Quiz 3 **Test Form A** November 28, 2001

INSTRUCTIONS: Use a soft, #2 pencil. Your marks must be dark to be counted correctly.
Write your perm number and **bubble in your perm number**. Correct perm = 2 points!
Bring a **CALCULATOR**

1. Predict how the following reaction at equilibrium will shift by the affect of an increase in volume.

$$2\ NCl_3\,(g) \rightleftharpoons N_2\,(g) + 3\ Cl_2\,(g)$$

a) left

b) right **Answers are included at the end of the quiz.**

c) no shift

2. Consider the following three equilibria occurring simultaneously in solution.

$$Ca^{2+}\,(aq) + C_2O_4^{2-}\,(aq) \rightleftharpoons CaC_2O_4\,(s) \quad (1)$$

$$H_2C_2O_4\,(aq) \rightleftharpoons H^+\,(aq) + HC_2O_4^-\,(aq) \quad (2)$$

$$HC_2O_4^-\,(aq) \rightleftharpoons H^+\,(aq) + C_2O_4^{2-}\,(aq) \quad (3)$$

If NaOH is added to the solution, will the amount of $CaC_2O_4\,(s)$ precipitate increase or decrease or stay the same

a) Increase

b) Decrease

c) Stay the same

3. A solution is prepared by adding 20.0 mL of 0.10 M HCl to 30.0 mL of 0.20 M HNO_3. Calculate the concentration of H^+ in this solution. Both HCl and HNO_3 are strong acids.

a) 0.04 M

b) 0.12 M

c) 0.16 M

d) 0.30 M

e) 0.14 M

4. Calculate the pH of a 0.10 M HNO_2 solution. ($K_a = 4.6 \times 10^{-4}$ for HNO_2)

a) 5.3

b) 1.0

c) 1.7

d) 2.2

e) 8.7

5. A 0.1 M aqueous solution of the salt $NaNO_2$ is made. Will the solution be acidic, basic or neutral?

a) acidic

b) basic

c) neutral

6. A 0.1 M aqueous solution of the salt $NaHCO_3$ is made. Will the solution be acidic, basic or neutral?

   a) acidic
   b) basic
   c) neutral

7. A 0.1 M aqueous solution of the salt NH_4NO_3 is made. Will the solution be acidic, basic or neutral?

   a) acidic
   b) basic
   c) neutral

8. Consider a 0.1 M $NaNO_2$ solution and a 0.1 M NaCN solution. Which solution will have the lower pH?

   a) 0.1 M $NaNO_2$
   b) 0.1 M NaCN
   c) Neither; the solutions have the same pH

9. List the **major species** present in a 0.25 M solution of CH_3COOH.

   a) CH_3COOH, CH_3COO^-, H^+, H_2O
   b) CH_3COO^-, H^+, H_2O
   c) CH_3COO^-, H^+, OH^-, H_2O
   d) CH_3COOH, H_2O
   e) CH_3COOH, CH_3COO^-, H^+, OH^-, H_2O

Acid	HA	A^-	K_a	p K_a
Hydrochloric	HCl	Cl^-		
Nitric	HNO_3	NO_3^-		
Hydronium ion	**H_3O^+**	**H_2O**	**1**	**0.0**
Hydrofluoric	HF	F^-	6.6×10^{-4}	3.18
Nitrous	HNO_2	NO_2^-	4.6×10^{-4}	3.34
Acetic	CH_3COOH	CH_3COO^-	1.76×10^{-5}	4.75
Carbonic (1)	H_2CO_3	HCO_3^-	4.3×10^{-7}	6.37
Hydrocyanic	HCN	CN^-	6.17×10^{-10}	9.21
Ammonium ion	NH_4^+	NH_3	5.6×10^{-10}	9.25
Carbonic (2)	HCO_3^-	CO_3^{2-}	4.8×10^{-11}	10.32
Water	**H_2O**	**OH^-**	**1.0×10^{-14}**	**14.00**

$pH = -\log [H^+]$ $[H^+] = 10^{-pH}$

$K_w = 1 \times 10^{-14}$ at 25°C $K_w = [OH^-][H^+]$ $K_w = K_a K_b$

ANSWERS: 1. b 2. a 3. c 4. d [HCl] = 0.04 M, $[HNO_3]$ = 0.12 M, => Total $[H^+]$ = 0.16 M

5. b 6. b Why basic? HCO_3^- is amphoteric. Compare the value of K_b to K_a 7. a 8. a

9. d Compare the value of K_b for NO_2^- to the value of K_b for CN^-. Smaller K_b => less OH^- => lower pH