

General Chemistry II

Dr. M. J. Wieder

Examination #5

Name _____

- (4) 1. In a buffer system that consists of $\text{HX}^{-2}/\text{H}_2\text{X}^{-1}$, the addition of a small amount of KOH will cause a decrease in the concentration of $(\text{HX}^{-2}, \text{H}_2\text{X}^{-1})$ and a corresponding increase in the concentration of $(\text{HX}^{-2}, \text{H}_2\text{X}^{-1})$.
- (4) 2. Which one of the following mixtures, when dissolved in water at 25°C , can serve as a buffer system?
- a) 0.2 mole KCl + 0.3 mole HCl
 - b) 0.3 mole KOH + 0.1 mole HF
 - c) 0.3 mole KOH + 0.2 mole HF
 - d) 0.3 mole KOH + 0.3 mole HF
 - e) 0.3 mole KOH + 0.4 mole HF
- (4) 3. In the titration of a weak base with strong acid, the highest pH value on the titration curve is:
- a) the initial pH
 - b) the pH at the 1/2 neutralization point
 - c) the pH at the equivalence point
 - d) the pH beyond the equivalence point
- (4) 4. At 25°C , when an aqueous solution of a weak acid, such as $\text{HC}_2\text{H}_3\text{O}_2$, has been half neutralized by strong base:
- a) pH = twice the initial pH value
 - b) pH = one half the initial pH value
 - c) pH = pK_a
 - d) pH = $\text{pK}_a - 14.00$
 - e) pH = $14.00 - \text{pK}_a$
- (4) 5. At 25°C , as KCN is added to a saturated aqueous solution of $\text{Fe}(\text{OH})_3$, the pH of the solution will (increase, decrease, remain the same).
 K_{sp} for $\text{Fe}(\text{OH})_3 = 4 \times 10^{-38}$ $K_{\text{formation}}$ for $\text{Fe}(\text{CN})_6^{-3} = 1 \times 10^{42}$
- (4) 6. The $K_{\text{formation}}$ value for $\text{X}(\text{NH}_3)_6^{+2}$ is 1×10^{18} , whereas that for $\text{Z}(\text{NH}_3)_6^{+2}$ is 1×10^{30} . Given 1M aqueous solutions of each complex ion at the same temperature, the solution of _____ will have the lower pH of the two.

- (4) 7. At a given temperature, as a saturated aqueous CaCO_3 solution is acidified, gaseous CO_2 is produced. As acid is added to the medium, the K_{sp} value for CaCO_3 (increases, decreases, remains the same). Assume sufficient $\text{CaCO}_3(\text{s})$ is present at all times to maintain equilibrium with its ions.
- (4) 8. Which one of the following weak acids would be most suitable for preparing a buffer mixture with a $\text{pH} = 4.20$ at 25°C ?
- a) HCOOH , $K_{\text{a}} = 1.8 \times 10^{-4}$ b) HF , $K_{\text{a}} = 6.6 \times 10^{-4}$
 c) HNO_2 , $K_{\text{a}} = 7.2 \times 10^{-4}$ d) CH_3COOH , $K_{\text{a}} = 1.8 \times 10^{-5}$
 e) $\text{C}_6\text{H}_5\text{COOH}$, $K_{\text{a}} = 6.3 \times 10^{-5}$
- (4) 9. If for a hypothetical slightly soluble salt, $\text{A}_2\text{B}(\text{s})$, K_{sp} at 25°C is 3.20×10^{-11} , then the molar solubility of A_2B in pure water is:
- a) $1.0 \times 10^{-4}\text{M}$ b) $2.0 \times 10^{-4}\text{M}$ c) $3.2 \times 10^{-4}\text{M}$ d) $4.0 \times 10^{-4}\text{M}$
- (4) 10. At what pH will $\text{Cu}(\text{OH})_2$ start to precipitate from an aqueous solution with a $[\text{Cu}^{+2}] = 0.20\text{M}$? K_{sp} for $\text{Cu}(\text{OH})_2(\text{s}) = 5.6 \times 10^{-20}$
- a) 4.72 b) 5.76 c) 6.62 d) 7.38 e) 8.55
- (4) 11. Consider the equilibrium reaction, at 25°C , shown below:
 $1\text{AgI}(\text{s}) + 2\text{CN}^{-1}(\text{aq}) \rightleftharpoons 1\text{Ag}(\text{CN})_2^{-1}(\text{aq}) + 1\text{I}^{-1}(\text{aq}) \quad K_{\text{c}}$
- What is K_{c} for the equilibrium reaction shown above?
 Given: K_{sp} for $\text{AgI}(\text{s}) = 8.5 \times 10^{-17}$ K_{f} for $\text{Ag}(\text{CN})_2^{-1}(\text{aq}) = 5.6 \times 10^{18}$
- a) 1.5×10^{-35} b) 7.1×10^{-18} c) 476 d) 4.8×10^{22} e) 6.6×10^{36}
- (14) 12. Match the following terms in Column A with the appropriate descriptor in Column B:

