



# Conceptual Chemistry - Unit 2 - Water and Solutions

## Unit Focus

This unit focuses on the unique structure of water and its ability to dissolve a variety of substances. Students will understand how substances dissolve in water and will be able to describe solutions in terms of concentration and particle interactions. Students will test various solutions to determine if they are electrolyte solutions and will be able to explain how electrolyte solutions conduct electricity. Students will use their understanding of density to determine the density of various beverage drinks by performing a laboratory experiment and interpreting qualitative data. Students will also get an introduction to acids, bases, and pH and will be able to distinguish between acidic, basic and neutral solutions. Students will engage in a variety of laboratory experiments that emphasize inquiry skills such as planning and conducting experiments, collecting, analyzing, and communicating data (creating and interpreting graphs). Students will have laboratory experiences that will support their understanding in Chemistry 2 if they choose to enroll in that class the following year.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>Next Generation Science</b> <i>High School Earth and Space Sciences: 9 - 12</i></p> <ul style="list-style-type: none"> <li>Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. <i>HS-ESS2-5</i></li> </ul> <p><i>High School Physical Sciences: 9 - 12</i></p> <ul style="list-style-type: none"> <li>Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. <i>HS-PS1-3</i></li> </ul> <p><b>Next Generation Science Standards (DCI)</b> <i>Science: 9</i></p> <ul style="list-style-type: none"> <li>Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. <i>PS2.9.B1</i></li> </ul>	<p><b>T1</b> Use the scientific process to generate evidence that addresses the original questions.  <b>T2</b> Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.  <b>T3</b> Evaluate scientific claims and analyze issues to verify the credibility of the source, data, and/or approach.</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
	<p><b>U1</b> Nearly all chemical reactions take place in solution.  <b>U2</b> Solutions are made of a combination of substances that are not chemically bonded.  <b>U3</b> Water is considered the "universal solvent."</p>	<p><b>Q1</b> What is solubility?  <b>Q2</b> How can the properties of solutions be explained in terms of concentration and particle interactions?</p>
Acquisition of Knowledge and Skill		
Knowledge	Skill(s)	
<p><b>K1</b> Polar molecules, such as water, are molecules that have a negatively charged end and a positively charged end due to the electronegativity differences between the atoms and/or the asymmetry of its structure.  <b>K2</b> Electrolyte solutions are solutions that contain ions and can conduct electricity.  <b>K3</b> Density is a measure of the mass of a substance per unit of volume, often expressed as grams per milliliter.</p>	<p><b>S1</b> Explain the relationship between the structure of water and its unique properties.  <b>S2</b> Use words, pictures and chemical equations to describe the process of dissolving substances in water.  <b>S3</b> Distinguish between acids and bases and compare pH values in acidic, basic and neutral solutions.  <b>S4</b> Solve problems using the density formula.</p>	

## Stage 1: Desired Results - Key Understandings

### Madison Public Schools Profile of a Graduate

#### *Critical Thinking*

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

**K4** Hard water is water that contains cations with a charge of +2, especially  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$

**K5** The pH scale is a logarithmic scale describing the concentration of hydrogen ions in solution.

**K6** The polar nature of water accounts for its ability to dissolve many ionic and molecular substances.

**K7** Solutions are homogeneous mixtures in which the physical properties are dependent on concentration and type of solute.