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Unit 2 Topic 2 (Water) Lab

Exploring the Properties of Water

Directions: You will have 12 minutes to spend at each lab station to complete each activity. When 12 minutes is up, the teacher will direct you to rotate stations. You must move in numerical order (if you start at station 3, when time is called, you will rotate to station 4). Follow the directions at each station. Conduct the lab activity and record your data on this lab sheet. Answer all questions in each section as well. You are encouraged to talk with your lab partner(s) about the activities, but all responses must be your own.

LAB STATION 1: POLARITY & DENSITY (light blue instructions)

Mass of empty water graduated cylinder:	Mass of empty oil graduated cylinder:
*Mass of water:	Volume of water: 50 mL
*Mass of vegetable oil:	Volume of vegetable oil: 50 mL
Density of water:	**Density of oil:**

Equation for density: D = m/V

***Remember to subtract mass of graduated cylinder from mass of cylinder + contents!!**

Observations:

- What happened after the water was added to the oil in the beaker?

  _____

  _____

  - Which liquid floats? _____
  - Why does this liquid float? _____

    _____
  - Water is polar (there is an uneven distribution of electrons throughout each molecule of water). Based on how oil and water either mix or separate, do you think that oil is polar or nonpolar? _____
- After the food coloring was added, what happened to it? Did it sink to the water, mix with the oil…?

  _____

  _____

  - Do you think the food coloring is more or less dense than the oil? _____
  - Based on the movement of the food coloring, do you think that it is polar or nonpolar?

    _____
- What happens when you stir the contents of the beaker?

  _____

  _____

LAB STATION 2: SURFACE TENSION (light green instructions)

Observations:

- What happened to the paper ball when placed in distilled water?

  _____

  _____
- What happened to the paper ball when placed in soapy water?

  _____

  _____

  Hydrogen bonding is responsible for helping water build a strong surface tension. What do you think the soap does to hydrogen bonds?

  _____
- Were you able to get the paperclip to stay afloat in either cup? _____
  - If so, which one(s)? _____

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Draw what the water drops look like from the side view (you may use a magnifying lens/ruler if you need to):

Water Drops	Soapy Water Drops

- Define surface tension: _____
  _____
  _____

Part II:

Number of Drops Held on the Penny	
Acetone	**Water**

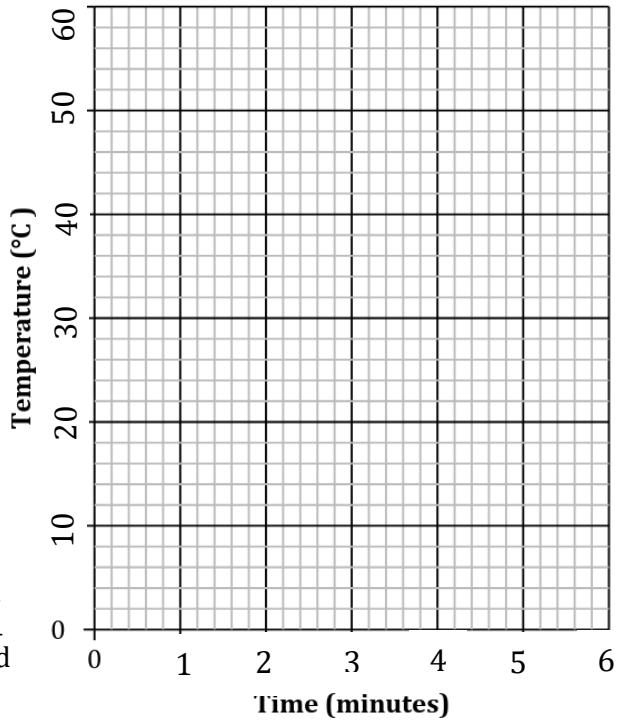
LAB STATION 3: HEAT CAPACITY (orange instructions)

Define specific heat:

_____
_____

Fill in the following table & graph as you complete this lab activity:

