

Chem12 Indicators : W.S. - 170

Indicators are weak acids that have one color in a basic solution, and another color in an acidic solution. The color depends on the pH, so indicators can be used to estimate the pH of a solution.

The equilibrium for an indicator, HInd (Bromthymol blue in this case) is shown below. Ind⁻ is the conjugate base of the acid HInd.



acid form

base form

yellow

blue

If we add an acid to the solution above, the shift is left, and the indicator will change color to yellow. If we add a base, the equilibrium will shift right, and the indicator will turn blue. The color change occurs over a pH range of 6.0 - 7.6.

Answer the following questions :

- 1) If HInd is red in an acid, and blue in a base, what is the color of Ind⁻.
- 2) Find the color of the indicator. (Use the indicator table).
 - a) Methyl Orange in a pH 8.0 solution.
 - b) Phenolphthalein in a pH 4.0 solution.
- 3) Give the color of Thymol blue in following solutions.
 - a) pH = 11.0, b) pH = 7.0, c) pH = 1.0.
- 4) Name an indicator that will change color at a pH of about 10.0.
- 5) Give the K_a expression for the indicator, HInd.
- 6) The color change for an indicator occurs when [HInd] = [Ind⁻]. This is called the **transition point** (or endpoint). Find an expression for K_a at the transition point.

Answers : 1) blue, 2)a) yellow, b) colorless, 3)a) blue, b) yellow, c) red, 4) Thymolphthalein, 5) $\frac{[\text{H}_3\text{O}^+][\text{Ind}^-]}{[\text{HInd}]}$, 6) $[\text{H}_3\text{O}^+]$.