

CHEMISTRY 102**EXAM 3 FORM B****SECTION 501****FALL 2008****DR. KEENEY-KENNICUTT**

- Directions: (1) Put your name on PART 1 and your name and signature on PART 2 of the exam where indicated.
- (2) Sign the Aggie Code on PART 2 of this exam.
- (3) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, **put the same answer down for both questions** for 5 pts. If you cannot decide between two answers, put your best answer down for the first (odd) question and the other answer down for the second (even) question. If you get the first one correct you'll get 3 pts; if you get the second one correct you'll get 2 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
- (4) Do NOT write on the envelope.
- (5) When finished, put everything in the envelope and wait to be excused. At the table, take everything out of the envelope. You can pick up the multiple choice part with the answers outside my office after 3pm.
- (6) There are a total of 33 questions (19 actual questions).
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PART 1

1&2. A 0.10 M solution of which one of the following salts has a pH greater than 7?

- (a) KBr (b) $\text{CH}_3\text{NH}_3\text{Cl}$ (c) $\text{Ba}(\text{NO}_3)_2$ (d) KClO (e) NH_4Cl

3&4. Which one of the following acids is NOT a strong acid?

- (a) HNO_3 (b) HClO_3 (c) HClO_4 (d) HCl (e) HF

5&6. The conjugate acid of HF is:

- (a) H_2F^+ (b) OH^- (c) F^- (d) H_3O^+ (e) none of these

7&8. The acid-base indicator, HIn , has a K_a value of 1.0×10^{-8} . The endpoint for any titration using this indicator will occur at $\text{pH} = \underline{\hspace{2cm}}$:

- (a) 7 (b) 10 (c) 6 (d) 8 (e) 13

9&10. Which of the following combinations are buffer solutions? All components are present in 0.50 M concentrations.

(1) HNO_3 and NH_4NO_3 (2) HClO_3 and NaClO_3 (3) HCN and NaCN (4) NH_3 and NH_4Cl

(a) 1, 3, 4 (b) 1, 2 (c) 2, 3, 4 (d) 3, 4 (e) 1, 3

11&12. Consider 0.1 M solutions of the following weak acids:

CH_3COOH $K_a = 1.8 \times 10^{-5}$

HBrO $K_a = 2.5 \times 10^{-9}$

Which of the following statements is **NOT** correct?

- (a) Acetic acid is a stronger acid than hypobromous acid.
- (b) The concentration of OH^- ions is greater in the HBrO solution.
- (c) $[\text{BrO}^-]$ in HBrO solution $>$ $[\text{CH}_3\text{COO}^-]$ in CH_3COOH solution.
- (d) $[\text{H}^+]$ in CH_3COOH solution $>$ $[\text{H}^+]$ in HBrO solution.
- (e) The pH of the CH_3COOH solution is lower than the pH of the HBrO solution.

13&14. A 0.20 M solution of a monoprotic acid is 3.7% ionized. What is the K_a for this weak acid?

(a) 1.3×10^{-3} (b) 3.7×10^{-4} (c) 3.2×10^{-6} (d) 2.9×10^{-5} (e) 2.7×10^{-4}

15&16. What is the pH of a 8.2×10^{-4} M HCl?

- (a) 2.35 (b) 4.51 (c) 4.72 (d) 3.09 (e) 3.17

17&18. It is desired to buffer a solution at pH = 10.3.

What molar ratio of CH_3NH_2 to $\text{CH}_3\text{NH}_3\text{Cl}$ should be used?

- (a) 0.88/1 (b) 0.70/1 (c) 0.12/1 (d) 2.8/1 (e) 0.40/1

19&20. Calculate the ΔG° for the reaction at 25°C if the value of the thermodynamic equilibrium constant, K_{thermo} , is 1.00×10^{-2} ? ($R = 8.314 \text{ J/mol}\cdot\text{K}$)

- (a) -5.4 kJ/mol (b) $+11.4 \text{ kJ/mol}$ (c) $+5.4 \text{ kJ/mol}$
(d) $+95.7 \text{ kJ/mol}$ (e) -11.4 kJ/mol

21&22. If K_w is 2.9×10^{-15} at 10°C , what is the pH of pure water at 10°C ?

