



# Chemistry for Health Science - Unit 1 - Aqueous Solutions

## Unit Focus

Unit 1 will focus on the characteristics of aqueous solutions. Students will explore the polarity of water and its relevance to body chemistry, electrolytes, diffusion and osmosis, osmotic pressure (isotonic, hypertonic, and hypotonic solutions for intravenous application), pH and buffers. Emphasis will be on the importance of ions in the body and units of concentration used in intravenous solutions (percent, parts per million, and molarity). As a culminating experience, students will research the application of solutions, diffusion, and osmosis in the human body and/or medical field and present their findings to the class.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>Next Generation Science Standards (DCI)</b> Science: 11</p> <ul style="list-style-type: none"> <li>Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (LS1.9.A4)</li> <li>The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (PS1.9.A2)</li> <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. (PS2.9.B1)</li> </ul> <p><b>Madison Public Schools Profile of a Graduate</b></p> <ul style="list-style-type: none"> <li>Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)</li> <li>Product Creation: Effectively use a medium to communicate important information. (POG.3.2)</li> </ul>	<p><i>Students will be able to independently use their learning to...</i></p> <p><b>T1</b> Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.</p> <p><b>T2</b> Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.</p>	
	<b>Meaning</b>	
	<b>Understanding(s)</b>	<b>Essential Question(s)</b>
	<p><i>Students will understand that...</i></p> <p><b>U1</b> The structure and interactions of matter are determined by electrical forces within and between atoms.</p> <p><b>U2</b> The human body has feedback mechanisms that work to maintain homeostasis (a constant internal environment).</p> <p><b>U3</b> Specific osmotic solutions are used to treat patients in various circumstances.</p> <p><b>U4</b> Buffer systems are solutions that contain a weak acid and its conjugate weak base. Buffers maintain relatively constant pH in a solution which is crucial for maintaining homeostasis in living systems.</p>	<p><i>Students will keep considering...</i></p> <p><b>Q1</b> Why is the concentration of solutions used for intravenous solutions important?</p> <p><b>Q2</b> What role do electrolytes play in maintaining human health?</p> <p><b>Q3</b> How does a buffer system maintain a steady pH in a solution?</p>
	<b>Acquisition of Knowledge and Skill</b>	
	<b>Knowledge</b>	<b>Skill(s)</b>
<p><i>Students will know...</i></p> <p><b>K1</b> Water is a polar molecule. Polar and many ionic substances(salts) dissolve in water.</p>	<p><i>Students will be skilled at...</i></p> <p><b>S1</b> predict whether a give substance is more soluble in a polar solvent like water, or in a non-polar solvent like oil.</p>	

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**K2** Ions such as  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ ,  $\text{Mg}^{2+}$ , and  $\text{HCO}_3^-$  play a key role in the body.

**K3** Acids are substances that donate hydrogen ions in an aqueous solution. Hydrochloric acid is necessary for the proper digestion of proteins in the stomach.

**K4** Bases are substances that accept hydrogen ions. Calcium hydroxide and magnesium hydroxide are bases that are used as antacid.

**K5** Buffer solutions are found in all body fluids and are responsible for maintaining the proper pH of those fluids.

**K6** Vocabulary; diffusion, osmosis, hypertonic, hypotonic, isotonic, electrolyte, acid, base, buffer

**K7** The pH of a solution describes its relative acidity or basicity.

**S2** predict whether a solute is a strong electrolyte, weak electrolyte, or nonelectrolyte

**S3** performing calculations involving the concentration of a solution, using percent (percent mass, percent volume, and percent mass by volume), molarity, and milliequivalents per liter.

**S4** preparing solutions of desired concentrations (including dilutions).

**S5** describing the process of osmosis, and the relevance of isotonic, hypertonic, and hypotonic solutions.

**S6** explaining the role of water and feedback mechanisms as related to a selected health condition.

**S7** calculate the pH of a solution given the concentration of hydronium (or hydroxide) ion

**S8** Write equations to show how a buffer solution neutralizes strong acids and bases.