

## Lesson Plan Title: Water!

Teacher's Name: Jillian Forauer    Subject/Course: Biology Honors  
Unit: Biochemistry                      Grade Level: 9

### Overview of and Motivation for Lesson:

Students will gain a background in chemistry to further understand the significance of chemistry in biology. Without chemistry, we cannot fully understand how atoms and molecules interact with each other.

Today is the study of water and the properties of water. Water is the solvent of life and water is EVERYWHERE in biological reactions. Students will be able to understand that water has important molecular interactions and polarity which determines the properties of water.

Stage 1-Desired Results	
<b>Standard(s):</b> <ul style="list-style-type: none"><li>• HS-LS1-6. Construct an explanation based on evidence that organic molecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form monomers that can further combine to form large carbon-based macromolecules. Clarification Statements: • Monomers include amino acids, mono- and disaccharides, nucleotides, and fatty acids. • Organic macromolecules include proteins, carbohydrates (polysaccharides), nucleic acids, and lipids.</li></ul>	
<b>Aim/Essential Question:</b> <ul style="list-style-type: none"><li>• Why is water so important to life?</li><li>• What is the structure of water?</li><li>• What are the important properties of water?</li></ul>	
<b>Understanding(s):</b> <p><i>Students will understand that . . .</i></p> <ul style="list-style-type: none"><li>• Water is polar due to the electronegative differences between the atoms of hydrogen and oxygen in water.</li><li>• Water has hydrogen bonding between water molecules which contribute to many of water's properties.</li></ul>	
<b>Content Objectives:</b> <p><i>Students will be able to . . .</i></p> <ul style="list-style-type: none"><li>• Draw interactions of multiple molecules of water.</li><li>• Describe the different intermolecular bonds/attractions.</li><li>• Describe why water's properties are important to life.</li></ul>	<b>Language Objectives:</b> <p>ELD Level 1 <i>Students will be able to . . . in English</i></p> <ul style="list-style-type: none"><li>• Describe the atoms of water and how the water molecule is arranged.</li></ul> <p>ELD Level 2 <i>Students will be able to . . . in English</i></p> <ul style="list-style-type: none"><li>• Explain why water has charges due to the atoms of which water is comprised.</li></ul> <p>ELD Level 4 <i>Students will be able to . . . in English</i></p> <ul style="list-style-type: none"><li>• Explain why water has charges due to the atoms of which water is comprised.</li></ul>
<b>Key Vocabulary</b>	

- Hydrogen bond
- Hydrophilic
- Hydrophobic
- “slightly negative” and “slightly positive”
- Cohesion
- Adhesion
- Solvent
- Specific heat
- High heat of vaporization

### Stage 2-Assessment Evidence

#### Performance Task or Key Evidence

- 1. Students will be able to describe the important properties of water.
- 2. Students will be able to draw molecules of water interacting with each other

#### Key Criteria to measure Performance Task or Key Evidence

- 1. Cohesion and adhesion: water sticks to itself and other things
- 1. Water is a good solvent: lots of molecules dissolve in water
  - Hydrogen bonds help to dissolve both polar and nonpolar molecules
- 1. Water freezes and becomes less dense.
- 1. The high specific heat means that water boils at a higher temperature.
- 1. Heat of vaporization means that water as a vapor loses a lot of energy and makes organisms cooler.
- 2. The drawings will have slight negative charges on oxygen of water and slight positive charges on the hydrogen of water.

### Stage 3- Learning Plan

#### Learning Activities:

Do Now/Bell Ringer/Opener: Review bonds from the previous lesson:

Review types of bonds in a video from youtube.

Review the homework by going through each question.

Review the type of bond formed when given two electronegativities. Quickly introduce what might happen with 3 atoms (the structure determines the polarity).

#### Learning Activity 1:

Fill out a “Water Cheat Sheet” with notes about the different important properties of water. Notes from the powerpoint about attractions BETWEEN molecules. Hydrogen bonds will be introduced with the context of water to start students on the topic of water.

1. Polar vs nonpolar review
  - a. How can you easily tell when a molecule is polar? – draw a line down the middle and if it’s the different on either side it’s polar.
2. Water is polar
  - a. Draw water and label the slightly positive and slightly negative sides to introduce slightly positive/negative.

3. Water is the universal solvent
4. Water has a high specific heat
  - a. Resists changes in temperature
5. Water has a high heat of vaporization
  - a. Sweat cools the body

**Learning Activity 2:**

**Draw water molecules:**

Draw 10 water molecules interacting with each other and label them all with charges and hydrogen bonds.

**Application**

What would happen if we didn't have water in our bodies but instead we had a nonpolar/different solvent?

**Summary/Closing**

Show students a complete "cheat sheet," have them ask questions if they missed anything, and ask if they need more help on any of the ideas on the sheet.

**Multiple Intelligences Addressed:**

- |                                     |                                               |                                        |                                             |
|-------------------------------------|-----------------------------------------------|----------------------------------------|---------------------------------------------|
| <input type="checkbox"/> Linguistic | <input type="checkbox"/> Logical-Mathematical | <input type="checkbox"/> Musical       | <input type="checkbox"/> Bodily-kinesthetic |
| <input type="checkbox"/> Spatial    | <input type="checkbox"/> Interpersonal        | <input type="checkbox"/> Intrapersonal | <input type="checkbox"/> Naturalistic       |

**Student Grouping**

- |                                      |                                      |                                |                                     |
|--------------------------------------|--------------------------------------|--------------------------------|-------------------------------------|
| <input type="checkbox"/> Whole Class | <input type="checkbox"/> Small Group | <input type="checkbox"/> Pairs | <input type="checkbox"/> Individual |
|--------------------------------------|--------------------------------------|--------------------------------|-------------------------------------|

**Instructional Delivery Methods**

- |                                                         |                                  |                                          |
|---------------------------------------------------------|----------------------------------|------------------------------------------|
| <input type="checkbox"/> Teacher Modeling/Demonstration | <input type="checkbox"/> Lecture | <input type="checkbox"/> Discussion      |
| <input type="checkbox"/> Cooperative Learning           | <input type="checkbox"/> Centers | <input type="checkbox"/> Problem Solving |
| <input type="checkbox"/> Independent Projects           |                                  |                                          |

**Accommodations**

Print out powerpoint for students with concussions or other needs.  
Students can use scrap pieces of paper if they need additional space.

**Modifications**

Altered worksheet with fewer spaces to fill out about the properties of water.

**Homework/Extension Activities:**

[Click here to enter text.](#)

**Materials and Equipment Needed:**

- Print outs of the "Water Cheat Sheet" worksheet
- Powerpoint

**Adapted from Grant Wiggins and Jay McTighe-Understanding by Design**

**Strengths:**

The students liked the "Water Cheat Sheet" idea in which their notes would be organized on one page. I was able to control exactly what they should be writing and when it was time to take notes

**Opportunities for growth:**

I would have loved to create a station activity in which the students go around the room and observe different properties of water at each station. For example, a station where students attempt to get a paper clip to sit on top of water in a bowl, a station where students drop as many drops of water on a penny and use a different solvent to compare, a station where they time how long it takes to boil water, etc.

With the period 1+2 A week class, I didn't mention hydrogen bonding as much when referring to the 5 properties of water on their "cheat sheet." I think it would be helpful to emphasize this in another class. Drawings of hydrogen bonds and explaining the energy it takes to break bonds will help.