Properties of Water

Contributors

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Intended Audience

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Intended Audience

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<tr>
<td>Classroom Setting</td>
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<td>Requires special equipment</td>
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<td>Uses hands-on manipulatives</td>
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<td>Requires mathematical skills</td>
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<td>Can be performed individually</td>
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<td>Requires group work</td>
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<td>Requires more than one (45 min class) period</td>
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<td>Appropriate for special needs student</td>
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Introduction

Description

Students will manipulate water in various ways in order to see the different properties of water in action.

Abstract

Students will manipulate water in three different ways. At station one, they will start by dropping water on wax paper to see its cohesiveness. At station two, they place drops of water on a penny to witness water tension. At station three, students continue to explore water tension by making paper-clips float on top of the water.

Core Themes Addressed

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<th>Microbial Cell Biology</th>
<th>Microbial Genetics</th>
<th>Microorganisms and Humans</th>
<th>Microorganisms and the Environment</th>
<th>Microbial Evolution and Diversity</th>
<th>Other –Properties of Water</th>
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Keywords

Surface tension, cohesion

Learning Objectives

At completion of this activity, learner will:

1. Identify the properties of water.

2. Explain the differences between the various properties of water

National Science Education Standards Addressed

Teaching Standard B: Structure and properties of matter (Structure and properties of water).
Teacher Handout
Properties of Water

Student Prior Knowledge

Students should have the following knowledge prior to completing this activity:

- Know the chemical composition of water (H₂O).
- Be able to use transfer pipettes effectively

Teacher Background Information

In this lab, students will circulate through three different lab stations. Each station will need to be reset before the students rotate to the next station. Students should be allowed ~7 minutes per station in order to complete both the activity and the worksheet questions that correspond to the activity at each station.

Class Time

This activity will require a minimum of one 50-minute class period

Teacher Preparation Time

This lesson will require approximately 10-15 minutes of preparation time.

1. Cut one square (5cmx5cm) of wax paper for each group of students that will visit station one.
2. Place all materials at their corresponding lab stations: Station one: wax paper, dish soap, cup of water, transfer pipette. Station two: penny, transfer pipette, cup of water, dish detergent. Station three: cup of water, 15 paper clips

Materials and Equipment

Station 1:
- wax paper squares (5cmx5cm)
- cup/petri dish of dish soap (1ml)
- cup of water (4oz in 8oz plastic cups)
- transfer pipette
- glass slide
- 2 toothpicks

Station 2:
-penny
-transfer pipette
-cup of water (15 ml)
-cup/petri dish of dish detergent

**Station 3:**
-cup of water (8oz plastic cup)
-15 medium paper clips

**Methods**

1. Before lab, set up the three lab stations, with extra materials ready to replace between rotations.
2. Break students into groups (typically groups of three or four, or a size group that accommodates class size)
3. Allow students to rotate through the three stations
4. Reset stations between rotations as needed (wax paper, etc).

**Tips/Suggestions**

If students have difficulty getting their paper clips to float in station three, remind them of the concept of water tension. If need be, show them how to place the paper clip on top of water by laying it on the surface of the water evenly.

**Extension/Additional Resources**


**Answers to Student Handouts**

**LECTURE:** *WATER* has several unique properties. Its pH is 7, meaning that it is **NEUTRAL**, and has a freezing point of **32°F**. Four important properties of water include the following: water is a **SOLVENT**, it is cohesive, it conducts **ELECTRICITY**, and it has **WATER** tension. In lab today, we will be looking a few of these properties first hand.

**LAB:**

**STATION I:**

1. What do the droplets look like on the wax paper?
   - ROUND, BUBBLED
2. What do the droplets look like on the glass surface?
   - THEY FLATTEN OUT
What do you think accounts for this difference?
WAX IS HYDROPHOBIC AND GLASS IS HYDROPHILIC.

2. What happens to the drop of water? Why do you think this result happened?

THE SOAP BREAKS THE SURFACE TENSION, THEREFORE THE WATER FLATTENS OUT

STATION II:

6. How do you explain the difference between the penny without detergent and the penny with detergent?

THE SURFACE TENSION IS BROKEN WHEN DETERGENT IS ADDED, THEREFORE THE PENNY WITHOUT THE DETERGENT WILL REMAIN IN A SPHERE AND THE PENNY WITH THE DETERGENT WILL FLATTEN OUT.

