

## Teaching Center

### CHM 2046 Exam 2 Review (Summer 2020)

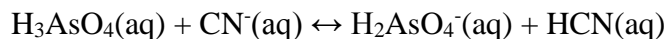
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1. Which compound would have increased solubility when placed in an acidic solution?

- (1) AgCl(s)      (2) KF(s)      (3) NaNO<sub>3</sub>(aq)      (4) H<sub>2</sub>CO<sub>3</sub>(aq)      (5) LiBr(s)

2. A solution is created by combining 0.50 M H<sub>3</sub>AsO<sub>4</sub> and 0.25 M HCN. Find the K<sub>eq</sub> of the chemical reaction shown below as well as determine whether the reactants or products will be favored.



pK<sub>a</sub> of H<sub>3</sub>AsO<sub>4</sub>: 2.30 | pK<sub>a</sub> of HCN: 9.21

(1) 8.12 x 10<sup>6</sup>; reactants

(2) 8.12 x 10<sup>6</sup>; products

(3) 1.23 x 10<sup>-7</sup>; reactants

(4) 1.23 x 10<sup>-7</sup>; products

(5) 3.09 x 10<sup>-12</sup>; reactants

3. Cr(III) forms an octahedral complex with the ligand CN<sup>-</sup>. How many unpaired electrons are in the d orbitals of chromium?

(1) 1

(2) 2

(3) 3

(4) 4

(5) 5

4. Calculate the pH of a solution that is 0.10 M CH<sub>3</sub>COOH and 0.05 M Ba(CH<sub>3</sub>COO)<sub>2</sub>

(1) 7.60

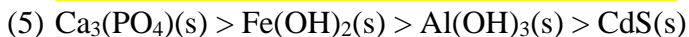
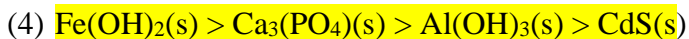
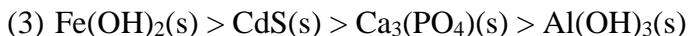
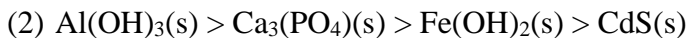
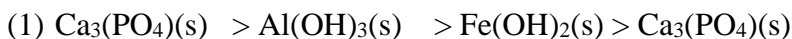
(2) 4.75

(3) 9.10

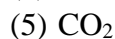
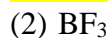
(4) 8.21

(5) 11.2

5. Arrange the following compounds in order of decreasing cation molar solubility.



6. Which of the following is a Lewis Base?



7. Which of the following mixtures will result in a buffer solution?

I: 50mL of 0.10 M NaOH added to 30mL of 0.10 M  $\text{CH}_3\text{COOH}$

II: 50mL of 0.10 M HCl added to 100mL of 0.10 M  $\text{NH}_3$

III: 50mL of 0.10 M  $\text{HClO}_2$  added to 50mL of 0.10 M  $\text{NaClO}_2$

(1) Only II (2) Only III (3) I and III (4) II and III (5) I, II and III

8. Two buffers were prepared - the first was made by mixing 50 mL of 0.50 M HF and 50 mL of 0.50 M KF and the second was made by mixing 200 mL of 0.50 M HF and 50 mL of 0.50 M KF. Which mixture has the greater buffer capacity if an acid was added to both buffers?

(1) The first buffer

(2) The second buffer

(3) Both have the same capacity

9. 0.1123 M HBr is used to titrate a 100.0 mL solution of  $\text{NaNO}_2$  of unknown concentration. It took 88.07 mL of HBr to reach the equivalence point. What is the pH of the solution at the following points in the titration:

$$K_b \text{ of } \text{NO}_2^- = 1.4 \times 10^{-11}$$

- a) Before acid is added 8.07
- b) At half-equivalence 3.15
- c) At equivalence point 2.21
- d) After 100.0 mL of acid is added 2.17

10. Below is a list of formulas for complex compounds and ions; each is matched with its name. One formula – name combination contains an error. Which one?

- (1)  $\text{Na}_3[\text{AlF}_6]$  sodium hexafluoroaluminate
- (2)  $[\text{Fe}(\text{en})_2(\text{OH})_2]\text{ClO}_4$  bis(ethylenediamine)dihydroxoiron(III) perchlorate
- (3)  $\text{K}_2[\text{Pb}(\text{SCN})_2\text{F}_2]$  potassium difluorodithiocyanateplumbate(II)
- (4)  $[\text{Ni}(\text{CO})_6][\text{CuCl}_4]_2$  hexacarbonylnickel(II) tetrachlorocuprate(II)
- (5)  $[\text{Pt}(\text{NH}_3)_4\text{BrCl}](\text{NO}_3)_2$  tetraamminebromochloroplatinum(V) nitrate