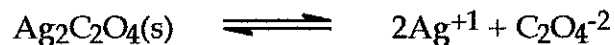
Column A

Column B

- | | | |
|-----------------------------|-------|--|
| a) Weak acid | _____ | Complete neutralization |
| b) Buffer systems | _____ | Ion product $> K_{\text{sp}}$ |
| c) Instability constant | _____ | K_{a} , K_{b} , or $K_{\text{hydrolysis}}$ |
| d) End point | _____ | Acid-base indicator |
| e) Equivalence point | _____ | Ion product $< K_{\text{sp}}$ |
| f) Precipitation will occur | _____ | $1/K_{\text{formation}}$ |
| g) Unsaturated solution | _____ | Indicator color change |

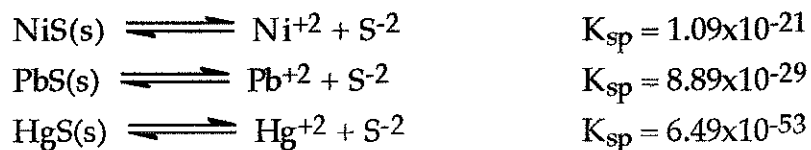
- (8) 13. What is the molar solubility, at 25°C , of $\text{Cd}(\text{OH})_2$ in an aqueous NaOH solution whose pH is 11.00?
 K_{sp} for $\text{Cd}(\text{OH})_2 = 5.0 \times 10^{-15}$ Show all work in the space below.
- (8) 14. Determine the instability constant, $K_{\text{instability}}$, for a 0.010M solution of $\text{X}(\text{NH}_3)_2^{+1}$ given that the equilibrium concentration of NH_3 is $2.0 \times 10^{-6}\text{M}$. Show all work in the space below.
- (9) 15. What is the pH of a solution resulting from the addition of 80 ml of 0.10M $\text{HC}_2\text{H}_3\text{O}_2$ to 20 ml of 0.10M KOH ? Assume volumes are additive. K_{a} for $\text{HC}_2\text{H}_3\text{O}_2 = 1.8 \times 10^{-5}$.
Show all work in the space below.

- (8) 16. Consider the following equilibrium:



If one liter of pure water can dissolve a maximum of 0.0337 grams of $\text{Ag}_2\text{C}_2\text{O}_4$ (Molar mass = 303.74 g/mol) at 25°C, determine K_{sp} for $\text{Ag}_2\text{C}_2\text{O}_4$. Show all work in the space below.

- (9) 17. Consider the following equilibria:



A saturated H_2S solution is 0.020M in Ni^{+2} , 0.015M in Pb^{+2} , and 0.001M in Hg^{+2} . The acidity of the medium is adjusted so that the concentration of S^{-2} is $5.2 \times 10^{-21}\text{M}$. Which metal ion(s), if any, will precipitate? Show all work in the space below.