Chemistry Lab: Acids/Bases and Aqueous Solutions

Test

Part 1- Acids and Bases (36 pts)

1. What is the conjugate base of the following acids: $HClO_4$, H_2S, PH_4^+, H_2O (_/1)

2. What is the conjugate acid of the following bases: CN^-, SO_4^{2-}, H_2O, HCO_3^- (_/1)

3. Label the acid, base, conjugate acid, and conjugate base in the equation (_/1)

$HCl\ (g) + H_2O\ (l) \rightarrow H_3O^+\ (aq) + Cl^-$

4. Predict whether equilibrium lies predominantly to the left or the right (_/1)

   a. $HSO_4\ (aq) + CO_3^{2-}\ (aq) \rightarrow SO_4^{2-}\ (aq) + HCO_3^-\ (aq)$

   b. $PO_4^{3-}\ (aq) + H_2O\ (l) \rightarrow HPO_4^{2-}\ (aq) + OH^-\ (aq)$

5. A solution made by adding solid sodium hypochlorite (NaClO) to enough water to make 2.00 L of solution has a pH of 10.50. Using the equation below calculate the number of moles of NaClO that were added to the water. (_/4)

$ClO^-\ (aq) + H_2O\ (l) \rightarrow HClO\ (aq) + OH^-\ (aq)$ $\quad K_b = 3.3 \times 10^{-7}$

6. In each of the following pairs choose the compound that creates a more acidic solution and briefly explain why (_/2)

   a. HBr, HF

b. PH_3, H_2S

c. HNO_2, HNO_3

d. H_2SO_3, H_2SeO_3

7. Calculate the pH of a solution containing 0.085 M nitrous acid and 0.10 M potassium nitrite. ($K_a = 4.5 \times 10^{-4}$) (_/4)

8. Calculate the formate concentration and the pH of a solution that is 0.05 M in formic acid, $HCHO_2$ ($K_a = 1.8 \times 10^{-4}$) and 0.10 M in HNO_3 (_/4)

9. Calculate the pH of a buffer composed of 0.12 M benzoic acid and 0.20 M sodium benzoate ($K_a = 6.34 \times 10^{-5}$) (_/3)

10. 50.0 mL of 0.10 M acetic acid ($K_a = 1.8 \times 10^{-5}$) is titrated with 0.10 M NaOH. Calculate the pH when the following volumes of base are added:

a. 10.0 mL (_/3)

b. 50.0 mL (_/3)

c. 75.0 mL (_/3)

11. A solution is predicted to have a pH of 3.5. Give **two** indicators that can be used and explain how these indicators are used to verify the test results. (_/3)

12. Give **three** uses for H_2SO_4 (sulfuric acid). (_/3)

Part 2- Aqueous solutions (23 pts)

1. A solution is prepared by mixing 1.00 g ethanol (C_2H_5OH) with 100.0 g of water to give a final volume of 101 mL. Calculate the molarity, mass percent, mole fraction, and molality of ethanol (_/2)

2. A 2.5 g sample to groundwater has 5.4 μg of Zn^{2+}. What is the concentration of Zn^{2+} in parts per million? (_/2)

3. Calculate the molality and mole fraction of a 36% by mass HCl solution (_/2)

4. Glycerin ($C_3H_8O_3$) is a nonvolatile nonelectrolyte with a density of 1.26 g/mL at 25°C. Calculate the vapor pressure at 25°C of a solution made by adding 50.0 mL of glycerin to 500.0 mL of water. The vapor pressure of pure water at 25°C is 23.8 torr, and its density is 1.00 g/mL (_/3)

5. Calculate the total vapor pressure of a solution containing 1.0 mol benzene (C_6H_6) and 2.0 mol toluene (C_7H_8). At 20°C the vapor pressure of benzene is 75 torr and toluene is 22 torr. (_/2)

6. List the following aqueous solutions in order of decreasing freezing point: 0.050 m $CaCl_2$, 0.15 m NaCl, 0.10 m $C_{12}H_{22}O_{11}$ (_/1)

7. Calculate the concentration of CO_2 in a soft drink that is bottled with a partial pressure of CO_2 of 4 atm over the liquid at 25°C. The Henry's law constant for CO_2 in water at this temperature is 3.1×10^{-2} M/atm (_/3)

8. A sample of 2.05 g of polystyrene was dissolved in enough toluene to create 100.0 mL of solution. The osmotic pressure of this solution is 1.21 kPa at 25°C. Calculate the molar mass of polystyrene (_/2)

9. Fill out the following table (_/5)

Type of colloid	Dispersing medium	Dispersed substance	Example
			Milk
			Paint
			Butter

			Fog
			Smoke

Part 1: __/36
Part 2: __/22
Total: __/58