

The Properties of Water
(Instruction Sheet)

Property : High Polarity

Activity #1 Surface Tension: PILE IT ON.

Materials: 1 DRY penny, 1 eye dropper, water.

Procedure:

1. Make sure the penny is dry.
2. Begin by estimating the number of drops of water that can be piled on the penny before it spills over.
3. Gently place drops of water on the penny until the water spills over.
4. Record the results.

Activity #2 Surface Tension: THE FLOATING PAPER CLIP

Materials: paper clip, container with water, ice.

Procedure:

1. Using a steady hand, see if you can get the paper clip to rest on the surface of the water in such a way that it will not sink.
2. After you succeed, place a piece of ice in the water and answer the questions on your answer sheet.

Activity #3: WATER AS A SOLVENT

Because of its high polarity, water is called the universal solvent. A solvent is a substance that dissolves, or breaks apart, another substance (known as a solute). A general rule that determines whether a substance will dissolve in a solvent depends upon its polarity. Polar solvents dissolve polar solutes and nonpolar solvents dissolve nonpolar solutes.

In this activity, you will compare the ability of water, alcohol, and vegetable oil to dissolve certain solids. **CAUTION: Rubbing alcohol is flammable, an eye irritant, and has fumes.**

Materials: graduated cylinder, 40 mL of alcohol, 3 beakers, 9 test tubes, test-tube rack, 40 mL of water, 40 mL of vegetable oil, sugar, salt, and margarine.

Procedure:

1. Number your test tubes (TT) 1-9.
2. Pour 10 mL of water into TT marked 1-3.
3. Pour 10 mL of alcohol into TT marked 4-6.
4. Pour 10 mL of vegetable oil into TT marked 7-9.
5. Place a cap full of sugar in TT 1, 4, & 7.
6. Place a cap full of salt in 2, 5, & 8.

7. Place a small piece of margarine in TT 3, 6, & 9.
8. Cover each TT with your thumb and shake. How well does each solvent dissolve the solute?
9. Observe and record the results.
10. Wash the TT with soap & water and reorganize the station so that it is ready for the next class.

Activity #4 Polarity: The Magnets

What is polarity? Move the magnets around each other. Notice the orientation they are in when they are attracted to each other. Notice what happens when you put two magnets with the same ends together. How is this an example of the water molecule?

Property: High Specific Heat and Heat of Vaporization

Activity #5: Comparing Water to Alcohol

Materials: 2 beakers, 2 thermometers, alcohol, water, stop watch, hot plate, goggles.

Procedure: READ ALL INSTRUCTIONS BEFORE STARTING!

1. In one beaker measure out 30 mL of alcohol and in the other measure out 30 mL of water.
2. Record the temperature of both the alcohol and the water.
3. Place both beakers on a hot plate at the same time and heat them for 1 minute.
4. Remove both beakers from the hot plate at the same time and record their temperatures.
5. Allow the beakers to cool for around 2 minutes and record their temperatures again.
6. Dump out the old water and alcohol and measure out 20 mL of alcohol and 20 mL of water.
7. Place both beakers on the hot plate simultaneously and time how long it takes each liquid to boil.
8. Measure the temperature of the boiling liquids and record them on your record table.

Activity #6 Chemistry of Living Things:

Look at the elements and compounds that make up living things. Approximately 96 % of your body mass is composed of the elements oxygen (65%), hydrogen (10%), carbon (18%), and nitrogen (3%). The other 4% is composed of calcium (1.5%), phosphorus (1.0%), potassium (0.35%), sulfur (0.25%), sodium (0.15%), magnesium (0.05%), copper/zinc/selenium/molybdenum/fluorine/chlorine/iodine/manganese/cobalt/iron (0.70%), and lithium/strontium/aluminum/silicon/lead/vanadium/arsenic/bromine are found in trace amounts. Consider your body mass. How many pounds of each element/compound would you expect to find in your body?

The Properties of Water
(student handout)

Biology
Name _____.

Period 1 2 3 4 5

Activity #1: Pile it On ESTIMATE: _____ ACTUAL AMOUNT: _____.

1. What property of water allows the water droplets to pile up on the penny?
2. Define the following:
cohesion -
adhesion-
surface tension-

Activity #2 The Floating Paper Clip

3. What does it mean to float?

Is the paper clip actually floating? Explain.

4. What property of water allows a paper clip to rest on its surface?

Activity #3 The Super Solvent

Substance	Water	Alcohol	Vegetable Oil	Key
Sugar				+++ dissolves ~100%
Salt				++ or + partial dissolve
Margarine				0 did not dissolve

5. Which solvent dissolved the best?
6. What gives water the ability to dissolve things?
7. What general rule determines whether a solute will dissolve in a solvent?
8. From this experiment would you conclude that sugar is polar or nonpolar? Explain.

Activity #4 Magnetism

Record observations with magnets:

How does the magnet's behavior compare to a polar water molecule:

Activity #5 Specific Heat and Heat of Vaporization

Data Table: Difference Between Alcohol and Water

	Before Hot Plate	After 1 minute	After cooling 2 min.	Time to Boil	Boiling point
Temp. of WATER					
Temp. ALCOHOL					

9. Which liquid changed temperatures the fastest?

10. Which liquid took longest to boil?

Activity #6 Compounds in Living Things:

Your Total body weight:_____.

C=_____ H₂O=_____ Ca= _____ S=_____ NaCl= _____ Mg=_____ P=_____ N=_____.

11. What are the four most common elements in your body?

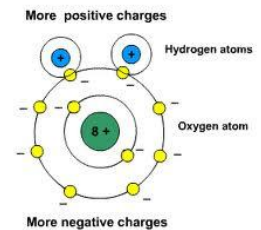
1. Why is Earth unique in our solar system _____.
2. Of the 9 planets in our solar system, it is only on Earth that water exists in its three _____ matter.
3. Water is so important to living things that at least _____ or more of the average weight of a plant or animal is made up of water. Human beings are nearly _____% water.

Water! General Physical and Chemical Properties

4. Most water is _____-less, _____-less, _____-less, and fairly commonplace.
5. As a chemical, water is extremely unusual.
 - A. water possesses great _____.
 - B. water is a powerful _____.
 - C. water provides an excellent _____ for chemical reactions.
 - D. water can absorb and release more _____ than almost any other substance.

The Effects of Molecular Structure: H₂O

6. Bonds between _____ and _____ are very strong resulting in a very stable substance.
7. Its lopsided shape makes it act like a chemical _____ with a _____ end and a _____ end.
8. Ice is _____ dense than water. Floating ice acts as _____.



Heat Capacity: Climatic Effects

9. Water has the ability to hold and release large amounts of _____.
10. As a consequence, tropical oceans _____ heat, which then moderates the effect of sudden and drastic temperature changes in the Earth's climate.

Latent Heat: Changes of State and Heat Effects

11. Water gives up a large amount of heat simply by changing from a _____ to a _____, as happens during freezing. The heat given off during freezing may prevent blossoms from freezing.
12. When ice thaws, it absorbs _____, causing heat to be extracted from its surroundings.
13. Similar examples of heat absorption are observed as water changes from a _____ to a _____, or from a _____ to a _____.
14. Latent heat in the atmosphere is what creates _____ patterns.
15. _____ bonds are weak links between other water molecules. The skin on the surface of water, called _____ tension, is a result of this.