STATION III:

3. Is a paper clip more or less dense than water? How do you know?

LESS, BECAUSE IT DOES NOT BREAK SURFACE TENSION.

4. Why do you think the paper clip floats?

SURFACE TENSION

WRAP-UP:

1. What physical property of water did each station represent?

-The wax paper: COHESION

-The penny: COHESION/SURFACE TENSION

-The paperclip: SURFACE TENSION

2. Why does water cling to itself? What could you guess about wax paper and why water clings to it more than a glass surface?

WATER CLINGS TO ITSELF DUE TO HYDROGEN BONDING, MEANING IT IS COHESIVE.
3. What effect does detergent have on water? Why does this happen?

DETERGENT BREAKS THE SURFACE TENSION BECAUSE IT BREAKS WATER'S HYDROGEN BONDS.
Student Handout
Properties of Water

Introduction

LECTURE: _______________ has several unique properties. Its pH is 7, meaning that it is ________________, and has a freezing point of ___°F. Four important properties of water include the following: water is a ________________, it is cohesive, it conducts ________________, and it has ________________ tension. In lab today, we will be looking a few of these properties first hand.

Student Background Knowledge

• Have a basic understanding of the chemical composition of water
• Be able to use transfer pipettes correctly

Vocabulary

Surface Tension: the ability of a liquid’s surface to resist an external force

Cohesion: when molecules stick together because they are attracted to each other

Materials Checklist

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<tr>
<td>1 square of wax paper (5cmx5cm)</td>
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<tr>
<td>2 8oz cups</td>
</tr>
<tr>
<td>15 paper clips</td>
</tr>
<tr>
<td>2 transfer pipettes</td>
</tr>
<tr>
<td>2 toothpicks</td>
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<tr>
<td>1 glass slide</td>
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Procedure

1.) Go to each station. (Students are allotted ~7 minutes per station.)
Student Worksheet
Properties of Water

Name________________________
Date__________________
Period________________________

STATION I: Suck up some water with a transfer pipette. Place a couple of drops on the wax paper. Place a couple of drops of water on a glass slide.

1. What do the droplets look like on the wax paper?

- What do the droplets look like on the glass surface?

- What do you think accounts for this difference?

- Take a toothpick and dip the end in a small amount of detergent. Slowly touch the detergent end of the toothpick into the drop of water on the wax paper.

2. What happens to the drop of water? Why do you think this result happened?

STATION II: You will need a penny and transfer pipette. The goal is to put the most drops of water on top of the penny without the water running off the penny onto the table. Before you start, have each person guess how many drops of water each penny will hold. The person who can put the most drops on the penny wins.

1. What were the predictions about how many drops of water the penny could hold?

2. How many drops of water was the winning person able to fit on the penny?

3. What did the penny look like right before it leaked onto the table?
*Repeat the same game, but now cover the surface of the penny with a thin layer of detergent (apply detergent using a toothpick) before starting the game. Before you start predict what will happen.

Prediction:

5. How many drops of water was the winning person able to fit on the penny?

6. How do you explain the difference between the penny without detergent and the penny with detergent?

**STATION III:** Fill your cup with water until it IS ¾ full. Drop paper clips into the cup. The goal of this game is to be the first person to get a paper clip to float on water. The paper clip should not be bent, or poked through the cup or any other clever manipulations. Resist the temptation to use other objects as well.

1. How did the winning person get their paper clip to float?

2. When the paper clip floats, look at the surface of the water and describe what it looks like?

3. Is a paper clip more or less dense than water? How do you know?

4. Why do you think the paper clip floats?

**WRAP-UP:**

1. What physical property of water did each station represent?

   - The wax paper:
   
   - The penny:
   
   - The paperclip:

2. Why does water cling to itself? What could you guess about wax paper and why water clings to it more than a glass surface?

3. What effect does detergent have on water? Why does this happen?