

University of Kentucky

Department of Chemistry

READ THESE DIRECTIONS CAREFULLY BEFORE STARTING THE EXAMINATION!

It is *extremely* important that you fill in the answer sheet EXACTLY as indicated, otherwise your answer sheet may not be processed; ALL entries are to be made on SIDE 1 of the answer sheet. Use a #2 pencil (or softer); fill in the circles completely and firmly. Erasures must be complete. Use only the following categories:

NAME:	Print your name starting at the first space, LAST NAME first, then a space, followed by your FIRST NAME, then another space, followed by your MIDDLE INITIAL. Fill in the <u>correct</u> circles below your printed name corresponding to the letters of your name; for the spaces, fill in the top blank circle.						
STUDENT NUMBER:	This is VERY IMPORTANT! Under IDENTIFICATION NUMBER, put in your 8 DIGIT STUDENT ID NUMBER (do not use the 9 at the beginning of your number) beginning in column A and continuing through column H, column I will be blank, (do NOT use column J at this time); be sure to fill in the correct circles (a common error to be avoided is mistaking "0" for "1").						
TEST FORM:	Fill in the "3" blank in the J column under IDENTIFICATION NUMBER (to indicate Hour Examination III).						
SPECIAL CODES:	Use for course and section number; in positions K-P write in one of the following: <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Dr. Woodrum</td> <td>107-001</td> </tr> <tr> <td>Dr. Sault</td> <td>107-002, 107-003</td> </tr> <tr> <td>Dr. Ades</td> <td>107-004, 107-401</td> </tr> </table>	Dr. Woodrum	107-001	Dr. Sault	107-002, 107-003	Dr. Ades	107-004, 107-401
Dr. Woodrum	107-001						
Dr. Sault	107-002, 107-003						
Dr. Ades	107-004, 107-401						
SIGNATURE:	You MUST sign the examination answer sheet (bubble sheet) on the line directly above your printed name. Use your legal signature.						

Answering Questions:

Starting with answer "1" on SIDE 1, fill in the circle indicating the one best answer for each of the **27 questions** in this examination. Your score is the sum of the appropriate credit for each response. On the day following the examination, an examination key will be posted on Blackboard.

Grading and Reporting:

The examination scores will be posted in Blackboard as soon as possible after the examination. If an error has occurred in scoring your answers, inform your instructor within 48 hours of the posting of your score.

BE SURE THAT YOUR TEST HAS 27 QUESTIONS, A PERIODIC TABLE, AND ONE SHEET OF SCRATCH PAPER. You may NOT use your own scratch paper during this examination. Cell phones, computer, and pagers are to be turned off and out of sight during the exam.

1. What is the K_a value for the cation in $C_2H_5NH_3Br$? K_b for $C_2H_5NH_2 = 5.6 \times 10^{-4}$

A. 1.0×10^{-14}

C. 6.5×10^{-10}

B. 5.6×10^{-4}

D. 1.8×10^{-11}

2. What is the pH of a KNO_2 solution?

A. Less than 7

C. Greater than 7

B. Equal to 7

D. Additional information is needed to answer the question.

3. What is the pH of a 0.75 M sodium benzoate, $NaC_7H_5O_2$ solution? K_a for benzoic acid, $HC_7H_5O_2$, is 6.5×10^{-5} .

A. 9.03

C. 8.06

B. 9.93

D. 11.84

4. Which one of the following has the stronger acid listed first?

A. H_2Se , H_2Te

C. H_2O , HF

B. HBr , HI

D. H_2S , H_2O

5. Which one of the following is the strongest acid?

A. $HBrO$

C. $HBrO_3$

B. $HClO$

D. $HClO_3$

6. Which of the following will act as a Lewis acid?

A. CH_4

C. NH_3

B. BF_3

D. Cl^-

-
7. Which statement is **false**?
- A. A solution that contains HNO_3 and NaNO_3 can act as a buffer.
 - B. A solution that contains a weak acid and its conjugate base can act as a buffer.
 - C. When NaOH is added to a buffer containing HF and NaF , the HF will neutralize the base.
 - D. A buffer resists changes to pH upon the addition of an acid or a base.
-

8. What is the pH of 550 ml of a solution containing 0.25 mol $\text{C}_6\text{H}_5\text{NH}_2$, aniline, and 0.75 mol $\text{C}_6\text{H}_5\text{NH}_3\text{Br}$, anilinium bromide? K_b for aniline is 3.9×10^{-10} .

