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Chem 20 Purple Cabbage Lab

Include all information and work on this sheet only.
No additional papers will be accepted for this lab.

Background Information (4)

Using modified Arrhenius theory, describe the differences between an acid and a base:

What does pH stand for?

Describe 6 common uses for acids and bases (3 each). Include their use, chemical name, common name and chemical formula for each.

Objectives

The purpose of this lab is

1. To determine the pH determining ability of purple cabbage
2. To observe the difference in pH between acids and bases
3. To determine the pH range of solutions based on various indicators

Hypothesis: (2)

HCl			Bleach	
NaOH			Shampoo	
Vinegar			Dish Soap	
Baking Soda			Canola Oil	
Vitamin C			Milk of Magnesia	
Drain Cleaner			Lemonade	
Ammonia			Syrup	
Orange Juice			Grape Pop	

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Variables (8)

Controlled (5)	Manipulated (2)	Responding (3)

Materials

Hot plate
600mL beaker
Stir rod
Various indicators
Purple Cabbage
pH meter
Water
Paper towel (for clean up)
Various substances to test
Spot plate
Eye dropper
Paper and Pencil

Procedure

1. Obtain all materials at your lab station
2. Measure 250mL water into your beaker
3. Add as much cabbage as possible allow for all pieces to be covered in water
4. Allow cabbage to boil for 30 minutes until the water is a deep purple color
5. While cabbage boils, obtain a small sample of each substance provided in your watch glass. (be sure you know the order in which you are adding the substances to the watch glass, you do not want to mess this up)
6. Slowly add 4 drops of the indicator to each separate sample, note the color change
7. Once the cabbage water is sufficiently purple, remove liquid and discard of solid matter (pour liquid into a smaller beaker – chuck the remains)
8. Obtain new samples of the substances in your cleaned watch glass
9. Slowly add 4 drops of the cabbage water to the samples
10. Record the color change
11. Repeat steps 8-10 using 2 other indicators

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Experimental Results (4)

Table 1:

Substance	Cabbage Water Indicator Color	Indicator #1	Indicator #2	Indicator #2
HCl				
NaOH				
Vinegar				
Baking Soda				
Vitamin C				
Drain Cleaner				
Ammonia				
Orange Juice				
Bleach				
Shampoo				
Dish Soap				
Canola Oil				
Milk of Magnesia				
Lemonade				
Syrup				
Grape Pop				

Note any experimental error or additional notes here:

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Analysis of Results (16total)

Using your chemical indicator results, determine the pH range of each solution. (16)

Substance	pH range according to results
HCl	
NaOH	
Vinegar	
Baking Soda	
Vitamin C	
Drain Cleaner	
Ammonia	
Orange Juice	
Bleach	
Shampoo	
Dish Soap	
Canola Oil	
Milk of Magnesia	
Lemonade	
Syrup	
Grape Pop	

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From your experimental results, determine a cabbage pH indicator legend (2)

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
cabbage color														

How useful is your cabbage pH indicator? Explain your decision completely. (1)

Why is it important to know the pH of a substance? (1)

What is a universal indicator? Why are they more useful than litmus paper? What is the chemical version of a universal indicator made out of? What is it's color range? (4)

Extension (4)
Create an appropriate extension for this lab. Where can this information be applied to real life?

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Follow up Questions (9 total)

1. How is a hydronium ion different from a hydrogen ion? How is it similar? (2)

2. Environmental scientists and technicians often determine the acidity of aquatic environments. Why is measuring pH with a meter better than using an indicator such as litmus? (1)

3. Which is the more common problem: acidic or basic aquatic environments? Briefly state your reasons for your answer. (2)

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4. Measurements of pH can be made using pH paper to provide a quick estimate of the hydronium ion concentration in aqueous solution. What is the estimated hydronium ion concentration in each of the following solutions? (2)

a. pure water: pH = 7

b. household ammonia: pH = 11

c. vinegar: ph = 2

d. drain cleaner: pH = 14

5. Hydronium ion concentration is a theoretical concept used to explain the properties of acids. Express each of the following concentrations as pH values: (2)

a. grapefruit juice: $[H_3O^+(aq)] = 10^{-3}M$

b. rain water: $[H_3O^+(aq)] = 10^{-5}M$

c. milk:$[H_3O^+(aq)] = 10^{-7}M$

d. soap: $[H_3O^+(aq)] = 10^{-10}M$