Drop activity instructions
- Water Density Column activity instructions

Loxahatchee River District Connections:

- Water supply
- Sewage
- Stormwater

River Center Exhibit Connections:

- Loxahatchee River Timeline
- Loxahatchee River Map – “Your Community, You River”
- LRD water board – drinking water, water use in our homes, wastewater treatment, and reuse

Density Column Experiment

Can you make freshwater float?

Definition of density: Density is a measurement that compares the amount of matter an object has to its volume. An object with a lot of matter in a certain amount of volume has high density. An object with a little matter in the same amount of volume has a low density.

So, if something is denser it has more stuff inside it. If something is less dense it has less stuff inside it.



Today you will be testing if freshwater or saltwater has a higher density.
(Teacher - use dye coloring to create green freshwater and purple saltwater)

- Step one:
 - Grab a test tube from the tray and a pipette.
- Step two:
 - Dip the pipette into the bottle of saltwater, draw up the water into the pipette. Then, grab your test tube and squeeze the water in.
- Step three:
 - Now dip your pipette into the freshwater, draw the same amount that you used with the saltwater.
- Step four:
 - Slowly drip the freshwater **on the top** of the saltwater into the test tube. Try your best not to shake the test tube when doing this step.

Questions:

- Is the freshwater sinking below or floating above the saltwater?
- Why do you think this is happening?
- Do you think the saltwater is more dense than the freshwater or less dense?

Answers:

The green water (freshwater) should have floated above the purple water (saltwater). The reason this happens is because the saltwater has a higher density than the fresh water.

The purple water has salt and water mixed together, living in one space. So, when you add the green water to it, it is lighter and will float above the purple water.

You can try this at home with other liquids too!



Drops on a Penny Lab

Cohesion

Water molecules are attracted to other water molecules. The oxygen end of water has a negative charge and the hydrogen end has a positive charge. The hydrogens of one water molecule are attracted to the oxygen from other water molecules. This attractive force is what gives water its cohesive properties.

Surface Tension

Surface tension is the name we give to the cohesion of water molecules at the surface of a body of water. The cohesion of water molecules forms a surface "film" or "skin." Some substances may reduce the cohesive force of water, which will reduce the strength of the surface "skin" of the water.

Objective

Hydrogen bonds and surface tension give water some amazing properties. Let us use them to see how many drops of water fit on a penny.

You might think that you cannot fit many drops of water on the surface of a penny. Pennies are just so small! In this experiment, you will see surface tension and cohesion at their finest. How many drops of water can you fit? There is only one way to find out, one drop at a time.

Procedure

1. Wash and rinse a penny in tap water. Dry it completely with a towel.
2. Place the penny on a flat surface.
3. Use an eyedropper or pipette to draw up water.
4. Carefully, drop individual drops of water onto the flat surface of the penny.
5. Keep track of the water drops as you add them, one at a time, until the water eventually runs over the edge of the penny. You will probably be surprised by the number of drops you get on there.

How does it work?

There are two properties at work in this experiment: cohesion and surface tension. Cohesion is the attraction of like molecules to one another. In this case, the like molecules are the H₂O molecules in the water drops. Surface tension is a term to describe the cohesion between water molecules.

Water's cohesion and surface tension are special because of hydrogen bonds. Hydrogen bonds are formed by the hydrogen atoms of one molecule being attracted to the oxygen atoms of another molecule.

The cohesion and surface tension of water becomes apparent when the drops of water you added reach the penny's edge. Once the water has reached the edge, you begin to see a bubble or dome of water forming on top of the penny. The bubble is a result of the water molecules clinging to one another in an optimal shape.

Take it further

Extend this experiment by trying different coins such as dimes, nickels, or quarters or try using saltwater instead.

