

Exam 3 Practice Test
CHM 1046, Spring 2000
Palmer Graves, Instructor

MULTIPLE CHOICE

Section 16.3 Buffer Solutions

1. What is the pH of a buffered system made by dissolving 10.70 grams of NH_4Cl and 20.00 mL of 12.0 M NH_3 in enough water to make 1.000 L of solution? The K_b for ammonia is 1.8×10^{-5} .
 - a) 9.18
 - b) 9.26
 - c) 9.33
 - d) 11.32
2. What is the $[\text{CH}_3\text{CO}_2^-]/[\text{CH}_3\text{CO}_2\text{H}]$ ratio necessary to make a buffer solution with a pH of 4.44? The K_a for acetic acid is 1.8×10^{-5} .
 - a) 0.30:1
 - b) 0.50:1
 - c) 1.07:1
 - d) 1.33:1
3. What is the change in pH when 0.005 moles of HCl is added to 0.100 L of a buffer solution that is 0.100 M in $\text{CH}_3\text{CO}_2\text{H}$ and 0.100 M NaCH_3CO_2 ? The K_a for acetic acid is 1.8×10^{-5} .
 - a) 0.00
 - b) 0.20
 - c) 0.47
 - d) 1.30

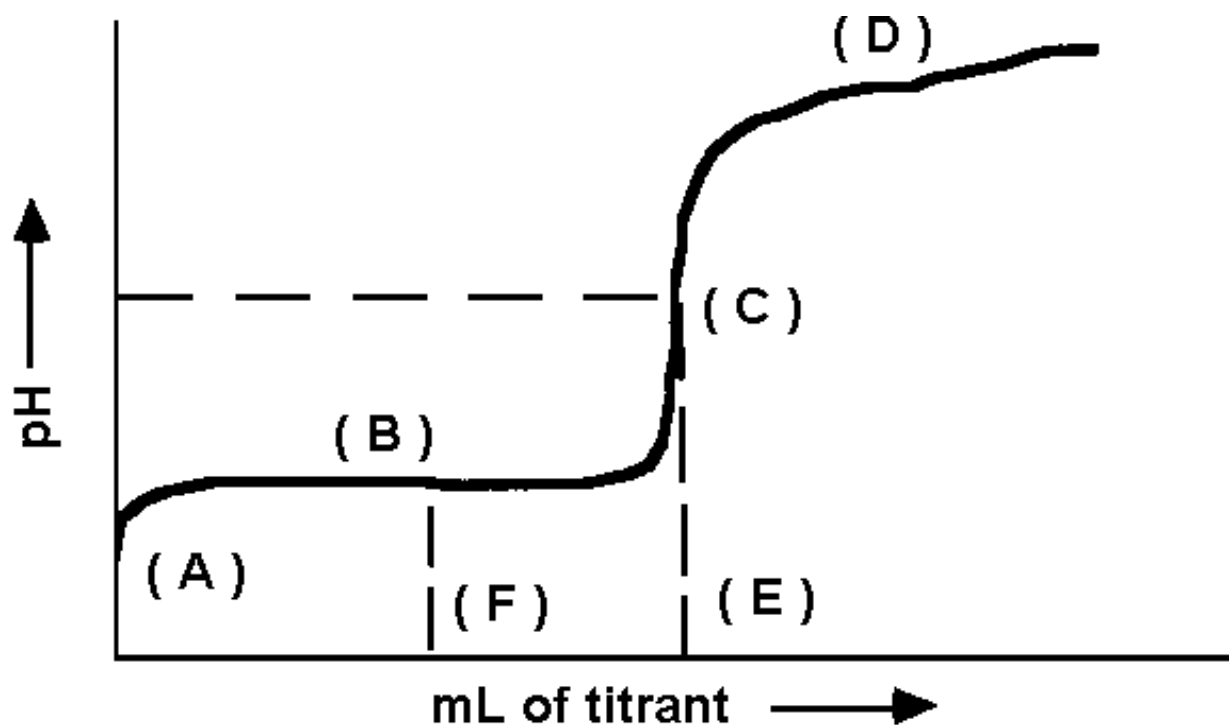
Section 16.4 The Henderson-Hasselbalch Equation

