Name _____ Block: _____ Date: _____

Chemistry 12

ACID-BASE INDICATORS

1. An indicator HInd is yellow in 0.1M NaOH and blue in 0.1M HCl. The pH range in which the colour change occurs in this indicator is 3.6 - 5.2.

   a) Write the ***equilibrium equation*** describing this indicator.

   _____

   b) What is the colour of HInd? _____ What is the colour of Ind^-? _____

   c) What is the pH at the transition point of this indicator? _____

   d) What is the value of pKa for this indicator? _____

   e) What is the Ka of this indicator? _____

   f) At pH = 2.2, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   g) At pH = 7.0, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   h) At pH = 11.3, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   i) At pH = 4.4, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   j) At pH = 4.3, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   k) In 0.001M HNO_3, this indicator is the colour ____ and [HInd] (>,<,=) ___ [Ind^-].

   l) In 0.001M KOH, this indicator is the colour _____ and [HInd] (>,<,=) ___ [Ind^-].

   m) At the *transition point*, is $[H_3O^+]$ = Ka (indicator.)? _____

2. A solution turns yellow when Orange IV is added and red when methyl orange is added. Give the approximate pH range of the solution.

3. A solution turns yellow when chlorophenol red is added and also yellow when methyl orange is added. Give the approximate pH range of the solution.

4. A solution turns magenta when phenolphthalein is added and yellow when alizarin yellow is added. Determine the approximate $[H_3O^+]$.

5. A 0.10 M solution of a weak acid HX turns red in both chlorophenol red and in neutral red indicator.

   a) Determine the approximate pH of this solution of HX. _____

   b) Determine the Ka of the weak acid HX (Not the Ka (indicator)!)
   (Hint: Use an ICE table!)

6. An indicator "Gupta Green" (HGg) turns yellow when $[H_3O^+]$ drops below 1.2×10^{-4} M and turns blue when $[H_3O^+]$ rises above 1.8×10^{-3} M. (Notice 2 SD's)

   a) Find the pH range over which the indicator changes colour.(2SD's)

   b) Determine the pKa of the indicator "Gupta Green". _____

   c) What colour would 0.00019 M HCl be in this indicator? _____

   d) What colour would 0.010 M NaOH be in this indicator? _____

   e) What colour would 0.10 M CH_3COOH be in this indicator?
   (Show how you got $[H_3O^+]$)

7. An indicator HInd turns yellow in 0.10 M HCl and blue in 0.10 M NaOH.

   a) Write the equation describing the ***equilibrium*** in HInd.

   _____

   b) What colour is HInd? _____ What colour is Ind^-? _____

c) HInd is green in the range pH = 5.4 to pH = 6.2. Determine the Ka of HInd.(1)

d) When a few drops of HInd are added to a weak acid HA_1, the colour is yellow. Which is the stronger acid, HInd or HA_1?

e) When a few drops of HInd are added to a weak acid HA_2, the colour is blue. Which is the stronger acid, HInd or HA_2?

f) Which acid is stronger, HA_1, or HA_2? _____

g) List the acids HInd, HA_1 and HA_2 in order of strength from strongest to weakest.

_____> _____ > _____

h) List the bases Ind^-, A_1^-, and A_2^-, in order of strength from strongest to weakest.

_____> _____ > _____