Water Properties Activity: Properties of Water in Biology

AP Biology/College Level Teacher Guide

Overview

This guide supports implementation of the Water Properties Activity: Properties of Water in Biology using the 5E instructional model.

Learning Objectives

- Students will model how water's polarity and hydrogen bonding create its unique properties
- Students will analyze how water's properties affect biological processes
- Students will explain how water's properties maintain homeostasis
- Students will evaluate the role of water in supporting life on Earth

Standards Alignment

Topic 1.1: Structure of Water and Hydrogen Bonding

- **LEARNING OBJECTIVE 1.1.A:** Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function.
- **ESSENTIAL KNOWLEDGE 1.1.A.1:** Living systems depend on the properties of water to sustain life.
- i. Water has polarity, because of the formation of polar covalent bonds between hydrogen and oxygen within water molecules. This polarity contributes to hydrogen bonding between and within biological molecules.
- ii. Water has a high specific heat capacity, which allows for the maintenance of homeostatic body temperature within living organisms.

- iii. Water has a high heat of vaporization, which allows for the evaporative cooling of the surrounding environment. In living organisms, this property allows for body temperature to be maintained.
- **ESSENTIAL KNOWLEDGE 1.1.A.2:** The hydrogen bonds between adjacent polar water molecules result in cohesion, adhesion, and surface tension.

Prerequisites

- Atomic structure and bonding
- Polarity and electronegativity
- Temperature and heat concepts
- Basic chemistry principles

Time Estimate

50 minutes

Materials Needed

- Computer with internet access
- Student Activity Sheet
- Molecular model kit (optional)

Teaching Tips by Phase

Phase 1: ENGAGE (5-10 minutes)

- Start with the phenomenon or problem presented
- Elicit student predictions and prior knowledge
- Create cognitive dissonance if possible
- Build excitement for investigation

Phase 2: EXPLORE (15-20 minutes)

- Allow students to investigate with minimal guidance
- Circulate and ask probing questions
- Encourage systematic data collection
- Note common discoveries and difficulties

Phase 3: EXPLAIN (10-15 minutes)

- Have students share their findings first
- Build on their observations to introduce concepts
- Address misconceptions directly
- Connect to broader biological principles

Phase 4: ELABORATE (10 minutes)

- Apply knowledge to new scenarios
- Make real-world connections
- Encourage deeper investigation
- Support transfer of learning

Phase 5: EVALUATE (5-10 minutes)

- Use varied assessment strategies
- Focus on conceptual understanding
- Provide immediate feedback
- Plan follow-up based on results

> **Remember:**
>
> The goal is student discovery through guided inquiry. Resist the urge to explain concepts before students have explored them!