- A. 9.98
 - B. 5.41
 - C. 4.11
 - D. 9.59
-

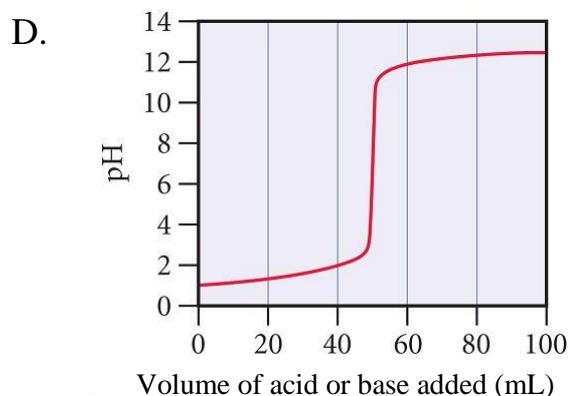
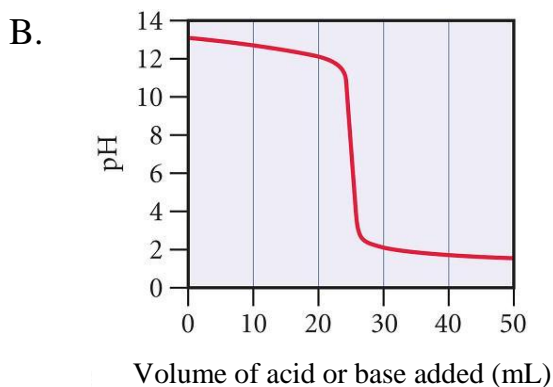
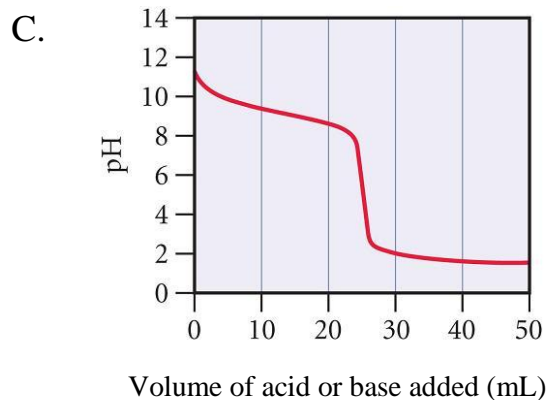
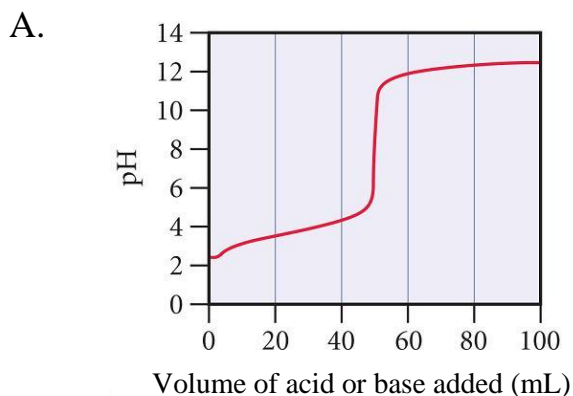
9. A buffer solution is 0.200 M in HNO_2 and 0.185 M in NaNO_2 . What is the pH of the buffer system after 50.0 mL of 0.100 M HCl is added to 250.0 mL of the buffer solution?? K_a of $\text{HNO}_2 = 4.6 \times 10^{-4}$

