Names _____ Block _____ Date _____

"Liquid X" Lab

BIG QUESTION: _____

Station 1 – Surface Tension, Cohesion, and Adhesion

*Water is **cohesive**, **adhesive**, and has **surface tension**. Does Liquid X have the same properties?*

1. *Use a pipette to carefully place drops of each liquid onto a dry penny.*
2. *Count the number of drops you are able to "pile up" on top of the penny before the liquid spills.*
3. *Dry your penny between each trial.*
4. *Record your data and repeat each liquid 3 times. Find the average or mean of your results.*
5. *Clean up.*

Data

Sample	Number of Drops Before Spilling			Mean
	Trial 1	Trial 2	Trial 3	
Water				
Liquid X				

- In this experiment, identify the:
  - Independent variable _____
  - Dependent variable _____
  - **Two** constants _____, _____
- Write a conclusion: How do your results for "Liquid X" compare to water?

Station 2 – pH Gizmo

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. **Acids** are substances that produce hydrogen ions (H^+) when dissolved in water. Lemon juice is an example of an acid.
   A. What does lemon juice taste like? Sour
   B. What does it feel like if lemon juice gets in your eye? burn / stings

2. **Bases** are substances that produce hydroxide ions (OH^-) when dissolved in water. Hand soap is an example of a base.

   A. What does soap feel like? smooth/slippery tastes bitter

   B. What does it feel like if soap gets in your eye? burns/stings

Gizmo Warm-up

The strength of an acid or base is measured on the **pH** scale.The pH scale runs from 0 to 14. **Acidic** substances have a pH below 7. **Basic (alkaline)** substances have a pH above 7. Pure water has a pH of 7 and is considered **neutral**.

The *pH Analysis* Gizmo™ allows you to find the pH of a variety of liquids. In the Gizmo, check that the **Substance in the tube** is **Ammonia**, and click **Test**. Wait until the animation is finished.

1. **Indicators** change color in acids or bases. What is the color of the pH paper? ~~10 - 11~~ dark blue

2. Compare the paper to the **pH color chart**. What is the pH of ammonia? 10 - 11

3. Is ammonia acidic or basic? base

Test: Use the Gizmo to find the pH of each of the available substances. Classify each substance as acidic (pH < 7), basic (ph > 7), or neutral (pH = 7).

0-14 pH indicator paper		
Material in the tube	**pH value**	**Acidic, Basic, or neutral?**
Bleach		
Hand soap		
Juice (lemon)		
Milk		
Saliva (human)		
Stomach acid		
Vinegar		
Water (distilled)		

Station 3 – pH

*Water has a **neutral** pH of exactly **7**. How does the pH of Liquid X compare to this and the pH measurements of other common chemicals?*

1. *Remove the pH probe from the white bottle. Rinse with water from the squeeze bottle while holding it over a waste container. Gently blot dry with towel.*
2. *Insert the probe into the first sample. Wait for the LabQuest2 to stabilize. Record the pH.*
3. *Remove the probe, rinse with water again, and blot dry again.*
4. *Repeat for each solution, rinsing and drying between each.*
5. *Rinse and dry one more time before replacing the probe in the white bottle.*

Data

Sample	Liquid X	Water	Windex	Vinegar
pH Meter Measurement				

- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- How does the pH of "Liquid X" compare to the pH of water?

Station 4 – Universal Solvent

*Water is a **universal solvent** and makes chemical reactions possible as a result. Does Liquid X have this same property?*

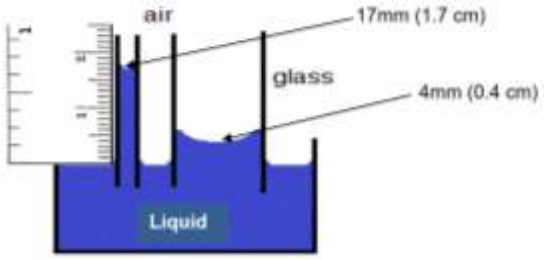
1. *Mix small scoops of sodium bicarbonate (baking soda) and citric acid in the same plastic cup.*
    - What happens? _____
2. *Pour a small amount of water into the plastic cup.*
    - What happens? _____
3. *Repeat steps 1 and 2 in a new plastic cup, but use "Liquid X" instead of water.*
    - What happens? _____

- Compare your results for "Liquid X" to water, which has the ability to act as a universal solvent.

Station 5 – Capillary Action

*Water can literally "climb" up thin tubes due to its cohesive and adhesive properties, thus demonstrating **capillary action**. Does Liquid X have the same property?*

1. *Use a ruler to measure how high water and Liquid X has climbed in each glass capillary tube.*
    - *Use the metric (centimeter) side. Measure each height in millimeters (mm). Count the smallest lines. Don't just read the number on the ruler!*



Tube Inner-Diameter	Height of “Liquid X” inside tube (above liquid in try) (mm)
5.0 mm	
3.0 mm	
0.5 mm	

- Compare to water, which has the ability to climb thin tubes, such as the stems of plants.

Station 6 –Density of the Solid

*The solid form of water (ice) is less dense than liquid, causing it to float (**buoyancy**) and protect aquatic life underwater. Does Liquid X have this same property?*

1. *Remove a solid block of water from the beaker using tongs.*
2. *Drop the block into a beaker of liquid water. Observe how it behaves.*
3. *Repeat steps 1 and 2 using frozen and non-frozen “Liquid X.”*
4. *Leave the “ice” in the liquid to melt.*

Substance	*Observations (What happened?*
Solid water (ice) in liquid water	
Solid “Liquid X” in liquid “Liquid X”	

- How does the frozen density of “Liquid X” compare to the frozen density of water?

Station 7 – Heat Capacity

*Water has a **high heat capacity**, which means it doesn't change temperature as much as other substances. Does Liquid X also have this property?*

1. *Record the initial temperature of the sand, water, and Liquid X.*
2. *Leave the temperature probes in the three beakers.*
3. *Place the three beakers on the hot plates (sand on left; water and Liquid X on right). Turn on each hot plate to a setting of "2" and press "play" in the lower left-hand corner of the LabQuest2 display.*
4. *Wait for the data to generate and record your data below.*
5. ***Turn off the hot plates when data is finished.***
6. *Discard the hot sand, hot water, and hot "Liquid X" in the "waste" containers and set up the experiment for the next group:*
    - *100 mL of fresh sand, Liquid X, and water in the same beakers.*
    - *Reinsert temperature probes in each substance.*

Data

Sample	Temperature (°C)						
	Initial (0 min)	1 min	2 min	3 min	4 min	5 min	Range
Sand							
Liquid X							

- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- Write a conclusion: How does the heat capacity of "Liquid X" compare to the heat capacity of water?

Name _____ Block _____ Date _____

"Liquid X" Lab Conclusion

Use the following framework to plan and organize your conclusion. Your formal conclusion must be written according to the directions from the Lab Report Template and Rubric.

Claim – Could "Liquid X" possibly sustain life?

Yes . . .

Evidence – What observations support your claim? Please describe at least 6 pieces of evidence.	**Reasoning** – Explain how your observations demonstrate that "Liquid X" would be able to sustain life.
- it has surface tension, cohesion, & adhesion - solid floats in liquid state - demonstrates capillary action - close pH to neutral - high heat capacity - good solvent	Similar to H_2O, essential for life

Extension – What other experiments or observations could be done to test the ability of "Liquid X" to sustain life?

"Liquid X" Lab Grading

- Stations Packet (35 pts, 5 pts per station)
- Conclusion Claim-Evidence-Reasoning Framework (5 pts)
- Formal Conclusion (10 pts)