Temperature→ Time ↓	Water	Oil
0 minutes (initial)		
1 minute		
2 minutes		
3 minutes		
4 minutes		
5 minutes		
6 minutes		



Questions:

1. Which substance, water or oil, has the higher specific heat? _____
   _____
2. What is the relationship between hydrogen bonding and specific heat?
   _____
   _____
   _____
3. Explain why it is important that water has a high specific heat:
   _____
   _____

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LAB STATION 4: CAPILLARY ACTION (ADHESION/COHESION) (light yellow instructions)

Define adhesion (use water in definition):

_____

_____

Define cohesion (use water in definition):

_____

_____

Define capillary action (use water in definition):

_____

_____

Fill in the following table:

Time	Height of Water in Tube	Height of Oil in Tube
0 minutes (initial)		
1 minute		
2 minutes		
3 minutes		
4 minutes		
5 minutes		
6 minutes		

- Based on your evidence, what can you say about water's speed of climbing the capillary tube?

  _____

  _____
- What does this mean about how fast water is able to climb tubes within plants?

  _____

  _____
- After pouring the water into a glass cylinder, explain why the water line is not a straight line across the glass container: _____

  _____

  _____

Acetone

Water

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LAB STATION 5: UNIVERSAL SOLVENT (purple instructions)

Define solvent:

_____

_____

Define solute:

_____

_____

Record your observations about how quickly and thoroughly each of the solutes dissolves in water and oil in the table:

SOLVENT	**SOLUTE**	
	Salt	Sugar
Water		
Oil		

Why do you think some substances dissolve easier in one type of liquid than another?

_____

_____

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LAB STATION 6: BUILDING A MOLECULE OF WATER (deep blue instructions)

Follow the instruction on the lab station handout and glue or tape two water molecules here in the space provided:

1. Use your water molecule above and indicate which side of the molecule is negatively charged and which is positively charged.
2. Define polarity: _____
   _____
   _____
3. What type of bond holds the oxygen and hydrogen together in a single molecule of water?
   _____
4. What kind of bond holds two molecules of water together? _____

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PAPER BASED "STATIONS" TO COMPLETE WHEN YOU HAVE SPARE TIME AT A STATION!

P.B. Station 1: Graphing Water at Different Temperatures

For such a small molecule, water has a very high specific heat. This means it takes a lot of energy to raise the temperature of water. Another important property is the range of temperature for which water remains a liquid. When water evaporates, like from sweat, it also removes a lot of heat from our body. Using the data below, create a graph to demonstrate the heating curve of water. The water starts out as ice and is heated until it is all water vapor. When you are finished with the graph, label the areas on the graph as: ice, water, steam, melting, or evaporating. Don't forget to give it a title and completely label the axes. Then answer the questions below.

minutes	degrees Celcius	minutes	degrees Celcius	minutes	degrees Celcius	minutes	degrees Celcius
0	-15	9	15	18	60	28	100
1	-10	10	20	19	65	29	100
2	-5	11	25	20	70	30	100
3	0	12	30	21	75	31	100
4	0	13	35	22	80	32	100
5	0	14	40	23	85	33	100
6	0	15	45	24	90	34	105
7	5	16	50	25	95	35	110
8	10	17	55	26	100	36	115
				27	100		

Questions (graph on next page):

1. At what temperature does ice melt? How do you know?

2. At what temperature does water boil? How do you know?

3. Why doesn't the temperature of the water change while the ice is melting or boiling? (what is happening to the heat energy?)

