

SI Session 11 & 12
Feb. 25 and 27 2014

1. Calculate the freezing point depression of a NaCl water mixture. 25g of NaCl were poured in 100ml of water. Kf of H2O is 1.86.

$$\Delta T = (1.86) \left(\frac{25/58.44}{-1 \text{ kg}} \right) (2)$$

2. True or False: As the molarity of a solution increases, the osmotic pressure increases.

$$\pi = iMRT \quad \text{if } M \text{ increases, } \pi \text{ increases}$$

True

3. Calculate the osmotic pressure of a 2M NaCl solution at 25 C.

$$\pi = (2)(2)(.0821)(273+25)$$
$$\pi = 97.86$$

b. What would happen to osmotic pressure if temperature was increased?

osmotic pressure would increase

$$\pi =$$

4. Which has the higher van off factor, NaCl, or CaCl₂?

$$\text{NaCl} = 2$$
$$\text{CaCl}_2 = 3 \quad \text{Thus, CaCl}_2$$

5. Explain the difference between a Bronsted-Lowry acid and a Lewis Acid.

Bronsted: H⁺ donor

Lewis: electron acceptor

6. For the reaction $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$, indicate the bronsted acid and base.

acid \ base

b. What does amphiprotic mean?

A compound ^{is capable of} acting as an acid or as a base

7. Write the equilibrium expression for the ionization of HF in water.



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{F}^-]}{[\text{HF}]}$$

8. As acid strength increases what happens to the strength of the conjugate base? Explain why?

It decreases

9. An HCl solution is measured to have a pH of 3.2. What is the H ion concentration?

$$\begin{aligned} -\text{pH} &= \log(\text{H}_3\text{O}^+) \\ -3.2 &= \log(\text{H}_3\text{O}^+) \\ 10^{-3.2} &= \text{H}_3\text{O}^+ \end{aligned}$$

10. Calculate the H₃O conc. in a 3M HNO₃ solution.

$$\frac{3 \text{ HNO}_3}{1 \text{ HNO}_3} \times \frac{1 \text{ H}_2\text{O}}{1 \text{ H}_2\text{O}} = 3 \text{ moles H}_2\text{O} = 3 \text{ M H}_3\text{O}^+$$

b. Calculate the OH conc.

$$\begin{aligned} [\text{H}_3\text{O}][\text{OH}] &= 1 \times 10^{-14} = K_w \\ 3[\text{OH}] &= \frac{1 \times 10^{-14}}{3} \end{aligned}$$

11. Determine for the following, the stronger acid:

a. HOCl vs. HOBr

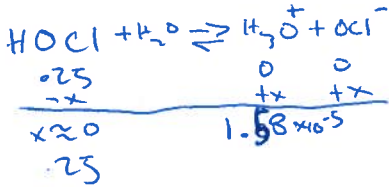
b. HOBr vs. HOBr₂

c. HI vs. HF

d. CH₃CH₂COOH vs. CH₃COOH

e. CCl₃COOH vs. CH₃COOH

12. Calculate the K_a of HOCl if a .25 M solution of HOCl has a pH of 4.8.



in a that

$$pH = -\log[H_3O^+] \quad K_a = \frac{(1.58 \times 10^{-5})(1.58 \times 10^{-5})}{.25}$$

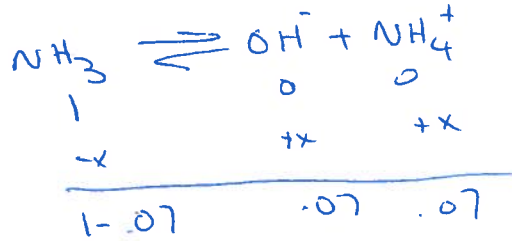
$$10^{-pH} = [H_3O^+]$$

$$[H_3O^+] = .0000158$$

13. 7% of a 1M NH_3 (a weak base) solution ionized in water. Calculate the K_a , OH conc., and pH of the solution.

$$7\% \text{ of } 1M = .07$$

$$[OH] = .07$$



$$K_b = \frac{(.07)(.07)}{.93}$$

$$K_b = .00527$$

$$K_w = K_b \cdot K_a$$

$$K_a = \frac{K_w}{K_b} = 1.898 \times 10^{-12}$$

$$pOH = -\log(.07)$$

$$pOH = 1.155$$

$$pH = 14 - pOH$$

$$14 - 1.155$$

$$\boxed{pH = 12.85}$$