

Teaching Center

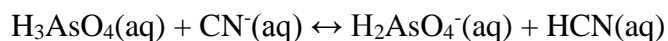
CHM 2046 Exam 2 Review (Summer 2020)

Visit <https://teachingcenter.ufl.edu/tutoring/test-reviews/> for this review as well as reviews for the other courses we tutor!

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

- (1) AgCl(s) (2) KF(s) (3) NaNO₃(aq) (4) H₂CO₃(aq) (5) LiBr(s)

2. A solution is created by combining 0.50 M H₃AsO₄ and 0.25 M HCN. Find the K_{eq} of the chemical reaction shown below as well as determine whether the reactants or products will be favored.



pK_a of H₃AsO₄: 2.30 | pK_a of HCN: 9.21

- (1) 8.12 x 10⁶; reactants
(2) 8.12 x 10⁶; products
(3) 1.23 x 10⁻⁷; reactants
(4) 1.23 x 10⁻⁷; products
(5) 3.09 x 10⁻¹²; reactants

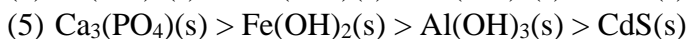
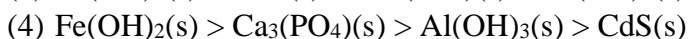
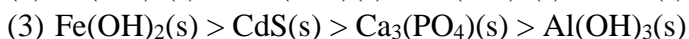
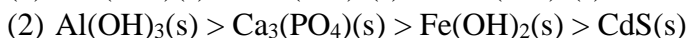
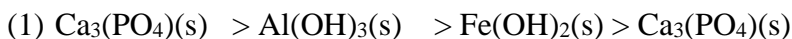
3. Cr(III) forms an octahedral complex with the ligand CN⁻. How many unpaired electrons are in the d orbitals of chromium?

- (1) 1
(2) 2
(3) 3
(4) 4
(5) 5

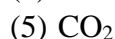
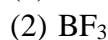
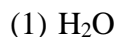
4. Calculate the pH of a solution that is 0.10 M CH₃COOH and 0.05 M Ba(CH₃COO)₂

- (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 CH_3COOH

II: 50mL of 0.10 M HCl added to 100mL of 0.10 M NH_3

III: 50mL of 0.10 M HClO_2 added to 50mL of 0.10 M 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 NaNO_2 of unknown concentration. It took 44.07 mL of HBr to reach the equivalence point. What is the pH of the solution at the following points in the titration:

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

- 1) Before acid is added
- 2) At half-equivalence
- 3) At equivalence point
- 4) After 100.0 mL of acid is added

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 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) FeCO_3 ; $1.0 \times 10^{-7} \text{ M}$
- (4) 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 HXO_2 is greater than the K_a of HYO_2 , but (II) the K_a of HX is less than the K_a of HY

- (A) (I) X is less electronegative than Y, and (II) the H—X bond is longer than the H—Y bond
- (B) (I) X is more electronegative than Y, and (II) the H—X bond is shorter than the H—Y bond
- (C) (I) the H—X bond is weaker than the H—Y bond, and (II) X is more electronegative than Y
- (D) (I) the H—X bond is stronger than the H—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 CaCl_2 and 0.20 CuCl_2 . A solution of NaOH is added to the mixture to try and separate the metal ions. What is the highest concentration of NaOH that can be added? K_{sp} of Ca(OH)_2 is 6.5×10^{-6} and K_{sp} of Cu(OH)_2 is 2.2×10^{-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_{sp} of CoS is 4.0×10^{-21} and K_{f} of $[\text{Co(OH)}_4]^{2-}$ is 5.0×10^9 . What is the molar solubility (in M) of CoS in 2.0 M NaOH ?

- (1) 1.8×10^{-5}
- (2) 8.9×10^{-6}
- (3) 2.4×10^{-10}
- (4) 3.2×10^{-10}
- (5) 2.0×10^{-1}

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

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

- (1) RbI
- (2) NH_4NO_3
- (3) KCH_3COO
- (4) NaCN
- (5) BaCl_2