

**Chemistry 1020 Sample 2 for Hour Exam #5 (14A, 14B, & 15A) Revised by RBSK, 5/2003**

.....Each of the following questions is worth 7 points.....

You should study your text, study your handbook modules, and review your drill quizzes BEFORE taking this exam. When taking it you should only use a periodic table and a calculator. After completing the ENTIRE test, check your answers against those available in your handbook. Do NOT study for this exam by merely looking at the answers.

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- K-TYPE** answer format: *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.*
  - If the pOH of a solution is 8.2, then its pH is 6.8. **(14B-2)**
  - If the pH of a solution is 9.5, it would turn litmus red. **(14A-6)**
  - If NaCH<sub>3</sub>COO dissolves in water, the solution is neutral. **(14B-7)**
  - If CO<sub>2</sub> dissolves in water, there would be more CO<sub>2</sub> (aq) {aka H<sub>2</sub>CO<sub>3</sub> (aq)} than H<sup>+</sup> (aq) or HCO<sub>3</sub><sup>-</sup> (aq) ions in solution. **(14A-4)**
  
- What is the pOH of a 0.0015 M solution of perchloric acid? **(14B-3)**
  - 11.18
  - 2.82
  - 2.52
  - 11.48
  - 7.00
  
- CHALLENGE:** If NaHCO<sub>3</sub> is dissolved in water, the principal equilibrium is  $2 \text{HCO}_3^- = \text{H}_2\text{CO}_3 + \text{CO}_3^{2-}$ . What is the equilibrium constant for this equilibrium?
  - $[\text{K}_a(\text{HCO}_3^-)] * [\text{K}_a(\text{H}_2\text{CO}_3)]$
  - $[\text{K}_a(\text{HCO}_3^-)] \div [\text{K}_a(\text{H}_2\text{CO}_3)]$
  - $[\text{K}_a(\text{H}_2\text{CO}_3)] \div [\text{K}_a(\text{HCO}_3^-)]$
  - $[\text{K}_a(\text{HCO}_3^-)] * [\text{K}_a(\text{CO}_3^{2-})]$
  - $[\text{K}_a(\text{HCO}_3^-)] \div [\text{K}_a(\text{CO}_3^{2-})]$
  
- K-TYPE Answer Format:** *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.*

Use K-TYPE answer format to choose the correct statements from the following.

  - A solution prepared by adding 0.2 moles of NH<sub>3</sub>(aq) and 0.2 moles of NH<sub>4</sub>Cl to 300 ml of water would have buffer properties. **(15A-3)**
  - HClO reacts with NaOH to produce NaClO and water. **(14A-2)**
  - A solution prepared by mixing 1/8 mole of NaOH and 1/4 mole of HF in a liter of water would have buffer properties. **(15A-3)**
  - NH<sub>3</sub> (aq) is an acid and is related to the salt NH<sub>4</sub>NO<sub>3</sub>. **(14B-6)**

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5. **K-TYPE** Answer Format: *Mark a if A, B, C are correct; b if A, C; c if B, D; d if D only; e otherwise.* (14A-7)
- A. In the equation  $\text{HBr} + \text{H}_2\text{O} \rightarrow \text{Br}^- + \text{H}_3\text{O}^+$ , HBr acts like a Bronsted-Lowry base.
  - B. A Bronsted-Lowry base accepts  $\text{H}^+$  ion in an equation.
  - C.  $\text{H}_2\text{IO}_2^+$  is the conjugate base of  $\text{HIO}_2$ .
  - D. In the equation  $\text{H}_2\text{S} + \text{H}_3\text{BO}_3 \rightarrow \text{H}_2\text{BO}_3^- + \text{H}_3\text{S}^+$ ,  $\text{H}_3\text{BO}_3$  acts as a Bronsted-Lowry acid.
6. What happens to the  $[\text{OH}^-]$  of a solution if its pH decreases by 4 units? (14B-2)
- A. It becomes 4 times as large as the original value.
  - B. It is reduced to 1/4 of the original value.
  - C. It becomes 10,000 times as large as the original value.
  - D. It is reduced to 1/10,000 of the original value.
  - E. It is not affected.
7. What is the pH of a solution which is 0.30 M in methylamine ( $\text{CH}_3\text{NH}_2$ ) and 0.20 M in methylammonium chloride ( $\text{CH}_3\text{NH}_3\text{Cl}$ )? (15A-4)
- A. 10.85                      B. 3.15                      C. 10.50                      D. 3.50                      E. 8.40
8. What is the  $[\text{OH}^-]$  of a solution whose pH is 9? (14B-2)
- A.  $10^{-11}$  M                      B.  $10^{-10}$  M                      C.  $10^{-7}$  M                      D.  $10^{-5}$  M                      E.  $10^{-9}$  M

