South Pasadena • AP Chemistry

Name Key
Period ___ Date ___/___/___

# 18 • 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 $K_a = 2 \times 10^{-4}$) pKa = 3.7
   (A) 0.01 (C) 0.1 See scratch paper
   (B) 0.05 (D) 0.2

3. The acid-base indicator methyl red has a $K_a$ of $1 \times 10^{-4}$. 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 color changes at pH=4 red < 4
   (A) pink (C) orange yellow > 4
   (B) red (D) yellow 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 SB + SA
   (B) 0.2 mol NaCl + 0.3 mol HCl SALT + SA
   (C) 0.4 mol $HNO_2$ + 0.2 mol NaOH = $HNO_2 + NO_2^-$
   (D) 0.5 mol $NH_3$ + 0.5 mol HCl completely titrate = $NH_4^+ Cl^-$

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 $1.8 \times 10^{-5}$.
   (A) 8.73 (C) 9.43 $pK_b = 4.74$
   (B) 9.08 (D) 11.72

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

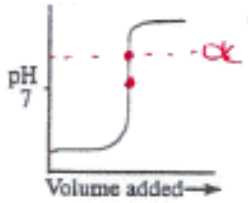
$$= 4.74 - \log\left(\frac{.30}{.20}\right)$$

$$= 4.74 - .176 = 4.56$$

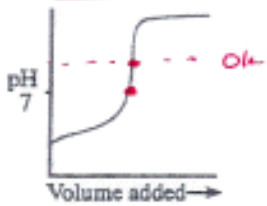
$$pH = 14 - pOH = 9.436$$

6. For which titration would the use of phenolphthalein introduce a significant error? phth change color @ pH=9
   $K_{indicator}$ for phenolphthalein = $1 \times 10^{-9}$

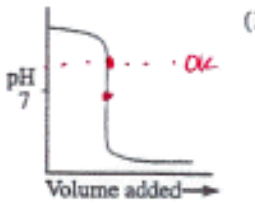
(A)



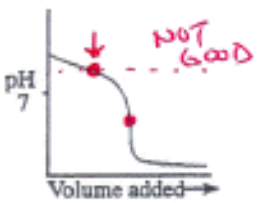

(B)



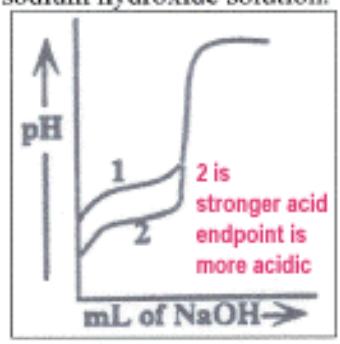

(C)




(D)




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 of acids are same because it takes the same amt 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 Lower 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
$pH = pK_a$
$= -\log 1.8\times10^{-5}$
$= 4.74$

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?

~~pH > 7~~
pH < 7
acidic!

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

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

Scratch Paper

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

$3.4 = 3.7 - \log \frac{(.10)}{x}$

$-.3 = -\log \frac{.10}{x}$

$.3 = \log \frac{.10}{x}$

$10^{.3} = \frac{.10}{x}$

$2.0 = \frac{.10}{x}$

$x = \frac{.10}{2.0} = .050$