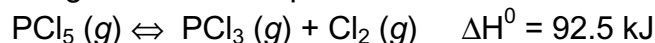


## CHE 107-002

Exam II

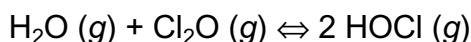
October 23, 1997

1. Consider the following reaction at equilibrium:



The equilibrium position could be shifted to the left (towards reactants) by:

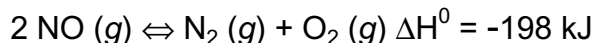
- A. raising the temperature      B. removing chlorine gas  
C. adding  $\text{PCl}_5$                       D. increasing the pressure on the system
2. The equilibrium constant  $K_p$  for the reaction



is 0.900 at 25 °C. For the following set of initial conditions, which way will the system shift to reach equilibrium?

$$p \text{H}_2\text{O} = 10.0 \text{ torr}; p \text{Cl}_2\text{O} = 69.0 \text{ torr}; p \text{HOCl} = 28.3 \text{ torr}$$

- A. left      B. right      C. no change      D. From the information given, it is impossible to choose.
3. Which one of the following statements is true for the reaction:



- A.  $K_p$  at 1000 K is less than  $K_p$  at 2000 K.  
B.  $K_p$  at 1000 K is larger than  $K_p$  at 2000 K.  
C.  $K_p$  at 1000 K is equal to  $K_p$  at 2000 K.  
D.  $K_p$  depends on total pressure as well as temperature.
4. If the equilibrium concentration of  $\text{H}^+$  is 0.0072 M in 0.08 M HF, what is the percent ionization of HF at this concentration?  
A. B. C. D.

5. Which one of the salts below will give a basic solution when it is dissolved in water?

A. NaF      B.  $\text{NH}_4\text{Cl}$       C.  $\text{NaNO}_3$       D. RbI

6. Which one of the compounds below **cannot** be classified as a strong acid or a strong base?

A.  $\text{H}_2\text{SO}_3$       B.  $\text{HNO}_3$       C. RbOH      D.  $\text{HClO}_4$

7. What is the pH of a 0.132 M HCl solution?  
 A. 0.88    B. -2.02    C. 2.02    D. -0.88
8. Formic acid has a  $K_a = 1.70 \times 10^{-4}$ . What is the pH of a 0.386 M solution of formic acid?  
 A. 3.77    B. 4.18    C. 2.63    D. 2.09
9. Codeine has a molar mass of 299 and a  $K_b = 8.91 \times 10^{-7}$ . What is the pH of a 23.2 mL solution containing 0.0387 g of codeine?  
 A. 4.15    B. 9.85    C. 6.05    D. 7.95

10. Given the following  $K_a$  values, which species is the strongest base?



- A.  $\text{CH}_3\text{COO}^-$     B.  $\text{COOH}^-$     C.  $\text{CN}^-$     D.  $\text{F}^-$
11. A solution is prepared mixing 55.0 mL of 7.00 M HCl and 30.0 mL of 3.50 M  $\text{HNO}_3$ . Assuming the volumes are additive, what is the pH of the solution?  
 A. 0.76    B. -0.76    C. 0.95    D. -0.95

12. Which of the following will produce a basic solution when added to water?

- A.  $\text{CO}_2(g)$     B.  $\text{SO}_3(g)$     C.  $\text{N}_2\text{O}_5(g)$     D.  $\text{Na}_2\text{O}(s)$