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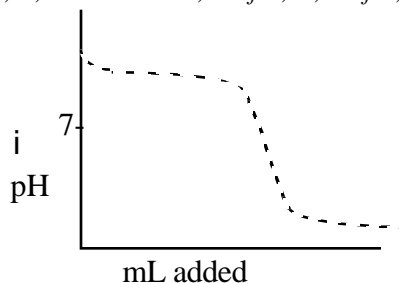
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9. How does the pH of an acid solution change when the  $[H^+]$  of the solution is decreased to 1/1,000 of its original value? **(14B-2)**
- A. It decreases by three units.
  - B. It increases by three units.
  - C. It becomes 1,000 times its original value.
  - D. It decreases to 1/1,000 of its original value.
  - E. It is not affected.

10. What is the pH of a solution prepared by adding 80.0 ml of 0.20 M barium hydroxide to 60.0 ml of 0.20 M hydrochloric acid? **(15A-7)**
- A. 1.54                      B. 0.85                      C. 12.70                      D. 13.16                      E. 12.46

11. **K-TYPE** Answer Format: *Mark a if A, B, C are correct; b if A, C; c if B, D; d if D only; e otherwise.*



- A. The curve in the diagram represents the titration of a base by an acid. **(15A-6)**
- B. The substance being titrated is a weak electrolyte **(15A-6)**
- C. The equivalence point is at  $pH < 7$ . **(15A-6)**
- D. An acid with  $K_a = 2.8 \times 10^{-8}$  is stronger than the one with  $K_a = 1.6 \times 10^{-6}$ . **(14A-8)**

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12. **K-TYPE** answer format: *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.* (14A-9)

- A. In  $\text{Cu}^{2+} + 6\text{I}^- \rightarrow [\text{CuI}_6]^{4-}$ ,  $\text{I}^-$  acts as a Lewis acid.
- B. In the equation  $\text{BF}_3 + \text{NH}_3 \rightarrow \text{BF}_3\text{NH}_3$ ,  $\text{NH}_3$  acts as a Lewis acid.
- C. A Lewis acid is defined to be a hydroxide ion acceptor.
- D. In the reaction  $\text{NH}_3 + [\text{FeCl}_6]^{4-} \rightarrow [\text{FeCl}_5\text{NH}_3]^{3-} + \text{Cl}^-$ ,  $[\text{FeCl}_6]^{4-}$  functions as a Lewis acid.

13. What is the pH of a 0.41 M solution of methylamine  $\text{CH}_3\text{NH}_2$ ? (14B-5, 15A-2)

- A. 8.47                      B. 3.71                      C. 1.85                      D. 12.15                      E. 10.29

14. **K-TYPE** answer format: *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.*

Use K-TYPE answer format to choose the correct statements from the following. (14A-10)

- A.  $\text{H}_2\text{SO}_4$  is less acidic than  $\text{H}_2\text{SeO}_4$ .
- B.  $\text{HIO}_4$  is less acidic than  $\text{HIO}$ .
- C.  $\text{PH}_3$  is more acidic than  $\text{HCl}$ .
- D.  $\text{HBr}$  is more acidic than  $\text{HCl}$ .

15. What is the pH of a 0.20 M solution of methylammonium chloride  $\text{CH}_3\text{NH}_3\text{Cl}$ ? (14B-9)

- A. 2.01                      B. 11.38                      C. 11.99                      D. 8.31                      E. 5.69

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16. Choose the substances which are correctly described using **K-TYPE** answer format: *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise. (14A-1)*
- A. HI is a strong acid.
  - B. KOH is a weak base.
  - C. H<sub>2</sub>S is a polyprotic acid.
  - D. CO<sub>3</sub><sup>2-</sup> is a weaker base than is SO<sub>3</sub><sup>2-</sup>.

Answer Sheet for Test "C2.H5.WB2.sample", 5/7/03

No. in Q-Bank	No. on Test	Correct Answer	
23	6	1	D
24	6	2	A
17	6	3	B
27	6	4	A
22	6	5	C
30	6	6	D
28	6	7	A
29	6	8	D
25	6	9	B
19	6	10	D
26	6	11	A
21	6	12	D
31	6	13	D
20	6	14	D
32	6	15	E
18	6	16	B