11. A solution contains  $0.001 \text{ M CO}_3^{2-}$  and  $0.001 \text{ M OH}^-$ . If  $\text{Fe}(\text{NO}_3)_2$  is added slowly to the solution, which salt will precipitate first? What concentration of  $\text{Fe}(\text{NO}_3)_2$  will cause its precipitation?

$$K_{\text{sp}}(\text{FeCO}_3) = 1.0 \times 10^{-13}$$

$$K_{\text{sp}}(\text{Fe}(\text{OH})_2) = 1.0 \times 10^{-15}$$

(1)  $\text{Fe}(\text{OH})_2$ ;  $1.0 \times 10^{-9} \text{ M}$

(2)  $\text{Fe}(\text{OH})_2$ ;  $1.0 \times 10^{-12} \text{ M}$

(3)  $\text{FeCO}_3$ ;  $1.0 \times 10^{-7} \text{ M}$

(4)  $\text{FeCO}_3$ ;  $1.0 \times 10^{-10} \text{ M}$

12. Consider the two statements below. Which of the following best explains (I) and (II)?

(I) the  $K_a$  of  $\text{HXO}_2$  is greater than the  $K_a$  of  $\text{HYO}_2$ , but (II) the  $K_a$  of  $\text{HX}$  is less than the  $K_a$  of  $\text{HY}$

(A) (I) X is less electronegative than Y, and (II) the  $\text{H}-\text{X}$  bond is longer than the  $\text{H}-\text{Y}$  bond

(B) (I) X is more electronegative than Y, and (II) the  $\text{H}-\text{X}$  bond is shorter than the  $\text{H}-\text{Y}$  bond

(C) (I) the  $\text{H}-\text{X}$  bond is weaker than the  $\text{H}-\text{Y}$  bond, and (II) X is more electronegative than Y

(D) (I) the  $\text{H}-\text{X}$  bond is stronger than the  $\text{H}-\text{Y}$  bond, and (II) X is less electronegative than Y

13. Consider the complex ion  $[\text{Cu}(\text{H}_2\text{O})]^{2+}$ . Which answer includes all of the following true statements?

I: It is paramagnetic    II: It is a low spin complex    III: It is a high spin complex

IV: The ligands are weak field ligands    V: The Cu has 2 unpaired electrons

(1) I, II, V

(2) I, III, IV

(3) III, IV

(4) III, V

(5) I, IV, V

14. Consider the following complex ions. Which ones do you expect to be colorless?

I:  $[\text{FeCN}_6]^{4-}$     II:  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$     III:  $[\text{Ti}(\text{NO}_2)_6]^{4-}$     IV:  $[\text{V}(\text{H}_2\text{O})]^{2+}$     V:  $[\text{Zn}(\text{H}_2\text{O})]^{2+}$

(1) I, II

(2) I, III, IV

(3) II, III, V

(4) III, IV

(5) I, IV

15. A solution contains 0.40 M  $\text{CaCl}_2$  and 0.20  $\text{CuCl}_2$ . A solution of  $\text{NaOH}$  is added to the mixture to try and separate the metal ions. What is the highest concentration of  $\text{NaOH}$  that can be added?  $K_{\text{sp}}$  of  $\text{Ca(OH)}_2$  is  $6.5 \times 10^{-6}$  and  $K_{\text{sp}}$  of  $\text{Cu(OH)}_2$  is  $2.2 \times 10^{-20}$ .

(1)  $4.0 \times 10^{-3} \text{ M}$

(2)  $5.7 \times 10^{-3} \text{ M}$

(3)  $2.3 \times 10^{-10} \text{ M}$

(4)  $3.3 \times 10^{-10} \text{ M}$

(5)  $2.5 \times 10^{-4} \text{ M}$

16. The  $K_{\text{sp}}$  of  $\text{CoS}$  is  $4.0 \times 10^{-21}$  and  $K_{\text{f}}$  of  $[\text{Co(OH)}_4]^{2-}$  is  $5.0 \times 10^9$ . What is the molar solubility (in M) of  $\text{CoS}$  in 2.0 M  $\text{NaOH}$ ?

(1)  $1.8 \times 10^{-5}$

(2)  $8.9 \times 10^{-6}$

(3)  $2.4 \times 10^{-10}$

(4)  $3.2 \times 10^{-10}$

(5)  $2.0 \times 10^{-1}$

17. A 0.10 M solution of which of the following would be most basic?

$K_{\text{a}}(\text{NH}_4^+) = 5.6 \times 10^{-10}$   $K_{\text{a}}(\text{CH}_3\text{COOH}) = 1.76 \times 10^{-5}$   $K_{\text{a}}(\text{HCN}) = 6.17 \times 10^{-10}$

(1)  $\text{RbI}$

(2)  $\text{NH}_4\text{NO}_3$

(3)  $\text{KCH}_3\text{COO}$

(4)  $\text{NaCN}$

(5)  $\text{BaCl}_2$