

CHEM 188 – Spring, 2012

Hour Exam 2 (Early)

March 7, 2012

Instructions:

Your scantron answer sheet must show your **NAME**, **7-DIGIT KU ID NUMBER**, and **LAB SECTION**. (Begin these entries at the **LEFT** end of the space provided.)

In answering the questions, be careful to fill in the corresponding circles on the answer sheet according to the number of the question on the exam. **USE A SOFT (No. 2) PENCIL**

Useful information: Henderson-Hasselbalch eqn. $\text{pH} = \text{pK}_a + \log \frac{[\text{conj. base}]}{[\text{acid}]}$

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. In the reaction

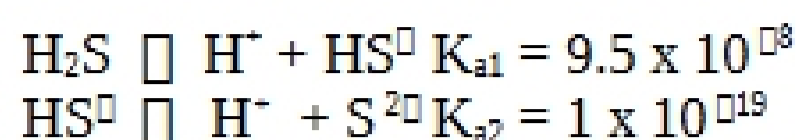


the **Brønsted bases** are

- A. CH_3COO^- and HCN B. CH_3COO^- and CH_3COOH C. HCN and CN^-
D. HCN and CH_3COOH E. CH_3COO^- and CN^-
2. What is the **pOH** (to the correct number of significant figures) of a solution in which the hydroxide ion concentration is $6.00 \times 10^{-3} \text{ M}$?
- A. 2 B. 2.2 C. 2.22 D. 2.222 E. 2.2218
3. Which of the following statements is **true** for a 0.10 M solution of a weak acid, HA?
- A. The $\text{pH} = 1.00$
B. The $\text{pH} > 1.00$
C. $[\text{H}^+] > [\text{HA}]$
D. $[\text{H}^+] < [\text{A}^-]$
E. none of the above

4. Which answer correctly lists all of the **weak bases** from the following list?
1. LiOH (lithium hydroxide)
 2. Mg(OH)₂ (magnesium hydroxide)
 3. KOH (potassium hydroxide)
 4. Al(OH)₃ (aluminum hydroxide)
 5. CH₃NH₂ (methyl amine)
- A. 2 & 5 B. 1 & 4 C. 2, 3 & 4 D. 4 & 5 E. 2, 4 & 5
5. Calculate the **pOH** of 0.0050 M Ca(OH)₂.
- A. 1.40 B. 1.70 C. 2.00 D. 2.30 E. 12.00
6. The K_a for hydrofluoric acid, HF, is 7.1 x 10⁻⁴. Calculate the **pH** of a 1.25 × 10⁻² M HF solution.
- A. 2.58 B. 2.99 C. 3.47 D. 5.00 E. 6.25
7. Estimate the **pH** of a 250 mL aqueous solution prepared by dissolving 2.5 g of acetic acid (CH₃COOH) in water. [K_a = 1.8 x 10⁻⁵ for acetic acid]
- A. 2.16 B. 2.46 C. 2.76 D. 3.06 E. 3.36
8. The pH of a 0.25 M weak monoprotic acid (HA) solution is 3.50. What is the K_a value for this acid?
- A. 6.3 x 10⁻⁸ B. 4.0 x 10⁻⁷ C. 1.3 x 10⁻⁶
D. 4.0 x 10⁻⁶ E. 1.3 x 10⁻⁵
9. Calculate the **percent ionization** of 0.50 M CH₃COOH (acetic acid), given K_a = 1.8 x 10⁻⁵.
- A. 0.60 % B. 1.3% C. 1.9% D. 2.7% E. 3.0%
10. How many **grams** of nitrous acid, HNO₂, are required to make 750 mL of an aqueous solution with a pH of 2.35? (K_a = 4.5 x 10⁻⁴ for nitrous acid.)
- A. 1.1 g B. 1.7 g C. 2.7 g D. 4.2 g E. 6.5 g
11. Methylamine (CH₃NH₂) is a weak base, with K_b = 4.4 x 10⁻⁴. Calculate the **pH** of a 0.010 M solution of CH₃NH₂.
- A. 10.32 B. 10.82 C. 11.11 D. 11.17 E. 11.28

12. Hydrosulfuric acid (H_2S) is a **diprotic acid**. Its two stages of ionization are:



Calculate the **concentration of S^{2-}** in a 0.10 M H_2S solution.

- A. 1×10^{-19} M B. 9.7×10^{-5} M C. 1.2×10^{-4} M
D. 0.011 M E. 0.10 M
13. Calculate the **pH** of a 0.25 M NaCN solution, given $K_a(\text{HCN}) = 4.9 \times 10^{-10}$.
- A. 2.65 B. 2.84 C. 7.00 D. 11.16 E. 11.35
14. Which of the following is the **most acidic solution**? [$K_a = 4.9 \times 10^{-10}$ for HCN, and $K_a = 4.5 \times 10^{-4}$ for HNO_2 .]
- A. 0.10 M HCN and 0.10 M NaCN
B. 0.10 M HCN
C. 0.10 M HNO_2
D. 0.10 M HNO_2 and 0.10 M NaNO_2
E. 0.10 M NaNO_2
15. Which of the following mixtures cannot be a **buffer solution**?
1. H_3PO_4 and NaH_2PO_4
2. Na_2CO_3 and NaHCO_3
3. NH_4Cl and NaCl
- A. 1 only B. 2 only C. 3 only D. 1 and 2 only E. 1, 2 and 3
16. A solution is prepared by mixing 500. mL of 0.40 M NaOCl and 500. mL of 0.20 M HOCl. What is the **pH** of this solution? $K_a(\text{HOCl}) = 3.2 \times 10^{-8}$.
- A. 6.89 B. 7.19 C. 7.49 D. 7.80 E. 8.10
17. You are asked to prepare an acetic acid - sodium acetate buffer solution with a pH of 4.25. What **molar ratio of CH_3COONa to CH_3COOH** should be used? [$K_a = 1.8 \times 10^{-5}$ for CH_3COOH]
- A. 3.2 B. 1.8 C. 0.57 D. 0.32 E. 0.18
18. You have 500.0 mL of a buffer solution containing 0.30 M benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$) and 0.30 M sodium benzoate ($\text{C}_6\text{H}_5\text{COONa}$). What will the **pH** of this solution be after the addition of 50.0 mL of 1.00 M NaOH solution? [$K_a(\text{C}_6\text{H}_5\text{COOH}) = 6.5 \times 10^{-5}$]
- A. 4.33 B. 4.49 C. 4.67 D. 4.89 E. 5.23