13. What is the conjugate base of  $\text{HClO}_3$  in the following reaction?



- A.  $\text{ClO}_3^-$     B.  $\text{HSO}_4^-$     C.  $\text{OH}^-$     D.  $\text{SO}_4^{2-}$
14. What is the pH of water at 40 °C given that  $K_w$  at this temperature is  $3.8 \times 10^{-14}$ ?  
 A. 7.0    B. 6.7    C. 7.3    D. 13.4
15. How many grams of NaOH (molar mass = 40) are needed to prepare 350 mL of solution with a pH of 10.0?  
 A.  $1.4 \times 10^{-9}$     B.  $3.7 \times 10^{-3}$     C.  $3.7 \times 10^{-9}$     D.  $1.4 \times 10^{-3}$
16. Which of the following is a true statement for a 0.10 M solution of a weak acid HA?  
 A. The pH is 1.00    B.  $[\text{H}^+]$  is much greater than  $[\text{A}^-]$   
 C.  $[\text{A}^-] = 0.10 \text{ M}$     D. The pH is greater than 1.00
17. What is the pH of the resulting solution when 36.0 g of acetic acid (molar mass = 60.06) and 30.0 g of sodium acetate (molar mass = 82.03) are diluted to a final volume of 800 mL with water?  $K_a$  for  $\text{CH}_3\text{COOH} = 1.8 \times 10^{-5}$   
 A. 4.53    B. 4.32    C. 4.71    D. 4.96

18. Which of the following will result in a buffered solution when equal volumes of the two aqueous solutions are mixed?
- A. 0.1 M HCl and 0.1 M NH<sub>3</sub>      B. 0.1 M HCl and 0.1 M NH<sub>4</sub>Cl  
 C. 0.2 M HCl and 0.1 M NH<sub>3</sub>      D. 0.1 M HCl and 0.2 M NH<sub>3</sub>
19. How many moles of sodium acetate (CH<sub>3</sub>COONa) must be added to 0.50 L of 0.575 M acetic acid (CH<sub>3</sub>COOH) to obtain a buffer solution with a pH = 4.29? K<sub>a</sub> for CH<sub>3</sub>COOH = 1.8 × 10<sup>-5</sup>
- A. 0.010      B. 0.050      C. 0.20      D. 0.10
20. What is the pH at the equivalence point for the titration of 0.020 moles of NH<sub>3</sub> with HCl? The total volume of the solution at the equivalence point is 300 mL. The K<sub>b</sub> for NH<sub>3</sub> = 5.6 × 10<sup>-10</sup>.
- A. 8.36      B. 5.64      C. 7.00      D. 1.71
21. How many mL of 0.335 M HCl are required to titrate 41.2 mL of 0.665 M Mg(OH)<sub>2</sub> to the equivalence point?
- A. 81.8      B. 95.7      C. 153      D. 164
22. What will happen when 124.0 mL of 0.152 M BaCl<sub>2</sub> and 108.1 mL of 0.129 M Na<sub>2</sub>SO<sub>4</sub> are mixed together? K<sub>sp</sub> for BaSO<sub>4</sub> = 1.1 × 10<sup>-10</sup>.
- A. BaSO<sub>4</sub> will precipitate      B. NaCl will precipitate  
 C. No precipitate will form      D. NaCl and BaSO<sub>4</sub> will precipitate
23. The molar solubility of an ionic compound M<sub>2</sub>X is 7.24 × 10<sup>-9</sup> M. What is the K<sub>sp</sub> for M<sub>2</sub>X?
- A. 3.80 × 10<sup>-25</sup>      B. 1.05 × 10<sup>-16</sup>      C. 1.52 × 10<sup>-24</sup>      D. 6.32 × 10<sup>-30</sup>
24. Silver chloride, which is insoluble in water, dissolves in water when a solution of NaCN is added. Which equation below can be used to explain why AgCl dissolves under these conditions?
- A. AgCl + CN<sup>-</sup> → AgCN + Cl<sup>-</sup>      B. AgCl + Na<sup>+</sup> → Ag<sup>+</sup> + NaCl  
 C. AgCl + CN<sup>-</sup> → Ag(CN)<sub>2</sub><sup>-</sup> + Cl<sup>-</sup>      D. AgCl + Na<sup>+</sup> → AgNaCl<sup>+</sup>
25. Addition of which one of the following aqueous solutions to CaCO<sub>3</sub> will cause the solubility of CaCO<sub>3</sub> to increase?
- A. CaCl<sub>2</sub>      B. Na<sub>2</sub>CO<sub>3</sub>      C. HCl      D. NaCl