Name: _____ Class; _____ Date: _____

Identifying Acids and Bases

Learner outcomes:

- Identify acids, bases and neutrals substances based on measures of their pH (*e.g., use indicator solutions or pH meters to measure the pH of water samples*)

Key Terms:

Acid	pH
Base	Neutral

Background Information: The pH scale is used to classify acids and bases of different strengths. It might help to think of a thermometer, which is a scale to classify temperatures. The pH scale is a scale from zero to fourteen. The pH values of acids are at one end of the scale, and those of bases at the other. The pH values are determined by the concentration of hydrogen ions in the solution. A **neutral** solution such as pure water, which is neither acidic nor basic, has a pH value of seven. **Acids** have pH values less than seven, while **bases** have pH values greater than seven.
An indicator is a chemical substance that changes color in acidic, basic or neutral solutions. Using an indicator is another way to estimate the pH of a substance.

Research question: What can you find out about acids, bases and indicators?

Materials:

Water	blue litmus paper (10 strips)	cabbage juice
dilute acid	red litmus paper (10 strips)	phenolphthalein (10 strips)
dilute base	pH paper (10 strips)	unknown samples "A" – "G"
test tube		
test tube rack		

Procedure:

For each of the known and unknown liquids follow the procedure listed below:

Complete known samples first as they represent the response of the indicator in acidic, basic and neutral solutions

1. Pour 5-7.5mL of the known/unknown solution into the plastic sample cup. Touch a piece of <u>each</u> indicator strip to the solution and record your observations (looking for colour change).

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9*. Toronto, ON: Addison Wesley.

2. Add 10 drops of the cabbage indicator into the sample and record the color in the table.

3. Wash and dry out the sample cup to prevent cross-contamination and test your next solution.

4. It is now time to test the unknown fluids. Test each of the fluids in the same manner that you did the known substances and record all of your results. **Any of the substances COULD be corrosive, poisonous and/or flammable – treat all with care.**

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Observations:

Results of indicator tests on 3 known acid/base samples										
Solution	**Blue Litmus Paper**		**Red Litmus Paper**		**pH Paper**		**Phenolphthalein**		**Cabbage Juice**	
	Colour Before	Colour After	Colour Before	Colour After	Colour After	pH (#)	Colour Before	Colour After	Colour Before	Colour After
Known Samples										
Neutral: Distilled Water										
Acid: $HCl_{(aq)}$										
Base: $Ca(OH)_{2\ (aq)}$										
Unknown Samples										
"A"										
"B"										
"C"										
"D"										
"E"										
"F"										

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"G"										

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Analysis:
Analyze your data to determine what **pH** of solution you had for each of your unknowns (acid, neutral or base) and <u>support</u> your answer with the results that you had.

Classifying Unknown Samples as Acids, Neutrals, or Bases	
"A"	
"B"	
"C"	
"D"	
"E"	
"F"	
"G"	

The Unknowns Were:

Fluid	Acid, Base or Neutral
A: 7-Up	
B: Drano (aqueous)	
C: Salt Water	
D: Vinegar	
E: Lemon Juice (diluted)	
F: Ammonia (aqueous)	
G: Baking Soda (aqueous)	

1. What general observations can you make about the acidic or basic nature of food and non-food (cleaning) samples?

Food Samples:

Non-Food Samples:

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2. What was purpose of the "Known" section of the lab?

3. Which of the indicators do you feel is the most useful? Explain your choice.

4. Suppose your teacher forgot to order pH paper but students needed indicators for both acids and bases, how could this problem be solved?

5. Jake and Emma tested 2 solutions and recorded their results below. Which solution would most likely have a pH less than 7? Explain your choice.

Results of indicator tests on 2 unknown acid/base samples				
Solution	**Blue Litmus Paper**	**Red Litmus Paper**	**Phenolphthalein**	**Cabbage Juice**
Unknown Samples				
"X"	Red	Red	White	Pink
"Y"	Blue	Blue	Pink	Green

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Extension:

1. When you bake with blueberries different things happen. When baked with yeast they remain blue, but when baked in muffins with baking soda they may turn slightly green. Suggest an explanation for this. (Hint: Think of what happens to cabbage juice in an acid and in a base.)

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