4. What is the percent dissociation of acetic acid if the solution has a pH = 4.74 and a $\text{p}K_a = 4.74$?
 - a) 100%
 - b) 50%
 - c) 10%
 - d) 1%

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Section 16.5 Titration Curves

5. Indicate the pH values at the equivalence point and halfway to the equivalence point in the titration of a weak acid with a strong base.
- A and B
 - B and C
 - C and B
 - C and E



Section 16.6 - 8 Titrations of Strong and Weak Acids and Bases

6. What volume of 0.500 M HNO_3 is needed to titrate 100.00 mL of 0.500 M Ca(OH)_2 to the equivalence point?
- 25.0 mL
 - 50.0 mL
 100. mL
 200. mL
7. Which of the following titrations result in a basic solution at the equivalence point?
- HI titrated with NaCH_3CO_2
 - HOCl titrated with NaOH
 - HBr titrated with KOH
 - $\text{Pb(NO}_3)_2$ titrated with NaI

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8. What is the pH at the equivalence point of a weak acid-strong base titration if 25.00 mL of aqueous hydrofluoric acid required 300.00 mL of 0.400 M NaOH? The K_a of HF is 6.76×10^{-4} .
- 5.63
 - 8.37
 - 10.83
 - 12.63
9. Sodium hypochlorite (NaOCl) is the active ingredient in household bleach. What is the concentration of hypochlorite ion if 20.00 mL of bleach requires 28.30 mL of 0.500 M acid to reach the equivalence point?
- 0.293 M
 - 0.353 M
 - 0.708 M
 - 1.21 M
10. What is the pH of the resulting solution if 25.00 mL of 0.432 M methylamine, CH_3NH_2 , is added to 15.00 mL of 0.234 M HCl? The K_a for methyammonium ion, CH_3NH_3^+ is 2.70×10^{-11} .
- 3.11
 - 3.74
 - 10.26
 - 10.89

Section 16.10 Solubility Equilibria

11. What is the chromium ion concentration for a saturated solution of $\text{Cr}(\text{OH})_3$ if the K_{sp} for $\text{Cr}(\text{OH})_3$ is 6.7×10^{-31} ?
- 8.19×10^{-16} M
 - 1.26×10^{-8} M
 - 2.17×10^{-8} M
 - 3.76×10^{-8} M

Section 17.2 Enthalpy, Entropy, and Spontaneous Processes: A Brief Review

12. Predict the sign of ΔS for both of the following processes.
- $2 \text{C}(\text{graphite}) + \text{O}_2(\text{g}) \rightarrow 2 \text{CO}(\text{g})$
 - $\text{C}_4\text{H}_{10}(\text{g}) \rightarrow \text{C}_4\text{H}_{10}(\text{l})$
- ΔS should be negative for I and negative for II.
 - ΔS should be negative for I and positive for II.
 - ΔS should be positive for I and negative for II.
 - ΔS should be positive for I and positive for II.

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Section 17.3 Entropy and Probability

13. What is the sign of ΔS for each of the following processes? Both occur at constant temperature.
- 2.0 moles of $O_2(g)$ goes from a volume of 44 L to a volume of 52 L.
 - 2.0 moles of $O_2(g)$ goes from a pressure of 1.0 atm to a pressure of 1.2 atm.
- ΔS is negative for I and negative for II.
 - ΔS is negative for I and positive for II.
 - ΔS is positive for I and negative for II.
 - ΔS is positive for I and positive for II.

