Names _____ Block _____ Date _____

"Liquid X" Lab

Station 1 – "The Penny Lab"

*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.

Claim – Does "Liquid X" display cohesion, adhesion, and surface tension like water?	
Evidence – What data supports your claim?	**Reasoning** – Explain how your observations demonstrate properties of cohesion, adhesion, and surface tension.

Station 2 – Bubble and Fizz

*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? _____

- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- Write a conclusion.

Claim – Is "Liquid X" a universal solvent?	
Evidence – What observations support your claim?	**Reasoning** – Explain how your observations demonstrate properties of universal solvency.

Station 3 – Frozen Density

*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"	

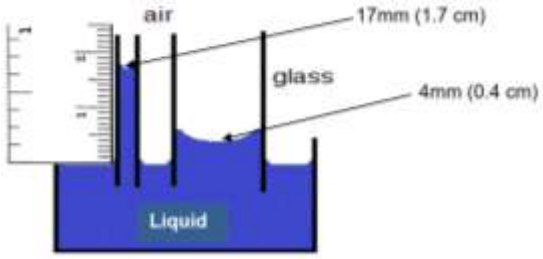
- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- Write a conclusion.

Claim – Does the solid form of "Liquid X" have buoyancy?	
Evidence – What observations support your claim?	**Reasoning** – Explain how your observations demonstrate properties of buoyancy.

Station 4 –Overcoming Gravity

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 water inside tube (above liquid in tray) (mm)	Height of "Liquid X" inside tube (above liquid in try) (mm)
5.0 mm		
3.0 mm		
0.5 mm		

- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- Write a conclusion.

Claim – Does "Liquid X" demonstrate capillary action?	
Evidence – What observations support your claim?	**Reasoning** – Explain how your observations demonstrate properties of buoyancy.

Station 5 – Hot Plate Race

*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							
Water							
Liquid X							

- In this experiment, identify the:
    - Independent variable _____
    - Dependent variable _____
    - **Two** constants _____, _____
- Write a conclusion.

Claim – Does "Liquid X" demonstrate high heat capacity?	
Evidence – What observations support your claim?	**Reasoning** – Explain how your observations demonstrate properties of high heat capacity.

Station 6 – 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? _____

    B. What does it feel like if lemon juice gets in your eye? _____

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? _____

    B. What does it feel like if soap gets in your eye? _____

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? _____

2. Compare the paper to the **pH color chart**. What is the pH of ammonia? _____

3. Is ammonia acidic or basic? _____

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 7 – Acids and Bases

*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	Ammonia	Lemon	Vinegar	Bleach	Milk
pH Meter Measurement							

- In this experiment, identify the:
  - Independent variable _____
  - Dependent variable _____
  - **Two** constants _____, _____
- Write a conclusion.

Claim – Does "Liquid X" have a neutral pH?	
Evidence – What observations support your claim?	**Reasoning** – Explain how your observations demonstrate the neutrality of "Liquid X."