

LAB 2: PROPERTIES OF WATER

BENCHMARKS:

SC.912.L.18.12 Discuss the special properties of water that contribute to Earth's suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent.

BACKGROUND INFORMATION:

Water is the most important chemical compound to living things. The characteristics that make water such a chemical compound to living things are:

1. **Its polarity:** Water has both a positive and negative charge on its molecule structure. This allows it to dissolve almost anything. However, what is not a universal solvent as it is unable to dissolve non-polar molecules such as fat. Instead it is referred to as a versatile solvent.
2. **It has a high heat capacity:** Thus water heats up slowly and cools down slowly. This is a good thing for all living things because if it only took a short time for water to heat up, animals and plants would boil in the heat of the sun.
3. **It is less dense as a solid than as a liquid:** This is why ice floats. This is essential to organisms that live where it is always cold. The ice floating on the top of bodies of water provides insulation for the life below and prevents these organisms from freezing in winter.
4. **It has a high surface tension:** Because of the hydrogen bonds between water molecules to each other, this creates a "net" of water molecules that allows some organisms to walk on water, such as water striders.
5. **Water is both cohesive and adhesive:** because of the hydrogen bonds between water molecules, water sticks to itself and is thus cohesive. Because water can form hydrogen bonds with other substances and cling to them it is also adhesive.

PURPOSE: To investigate how the molecular structure of water affects its properties and why those properties make it such an important chemical compound for life.

MATERIALS: safety goggles, test tubes and test tube rack, protractors, hot plates, measuring spoons, pipettes, pennies, beakers, thermometers, petri dishes, forceps, paperclips, unknown liquids

CONSUMABLE MATERIALS: salt, ethanol or isopropyl alcohol, oil, water, liquid soap, wax paper

PROCEDURE:

Your teacher will direct you to one of the stations. You will work at the station with two or three other people at a time. Carefully read the directions posted at each station and complete the activities. Record your observations on your worksheet. Clean up your area and wait for the signal to rotate to the next station.

LAB 3: PROPERTIES OF WATER

NAME: _____

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STATION 1: COHESION

Diagram of Water and Alcohol

Observations: _____

Inference: _____

STATION 2: ADHESION

1. Estimated number of water drops that can be piled on a penny. _____

| | Trial 1 | Trial 2 | Trial 3 | Total |
|---------------------|---------|---------|---------|-------|
| # of drops on penny | | | | |

2. Which properties of water allows the water droplets to pile up on the penny. _____

3. Define the following terms
Cohesion:

Adhesion:

STATION 3: SURFACE TENSION

What properties of water allow a paper clip to rest on its surface? _____

What happened when you added the liquid soap? Why do you think this happened?

STATION 4: VERSATILE SOLVENT

1. Which solvent dissolved the best?

2. What gives water the ability to dissolve things? _____

3. Is water a universal solvent? _____ Why or Why not? _____

4. From this experiment, would you conclude that salt is polar or non-polar? _____

Explain

| Substance | Water | Oil | Alcohol |
|-----------|-------|-----|---------|
| Salt | | | |

| Key |
|-----------------------|
| XX dissolved 100% |
| X partially dissolves |
| 0 did not dissolve |

STATION 5: ACIDS/BASES (PH)

Identify these symbols:

OH- _____ H+ _____

What makes a solution acidic? _____

What makes a solution basic?

Conclusion:

| Substance | Your prediction (Acid, Base, Neutral) | pH | Actual results (Acid, Base, Neutral) | Did your prediction match results? (yes, no) |
|--------------|---------------------------------------|----|--------------------------------------|--|
| Water | | | | |
| Orange Juice | | | | |
| Liquid Soap | | | | |

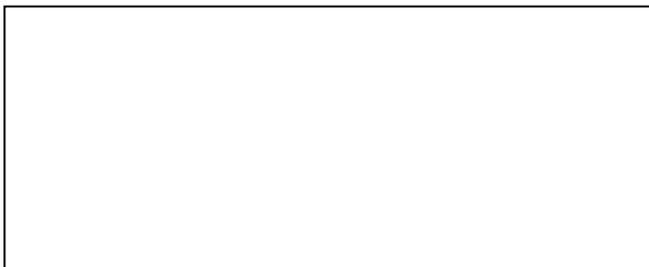
STATION 6: WATER MOLECULE

WATER CHEMICAL FORMULA: _____

Water Model



Water Molecules w/ Hydrogen Bonding



Explanation: _____

STATION 7: WHICH IS WATER?

| Test | Unknown #1 | Unknown #2 | Unknown #3 | Unknown #4 | Unknown #5 | Unknown #6 | Conclusions (water or not?) |
|----------|------------|------------|------------|------------|------------|------------|-----------------------------|
| Cohesion | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Are any of your unknown liquids water? Explain how you know, citing evidence from your testing.

