

CHEMISTRY 102**EXAM 3 FORM C****SECTION 502****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. Which one of the following acids is NOT a strong acid?

- (a) HF (b) HCl (c) HClO₃ (d) HNO₃ (e) HClO₄

3&4. A 0.10 M solution of which one of the following salts has a pH less than 7?

- (a) KClO₄ (b) CH₃NH₃Cl (c) Ba(NO₂)₂ (d) NaF (e) KCN

5&6. Which of the following combinations are buffer solutions? All components are present in 0.10 M concentrations.

- (1) HCN and NaCN (2) HNO₃ and NH₄NO₃ (3) NH₃ and NH₄Cl (4) HClO₃ and NaClO₃

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

7&8. Consider 0.1 M solutions of the following weak acids:



Which of the following statements is NOT correct?

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

9&10. The conjugate base of NH_3 is:

- (a) OH^-
- (b) H_3O^+
- (c) NH_4^+
- (d) NH_2^-
- (e) none of these

11&12. The acid-base indicator, HIn, has a K_a value of 1.0×10^{-4} . The endpoint for any titration using this indicator will occur at pH = _____:

- (a) 7
- (b) 13
- (c) 8
- (d) 10
- (e) 4

13&14. If K_w is 9.6×10^{-14} at 60°C , what is the pH of pure water at 60°C ?

- (a) 6.51
- (b) 7.00
- (c) 7.11
- (d) 7.45
- (e) none of these

15&16. What is the pH of a 1.5×10^{-4} M KOH?

- (a) 2.95 (b) 3.80 (c) 10.18 (d) 10.79 (e) 11.52

17&18. A 0.50 M solution of a monoprotic acid is 4.1% ionized. What is the K_a for this weak acid?

- (a) 1.3×10^{-3} (b) 3.7×10^{-4} (c) 1.2×10^{-6} (d) 1.8×10^{-7} (e) 8.4×10^{-4}

19&20. Calculate the ΔG° for the reaction at 25°C if the value of the thermodynamic equilibrium constant, K_{thermo} , is 0.145? ($R = 8.314 \text{ J/mol}\cdot\text{K}$)

- (a) +4.78 kJ/mol (b) -4.78 kJ/mol (c) +75.2 kJ/mol
(d) +400. kJ/mol (e) -75.2 kJ/mol

21&22. What is the pH of a solution that is 0.10 M KCN?

- (a) 11.20 (b) 10.01 (c) 7.00 (d) 3.45 (e) 2.67

23&24. It is desired to buffer a solution at pH = 3.80.
What molar ratio of $\text{HNO}_2/\text{NO}_2^-$ should be used?.

- (a) 1.2/1 (b) 0.80/1 (c) 0.12/1 (d) 0.35/1 (e) 2.8/1

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

25&26. A 100.0 mL sample of 0.200 *M* methylamine is titrated with 0.100 *M* HCl. Calculate the initial pH before the titration is begun. The K_b for methylamine is on the back of the envelope.

- (a) 11.45 (b) 12.00 (c) 12.25 (d) 12.59 (e) 13.00

27&28. A 100.0 mL sample of 0.200 *M* methylamine is titrated with 0.100 *M* HCl. Calculate the pH after 135 mL of 0.100 *M* HCl has been added.

- (a) 10.12 (b) 9.53 (c) 10.38 (d) 8.63 (e) 10.70

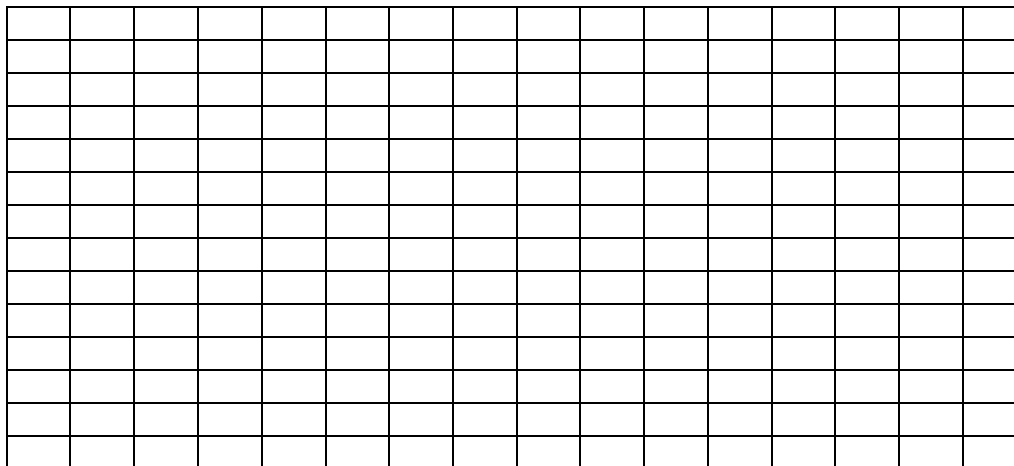
PART 2

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 100.0 mL sample of 0.200 *M* methylamine is titrated with 0.100 *M* HCl. Calculate the pH at the equivalence point.

(5 pts) **30.** A 100.0 mL sample of 0.200 *M* methylamine is titrated with 0.100 *M* HCl. Calculate the pH after 235 mL of 0.100 *M* HCl is added.

- (5 pts) **31.** A 100.0 mL sample of 0.200 M methylamine is titrated with 0.100 M HCl. Using the answers to Questions 21-26, sketch the titration curve with pH on the vertical axis and milliliters of acid 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 solution is prepared by mixing 2.00 mol of NaCH_3COO and 3.00 mol of CH_3COOH in a 1.00 liter container. To 200. mL of this solution is added 130. mL of 1.00 M NaOH. What is the pH of this new solution?

(5 pts) **33.** (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 $ZnF_2(s)$.

(5 pts) (b) If 16.2 grams of ZnF_2 will dissolve in 1.00 L of solution at $20^\circ C$, what is the K_{sp} for ZnF_2 at $20^\circ C$?

SCRAP PAPER OR COMMENTS ON EXAM

CHEMISTRY 102
EXAM 3 Form C

Fall 2008
Section 502

NAME _____
