**pH Indicator**

**Procedure #1**

pH Indicators for Acids:

1. Take seven clean test tubes from the Glassware shelf and place them on the workbench.

2. Add 5 mL of 0.1M HCl and 5 mL of water from the Chemicals shelf to the first test tube.

3. Add 9 mL of water to the 6 remaining test tubes.

4. Pour 1 mL of the solution from the first test tube into the second test tube.

5. Pour 1 mL of the solution from the second test tube into the third test tube.

6. Pour 1 mL of the solution from the third test tube into the fourth test tube.

7. Pour 1 mL of the solution from the fourth test tube into the fifth test tube.

8. Pour 1 mL of the solution from the fifth test tube into the sixth test tube.

9. Pour 1 mL of the solution from the sixth test tube into the seventh test tube.

10. Add two drops of bromothymol blue to each test tube, and observe the color of the solutions. Record your results.

11. Repeat steps 1-10 using methyl yellow as the indicator.

12. Repeat steps 1-10 using bromcresol green as the indicator.

13. Repeat steps 1-10 using red cabbage extract as the indicator.

**Results:**

Test tubes after 2 drops of bromothymol blue:

1. Yellow
2. Yellow
3. Yellow
4. Yellow
5. Yellow
6. Yellow
7. Blue

Test tubes after 2 drops of methyl yellow:

1. Red
2. Red
3. Pale orange
4. Yellow
5. Yellow
6. Yellow
7. Yellow

Test tubes after 2 drops of bromcresol green:

1. Yellow
2. Yellow
3. Yellow
4. Green
5. Light blue
6. Blue
7. Blue

Test tubes after 2 drops of red cabbage extract:

1. Red
2. Red
3. Light red
4. Pale purple
5. Pale purple
6. Pale purple
7. Pale purple
* **Question #1 :**

1. Calculate the concentrations of H3O+ and the pH of each acidic solution. Since HCl is a monoprotic acid, the H3O+ concentration is equivalent to the HCl molarity.

2. Summarize your results for each pH indicator, recording both the pH values and the color of the solution at each pH.

3. Estimate the useful range for each indicator, from a minimum to maximum pH. The range usually spans 1.5 to 2 pH units. For example, bromphenol blue is considered to be useful in the range from 3.0 to 4.6.

4. Which indicator is the best to use for observing pH changes around pH = 2, pH = 4 and pH = 6?
* **Answer :**

**Procedure #2**

pH Indicators for Bases:

1. Clear the workbench by dragging all of the previous test tubes to the Recycle bin (another option is to just click the 'reset lab' icon at top).

2. Take seven clean test tubes from the Glassware shelf and place them on the workbench.

3. Add 5 mL of 0.1M NaOH and 5 mL of water from the Chemicals shelf to the first test tube.

4. Add 9 mL of water to the 6 remaining test tubes.

5. Pour 1 mL of the solution from the first test tube into the second test tube.

6. Pour 1 mL of the solution from the second test tube into the third test tube.

7. Pour 1 mL of the solution from the third test tube into the fourth test tube.

8. Pour 1 mL of the solution from the fourth test tube into the fifth test tube.

9. Pour 1 mL of the solution from the fifth test tube into the sixth test tube.

10. Pour 1 mL of the solution from the sixth test tube into the seventh test tube.

11. Add two drops of bromothymol blue to each test tube, and observe the color of the solutions. Record your results.

12. Repeat steps 2-11 using red cabbage extract as the indicator.

13. Repeat steps 2-11 using alizarin yellow as the indicator.

14. Repeat steps 2-11 using phenolphthalein as the indicator.

**Results:**

Test tubes after 2 drops of bromothymol blue:

1. Blue
2. Blue
3. Blue
4. Blue
5. Blue
6. Blue
7. Light blue

Test tubes after 2 drops of red cabbage extract:

1. Light blue
2. Light blue
3. Light blue
4. Light blue
5. Blue
6. Purple
7. Light purple

Test tubes after 2 drops of alizarin yellow:

1. Red
2. Orange
3. Yellow
4. Yellow
5. Yellow
6. Yellow
7. Yellow

Test tubes after 2 drops of phenolphthalein:

1. Light purple
2. Light purple
3. Light purple
4. Pink
5. Clear
6. Clear
7. Clear
* **Question #1 :**

1. Calculate the concentrations of OH- and the pH of each basic solution. Since NaOH donates one OH- ion for each NaOH molecule, the OH- concentration is equivalent to the NaOH molarity. The pOH is calculated as -log[OH-] and the pH is calculated as 14 - pOH.

2. Summarize your results for each pH indicator, recording both the pH values and the color of the solution at each pH.

3. Estimate the useful range for each indicator, from a minimum to maximum pH. The range usually spans 1.5 to 2 pH units. For example, metacresol purple is considered to be useful in the range from 7.4 to 9.0.

4. Which indicator is the best to use for observing pH changes around pH = 7, pH = 8, pH = 10 and pH = 12?
* **Answer :**