• AP Chemistry

Name CALVIN
Period ___ Date ___/___/___

15 • Acid-Base Reactions

PRACTICE TEST

1. HCN is a weak acid ($K_a = 6.2 \times 10^{-10}$). NH_3 is a weak base ($K_b = 1.8 \times 10^{-5}$). A 1.0 M solution of NH_4CN would be
   (A) strongly acidic (C) neutral
   (B) weakly acidic (D) weakly basic

2. How many moles of HCOONa must be added to 1.0 L of 0.10 M HCOOH to prepare a buffer solution with a pH of 3.4? (HCOOH $K_a = 2 \times 10^{-4}$)
   (A) 0.01 (C) 0.1
   (B) 0.05 (D) 0.2

   pKa = 3.7 (see back)

3. The acid-base indicator methyl red has a K_a of 1×10^{-4}. Its acidic form is red while its alkaline form is yellow. If methyl red is added to a colorless solution with a pH = 7, the color will be
   (A) pink (C) orange
   (B) red (D) yellow

   Color changes at pH = 4
   Red < 4
   yellow > 4
   orange @ pH=4

4. Which mixture forms a buffer when dissolved in 1.0 L of water?
   (A) 0.2 mol NaOH + 0.2 mol HBr
   (B) 0.2 mol NaCl + 0.3 mol HCl
   (C) 0.4 mol HNO_2 + 0.2 mol NaOH
   (D) 0.5 mol NH_3 + 0.5 mol HCl

   SB + SA
   Salt + SA
   $2HNO_2 + NO_2^-$
   completely titrates = $NH_4^+Cl^-$

5. A buffer solution is prepared in which the concentration of NH_3 is 0.30 M and the concentration of NH_4 is 0.20 M. What is the pH of this solution? The equilibrium constant, K_b for NH_3 equals 1.8×10^{-5}.
   (A) 8.73 (C) 9.43
   (B) 9.08 (D) 11.72

   $pK_b = 4.74$

   $pOH = pK_b - \log \frac{[B]}{[HB^+]}$

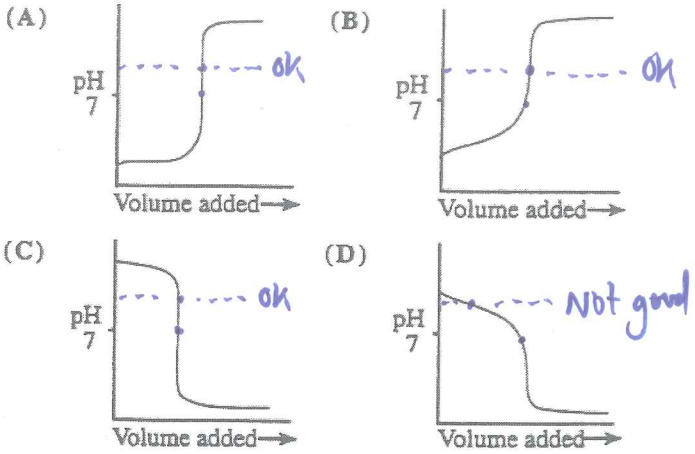
   $pOH = 4.74 - \log\left(\frac{.30}{.20}\right)$

   $= 4.74 - .176 = 4.56$

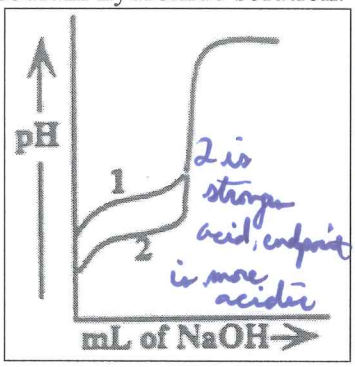
   $pH = 9.436$

6. For which titration would the use of phenolphthalein introduce a significant error?
   $K_{indicator}$ for phenolphthalein = 1×10^{-9}

   pHth changes color at pH=9



7. The titration curves labeled 1 and 2 were obtained by titrating equal volumes of two different acid samples with portions of the same sodium hydroxide solution.



   conc's are the same because it takes same amount of base to neutralize

   What conclusions can be drawn about the relative concentrations and strengths of acids 1 and 2 from these curves?
   (A) The concentrations are the same but acid 1 is weaker than acid 2.
   (B) The concentrations are the same but acid 1 is stronger than acid 2.
   (C) Acid 1 is the same strength as acid 2, but it is less concentrated.
   (D) Acid 1 is the same strength as acid 2, but it is more concentrated.

   Stronger acid will raise the pH of the neutralized solution

8. A 0.100 M solution of acetic acid ($K_a = 1.8 \times 10^{-5}$) is titrated with a 0.1000 M solution of NaOH. What is the pH when 50% of the acid has been neutralized?

(A) 2.38 (C) 5.70
(B) 4.74 (D) 7.00

Half titration
pH = pKa
$= -\log 1.8 \times 10^{-5}$
$= 4.74$

9. The pK_a values for several acid-base indicators are given in the table. Which indicator should be used in the titration of a weak base with a strong acid?

Indicator, pK_a	
2,4-dintrophenol	3.5
bromthymol blue	7.0
cresol red	8.0
alizarin yellow R	11.0

pH < 7
acidic?

(A) 2,4-dintrophenol
(B) bromthymol blue
(C) cresol red
(D) alizarin yellow R

Go Vikings!!

2) $pH = pK_a - \log \frac{[HA]}{[A^-]}$

$3.4 = 3.7 - \log \frac{(0.10)}{x}$

$-0.3 = -\log \frac{.10}{x}$

$10^{0.3} = \frac{.10}{x}$

$x = \boxed{0.050}$