PEEBEDU

Water Properties Explorer

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Water Properties Explorer**. Click the **Start Exploring** button to begin. Read the introduction popup, which describes four key properties of water: Polarity, Cohesion, Heat Capacity, and Density.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Water Properties Explorer as a scientific model.

M — Mode

What type of model is the Water Properties Explorer? Describe how this computational simulation represents water's properties. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about water.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about water's properties. For each, name the specific simulation feature and explain what property of water it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about water's properties. Consider what you cannot observe in the simulation that would be important for a complete molecular-level understanding of water.

P — Purpose

What is the learning goal of this simulation? Explain how the Water Properties Explorer is designed to help you understand how water's polarity and hydrogen bonding produce emergent properties that sustain life. In your answer, connect at least one specific simulation feature to a biological example of why that property matters for living organisms.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Water Properties Explorer. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for water's properties?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect macroscopic observations to molecular-level explanations?

Part 2 — NGSS Questions

1.

> *Simulation Task: Look at the water molecule diagram below the lake scene. Note the shape of the molecule, the labels on each atom, and the partial charge symbols (δ+ and δ–).*

Explain how the bent shape of a water molecule and the unequal sharing of electrons between oxygen and hydrogen atoms allow water molecules to form hydrogen bonds with each other.

HS-LS1-3

2.

> *Simulation Task: Set the temperature slider to 0°C and read both the Air Temp and Water Temp displays. Then slowly slide to 40°C and watch how each temperature changes.*

Describe what happens to the water temperature compared to the air temperature as you increase the slider. Explain why water resists rapid temperature changes and how this property helps living organisms maintain stable internal conditions.

HS-LS1-3

3.

> *Simulation Task: Move the slider to 35°C or higher and observe the particles rising from the lake surface. Read the Evaporation display and the Heat of Vaporization property card.*

Explain how evaporation removes heat energy from a surface. Describe how this process acts as a cooling mechanism that helps organisms regulate their body temperature.

HS-LS1-3

4.

> *Simulation Task: Set the slider to 20°C and observe the water strider walking across the lake surface. Look closely at the small dimples where its legs touch the water.*

Explain how hydrogen bonds between water molecules at the surface create a force called surface tension. Describe how this property supports the water strider and why it disappears when the lake freezes.

HS-LS1-3

5.

> *Simulation Task: Slide the temperature to −15°C and observe the lake. Note where the ice layer forms and what is happening to the fish beneath it. Then slide back to 20°C.*

Explain why ice forms at the top of the lake instead of sinking to the bottom. Describe how this property of water protects aquatic organisms during winter.

HS-LS1-3

6.

> *Simulation Task: Compare the lake at 20°C (liquid water, strider visible) and at −15°C (ice layer on top). Think about how water molecules are arranged differently in each state.*

In the box below, draw two side-by-side diagrams showing the arrangement of water molecules in liquid water and in ice. Label the hydrogen bonds in each diagram and indicate which arrangement is less dense.

Draw your diagrams here.

HS-LS1-3

7.

> *Simulation Task: Slowly sweep the slider from –20°C to 40°C. Observe all the changes: ice forming and melting, water temperature lagging behind air temperature, the water strider appearing, and evaporation increasing.*

Choose one property of water you observed in the simulation (high specific heat, surface tension, ice density, or evaporative cooling). Explain how this property helps maintain stable conditions in a natural ecosystem and predict what might happen to organisms in that ecosystem if water did not have this property.

HS-LS2-6