Section 17.5 Standard Molar Entropies and Standard Entropies of Reaction

14. Calculate ΔS° for the following reaction.
- $$N_2(g) + 2 O_2(g) \rightarrow 2 NO_2(g)$$

Species	S° , J/(K·mol)
$N_2(g)$	191.5
$O_2(g)$	205.0
$NO_2(g)$	240.0

- 156.5 J/K
- 121.5 J/K
- 15.5 J/K
- 636.5 J/K

Section 17.7 Free Energy

15. For the reaction $3 C_2H_2(g) \rightarrow C_6H_6(l)$ at 25°C, the standard enthalpy change is -631 kJ and the standard entropy change is -430 J/K. Calculate the standard free energy change at 25°C.
- 948 kJ
 - 503 kJ
 - 618 kJ
 - 1061 kJ
16. Consider the reaction:
- $$N_2(g) + 3 F_2(g) \rightarrow 2 NF_3(g) \quad \Delta H^\circ = -249 \text{ kJ and } \Delta S^\circ = -278 \text{ J/K at } 25^\circ\text{C}$$
- Calculate ΔG° and state whether the equilibrium composition should favor reactants or products at standard conditions.
- $\Delta G^\circ = -332 \text{ kJ}$; the equilibrium composition should favor products.
 - $\Delta G^\circ = -332 \text{ kJ}$; the equilibrium composition should favor reactants.
 - $\Delta G^\circ = -166 \text{ kJ}$; the equilibrium composition should favor products.
 - $\Delta G^\circ = -166 \text{ kJ}$; the equilibrium composition should favor reactants.

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17. The signs of ΔG , ΔH , and ΔS at 25°C are shown below for three reactions.

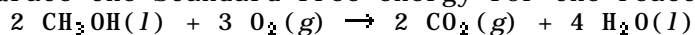
reaction	ΔG	ΔH	ΔS
I.	-	+	+
II.	-	-	+
III	-	-	-

Which reaction could go in the reverse direction at high temperature?

- I
- II
- III
- I and II

Section 17.9 Standard Free Energies of Formation

18. Calculate the standard free energy for the reaction given.

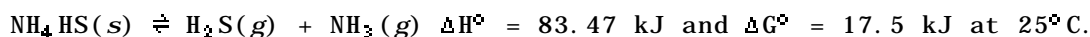


Species	ΔG_f° kJ/mol
$\text{CH}_3\text{OH}(l)$	-166.3
$\text{O}_2(g)$	0.00
$\text{CO}_2(g)$	-394.4
$\text{H}_2\text{O}(l)$	-237.1

- 465.2 kJ
- 797.8 kJ
- 1404.6 kJ
- 2069.8 kJ

Section 17.11 Free Energy and Chemical Equilibrium

19. For the following reaction find K_p at 25°C and indicate whether K_p should increase or decrease as the temperature rises.



- $K_p = 8.6 \times 10^{-4}$ and K_p should increase as the temperature rises.
- $K_p = 8.6 \times 10^{-4}$ and K_p should decrease as the temperature rises.
- $K_p = 1.2 \times 10^3$ and K_p should increase as the temperature rises.
- $K_p = 1.2 \times 10^3$ and K_p should decrease as the temperature rises.

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1. c)	Chapter: 16	QUESTION: 19
2. b)	Chapter: 16	QUESTION: 24
3. c)	Chapter: 16	QUESTION: 27
4. b)	Chapter: 16	QUESTION: 32
5. c)	Chapter: 16	QUESTION: 40
6. d)	Chapter: 16	QUESTION: 42
7. b)	Chapter: 16	QUESTION: 44
8. b)	Chapter: 16	QUESTION: 47
9. c)	Chapter: 16	QUESTION: 48
10. d)	Chapter: 16	QUESTION: 50
11. b)	Chapter: 16	QUESTION: 64
12. c)	Chapter: 17	QUESTION: 11
13. c)	Chapter: 17	QUESTION: 17
14. b)	Chapter: 17	QUESTION: 27
15. b)	Chapter: 17	QUESTION: 44

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16. c)

Chapter: 17 QUESTION: 50

17. c)

Chapter: 17 QUESTION: 52

18. c)

Chapter: 17 QUESTION: 58

19. a)

Chapter: 17 QUESTION: 83