

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Chemistry** ~ Ms. Hart

**Class:** Anions or Cations



### **9.4 Notes – Indicators**

#### **What are indicators?**

- Indicators allow us to determine the pH of a solution visually.
- Indicators change colors in a specific \_\_\_\_\_.
- Indicators are used when a base is added to an acid
  - This means indicators are only used when the pH is \_\_\_\_\_.
- Common indicators are listed in Table M.

#### **Most Common indicator = phenolphthalein**

- a) Phenolphthalein will change from a colorless solution to pink at the pH range \_\_\_\_\_.
- b) You have a beaker with acid in it. You add a few drops of phenolphthalein, and then begin to add a base to the beaker. Eventually the solution turns pink. What pH can you say the solution is? \_\_\_\_\_

**Example:** A solution was found to have a pH of 7.8. What color would the solution have if the following indicators were added?

1. bromthymol blue - \_\_\_\_\_
2. thymol blue - \_\_\_\_\_
3. In which solution will thymol blue indicator appear blue?
  1.  $\text{CH}_3\text{COOH}$
  2.  $\text{KOH}$
  3.  $\text{HCl}$
  4.  $\text{H}_2\text{SO}_4$
4. Which indicator is yellow in a solution with a pH of 9.8?
  1. methyl orange
  2. bromthymol blue
  3. bromcresol green
  4. thymol blue

#### **Classwork - Indicators**

Base your answers to questions 1 and 2 on the information below.

A truck carrying concentrated nitric acid overturns and spills its contents. The acid drains into a nearby pond. The pH of the pond water was 8.0 before the spill. After the spill, the pond water is 1,000 times more acidic.

1. What is the new pH of the pond water after the spill?
2. What color would bromothymol blue be at this new pH?
3. Which statement correctly describes a solution with a pH of 9?
  - (1) It has a higher concentration of  $\text{H}_3\text{O}^+$  than  $\text{OH}^-$  and causes litmus to turn blue.
  - (2) It has a higher concentration of  $\text{OH}^-$  than  $\text{H}_3\text{O}^+$  and causes litmus to turn blue.
  - (3) It has a higher concentration of  $\text{H}_3\text{O}^+$  than  $\text{OH}^-$  and causes methyl orange to turn yellow.
  - (4) It has a higher concentration of  $\text{OH}^-$  than  $\text{H}_3\text{O}^+$  and causes methyl orange to turn red.

4. Which indicator, when added to a solution, changes color from yellow to blue as the pH of the solution is changed from 5.5 to 8.0?
- (1) bromocresol green
  - (2) bromthymol blue
  - (3) litmus
  - (4) methyl orange
5. The table below shows the color of the indicators methyl orange and litmus in two samples of the same solution.

**Results of Acid-Base Indicator Tests**

Indicator	Color Result from the Indicator Test
methyl orange	yellow
litmus	red

Which pH value is consistent with the indicator results?

- (1) 1
  - (2) 5
  - (3) 3
  - (4) 10
6. The health of fish depends on the amount of oxygen dissolved in the water. A dissolved oxygen (DO) concentration between 6 parts per million and 8 parts per million is best for fish health. A DO concentration greater than 1 part per million is necessary for fish survival. Fish health is also affected by water temperature and concentrations of dissolved ammonia, hydrogen sulfide, chloride compounds, and nitrate compounds. Most freshwater fish thrive in water with a pH between 6.5 and 8.5.
- A student's fish tank contains fish, green plants, and 3800 grams of fish-tank water with  $2.7 \times 10^{-2}$  gram of dissolved oxygen. Phenolphthalein tests colorless and bromthymol blue tests blue in samples of the fish-tank water.
- a) Based on the test results for the indicators phenolphthalein and bromthymol blue, what is the pH range of the fish-tank water? [1]
  - b) When the fish-tank water has a pH of 8.0, the hydronium ion concentration is  $1.0 \times 10^{-8}$  mole per liter. What is the hydronium ion concentration when the water has a pH of 7.0? [1]
  - d) State how an increase in the temperature of the fish-tank water affects the solubility of oxygen in the water. [1]

Determine if the DO concentration in the fish tank is healthy for fish. Your response must include:

- a correct numerical setup to calculate the DO concentration in the water in parts per million [1]
- the calculated result [1]
- a statement using your calculated result that tells why the DO concentration in the water is or is not healthy for fish [1]