- A. 3.31
 - B. 3.21
 - C. 3.46
 - D. 2.79
-

10. Which one of the following mixtures would be best for preparing a buffer of $\text{pH} = 10.59$?

- A. $\text{C}_6\text{H}_5\text{NH}_2$ and $\text{C}_6\text{H}_5\text{NH}_3\text{Cl}$; K_b for $\text{C}_6\text{H}_5\text{NH}_2 = 3.9 \times 10^{-10}$
 - B. HF and NaF ; K_a for $\text{HF} = 3.5 \times 10^{-4}$
 - C. CH_3NH_2 and $\text{CH}_3\text{NH}_3\text{Br}$; K_b for $\text{CH}_3\text{NH}_2 = 4.4 \times 10^{-4}$
 - D. HClO and KClO ; K_a for $\text{HClO} = 2.9 \times 10^{-8}$
-

11. Which one of the following represents a titration in which a flask containing 0.10 M KOH is titrated by 0.10 M HNO₃?



12. 25.00 mL of a 0.250 M NH₃ solution is titrated with 0.100 M HCl. What is the pH after 5.00 mL of HCl has been added? K_b of NH₃ = 1.76×10^{-5}

A. 10.50

C. 3.69

B. 3.50

D. 10.31

13. 20.00 mL of 0.150 M HC₂H₃O₂ solution is titrated with 0.150 M NaOH. What is the pH at the equivalence point? K_a of HC₂H₃O₂ = 1.8×10^{-5}

A. 11.07

C. 9.07

B. 8.81

D. 8.11

14. Which statement is **true** for the indicator HIn?

- A. When an acid is added to a solution containing HIn, the color of the In^- will become evident.
- B. All indicators change color as the pH changes from acid (below 7) to a base (above 7).
- C. As the pH is decreased, the color of HIn will become evident.
- D. A good indicator is one in which the HIn form and the In^- form of the indicator are the same color.

15. What is the relationship between molar solubility, S , and K_{sp} for Ag_2S ?

- A. $K_{\text{sp}} = 4S^3$
- B. $K_{\text{sp}} = 2S^2$
- C. $K_{\text{sp}} = S^2$
- D. $K_{\text{sp}} = 27S^3$

16. Calcium hydroxide has a K_{sp} of 4.68×10^{-6} . What is the molar solubility of calcium hydroxide in water?

- A. $6.03 \times 10^{-3} \text{ M}$
- B. $1.08 \times 10^{-3} \text{ M}$
- C. 0.0105 M
- D. $1.53 \times 10^{-3} \text{ M}$

17. Calculate the molar solubility of PbBr_2 in 0.15 M NaBr . K_{sp} for $\text{PbBr}_2 = 4.67 \times 10^{-6}$.

- A. $4.6 \times 10^{-6} \text{ M}$
- B. 0.027 M
- C. 0.014 M
- D. $2.1 \times 10^{-4} \text{ M}$

18. Which one of the following is **not** more soluble in acid solution than in water?

- A. Ca(OH)_2
 - B. CaCl_2
 - C. CaF_2
 - D. CaSO_4
-

19. A solution containing NaCl is mixed with one containing AgNO₃ to form a solution is that is 1.33×10^{-4} M in NaCl and 2.40×10^{-7} M in AgNO₃. Will a precipitation occur in the mixed solution? The K_{sp} of AgCl is 1.77×10^{-10} .

- A. No, because Q is less than K_{sp} . C. No, because Q is greater than K_{sp} .
B. Yes, because Q is less than K_{sp} . D. Yes, because Q is greater than K_{sp} .
-

20. A solution is 0.042 M Pb²⁺ and 0.015 M Ag⁺. Chloride ions are added slowly until a precipitate begins to form. (1) Which cation will precipitate first? (2) What is the concentration of that cation once the second cation begins to precipitate?