4. How does water's specific heat relate to it's usefulness for life? Give as many examples as you can.

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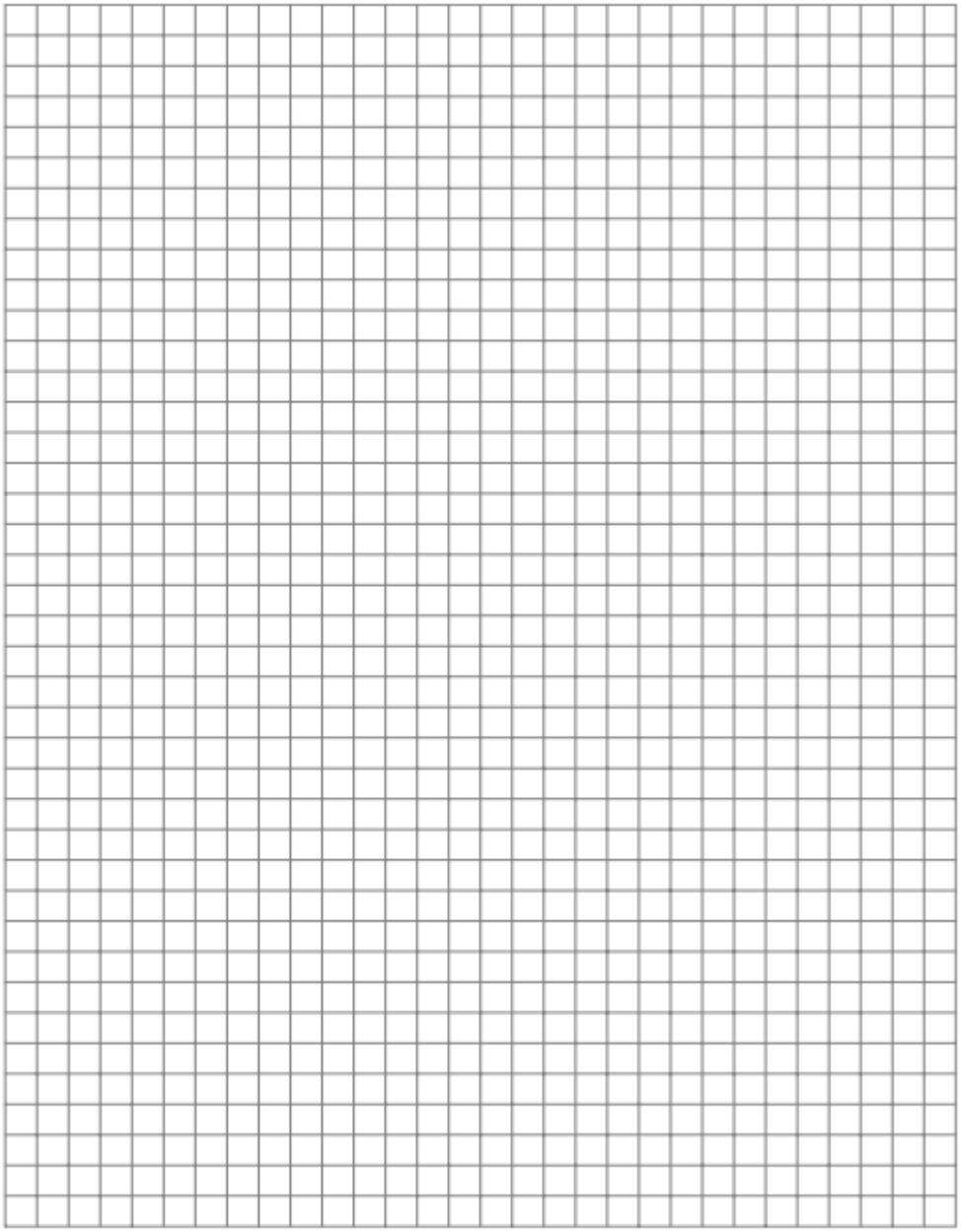

P.B. Station 2: What if…?

We all know that ice floats; we take it for granted. However, in nature, the solid form of a substance being less dense than the liquid form is extraordinary. What we don't know or think about much is how our world would be affected if ice did not float in water. This "thought" activity is explores the worldly implications if ice had a greater density than water.

Assume that there will be one change in the way that nature behaves: On the day after tomorrow, worldwide, ice (the solid form of water) will now become denser than water, rather than its current state, which is less dense.

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What will be the impact of this change?

Summarize your thoughts about the impact on the world if ice were denser than water. **Write at least one paragraph!**