- (a) 6.51 (b) 7.00 (c) 7.27 (d) 7.45 (e) none of these

23&24. What is the pH of a solution that is 0.25 M NH_4NO_3 ?

- (a) 4.93 (b) 5.50 (c) 9.16 (d) 4.32 (e) 7.00

The following 5 questions (25 – 31) deal with a single titration:

25&26. A 50.0 mL sample of 0.100 *M* nitrous acid is titrated with 0.200 *M* NaOH. Calculate the initial pH before the titration is begun. The K_a for nitrous acid is on the back of the envelope.

- (a) 2.17 (b) 1.58 (c) 1.00 (d) 2.39 (e) 2.04

27&28. A 50.0 mL sample of 0.100 *M* nitrous acid is titrated with 0.200 *M* NaOH. Calculate the pH after 10.0 mL of 0.200 *M* NaOH has been added.

- (a) 2.92 (b) 3.17 (c) 3.00 (d) 3.52 (e) 3.66

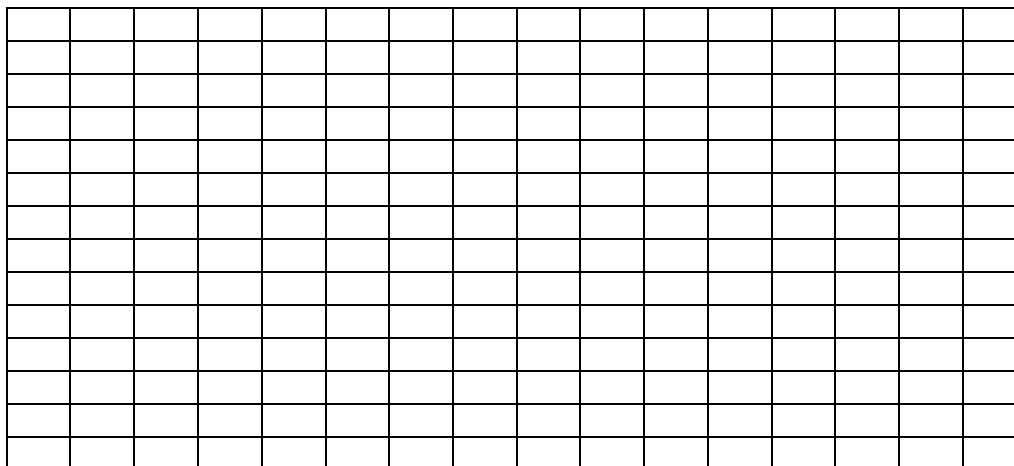
PART 2

Please read and sign: "On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam." _____

(5 pts) **29.** A 50.0 mL sample of 0.100 *M* nitrous acid is titrated with 0.200 *M* NaOH. Calculate the pH at the equivalence point.

(5 pts) **30.** A 50.0 mL sample of 0.100 *M* nitrous acid is titrated with 0.200 *M* NaOH. Calculate the pH after 30.0 mL of 0.200 *M* NaOH is added.

- (5 pts) **31.** A 50.0 mL sample of 0.100 M nitrous acid is titrated with 0.200 M NaOH. Using the answers to Questions 21-26, sketch the titration curve with pH on the vertical axis and milliliters of base added on the horizontal axis. Label the axes and plot your 4 points. Point out the buffer region and the equivalence point. If you cannot complete the calculations, sketch what the curve should look like for partial credit.



- (5 pts) **32.** (a) All solutions of soluble salts and bases will become saturated if the concentrations are high enough. Write the appropriate equilibrium and the K_{sp} expression for $\text{CuF}_2(\text{s})$.

- (5 pts) (b) If 47.0 grams of CuF_2 will dissolve in 1.00 L of solution at 25°C , what is the K_{sp} for CuF_2 at 25°C ?

(5 pts) **33.** A solution is prepared by mixing 1.00 mol of NH_4Cl and 2.00 mol of NH_3 in a 1.00 liter container.
To 100. mL of this solution is added 40.0 mL of 1.00 M HCl. What is the pH of this new solution?

SCRAP PAPER OR COMMENTS ON EXAM

CHEMISTRY 102
EXAM 3 Form B

Fall 2008
Section 501

NAME _____