K_{sp} for PbCl₂ = 1.17×10^{-5} , K_{sp} for AgCl = 1.77×10^{-10}

- A. (1) Ag⁺ precipitates first. (2) [Ag⁺] = 1.1×10^{-8} M when Pb²⁺ begins to precipitate.
B. (1) Ag⁺ precipitates first. (2) [Ag⁺] = 5.6×10^{-3} M when Pb²⁺ begins to precipitate.
C. (1) Pb²⁺ precipitates first. (2) [Pb²⁺] = 6.6×10^{-5} M when Ag⁺ begins to precipitate.
D. (1) Pb²⁺ precipitates first. (2) [Pb²⁺] = 1.2×10^{-9} M when Ag⁺ begins to precipitate.
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21. A 100.0 mL sample of a solution that is 0.0250 M in Zn(NO₃)₂ is mixed with a 400.0 mL sample of a solution that is 0.200 M in NaCN? After the solution reaches equilibrium, what concentration of Zn²⁺(aq) remains? K_f for [Zn(CN)₄]²⁻ = 2.1×10^{19} .

- A. 6.2×10^{-19} M C. 4.8×10^{-20} M
B. 2.2×10^{-10} M D. 1.4×10^{-15} M
-

22. Which statement is **false**?

- A. A spontaneous process is one that occurs without ongoing outside intervention.
B. If a process is nonspontaneous, the reverse process is spontaneous.
C. A spontaneous reaction always occurs at a high rate of speed.
D. A nonspontaneous process can occur by supplying energy from an external source.
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23. Which one of the following has an increase in entropy?

- A. carbon dioxide condensing C. NaCl(s) forming from its elements
B. BaCl₂ dissolving in water D. a hot iron bar cooling to room temperature
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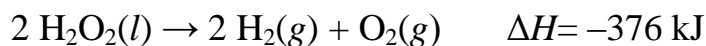
24. Which of the following statements is **false**?

- A. The entropy of the universe increases for spontaneous processes.
- B. Entropy is a state function.
- C. Entropy decreases as the number of energetically equivalent ways to arrange the components of a system increases.
- D. Entropy increases as the number of energetically equivalent ways to arrange the components of a system increases.

25. Which one of the following gives the correct sign for the ΔS of the process?

- A. Sublimation of carbon dioxide, $\Delta S > 0$
- B. $\text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{O}_2(g)$, $\Delta S < 0$
- C. The freezing of water, $\Delta S > 0$
- D. $\text{H}_2(g) + \frac{1}{2} \text{O}_2(g) \rightarrow \text{H}_2\text{O}(l)$, $\Delta S > 0$

26. Consider the decomposition of $\text{H}_2\text{O}_2(l)$ at 25 °C.



What are the signs of the entropy change of the surroundings and the universe, respectively?

- A. $\Delta S_{\text{surr}} < 0$; $\Delta S_{\text{universe}} > 0$
- B. $\Delta S_{\text{surr}} > 0$; $\Delta S_{\text{universe}} > 0$
- C. $\Delta S_{\text{surr}} < 0$; $\Delta S_{\text{universe}} < 0$
- D. $\Delta S_{\text{surr}} > 0$; $\Delta S_{\text{universe}} < 0$

27. The enthalpy of formation of $\text{CO}_2(g)$ is -393.5 kJ/mol . What is ΔS_{surr} for this reaction when it occurs at 30.0°C?

- A. 13.1 kJ/K
 - B. -13.1 kJ/K
 - C. -1.30 kJ/K
 - D. 1.30 kJ/K
-

CHE 107 SPRING 2012 Exam 3 Key

1. D
2. C
3. A
4. D
5. D
6. B
7. A
8. C
9. B
10. C
11. B
12. D
13. B
14. C
15. A
16. C
17. D
18. B
19. A
20. A
21. A
22. C
23. B
24. C
25. A
26. B
27. D
- 28.
- 29.
- 30.