Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chem 1120 Pretest 3 Sprin 2015

Multiple Choice
Identify the choice that best completes the statement or answers the question.

Chapter 19 Values
The following equilibrium constants will be useful for the problems in this chapter.

Substance	Constant	Substance	Constant
HCO_2H	$K_a = 1.8 \times 10^{-4}$	H_2CO_3	$K_1 = 4.2 \times 10^{-7}$
HNO_2	$K_a = 4.5 \times 10^{-4}$		$K_2 = 4.8 \times 10^{-11}$
HOCl	$K_a = 3.5 \times 10^{-8}$	$(COOH)_2$	$K_1 = 5.9 \times 10^{-2}$
HF	$K_a = 7.2 \times 10^{-4}$		$K_2 = 6.4 \times 10^{-5}$
HCN	$K_a = 4.0 \times 10^{-10}$	CH_3COOH	$K_a = 1.8 \times 10^{-5}$
H_2SO_4	K_1 = very large	HOCN	$K_a = 3.5 \times 10^{-4}$
	$K_2 = 1.2 \times 10^{-2}$	$C_6H_5NH_2$	$K_b = 4.2 \times 10^{-10}$
HOBr	$K_a = 2.5 \times 10^{-9}$	NH_3	$K_b = 1.8 \times 10^{-5}$

____ 1. A(n) ____ solution contains a conjugate acid-base pair with both the acid and the base in reasonable concentrations.
a. saturated
b. electrolytic
c. buffer
d. titrated
e. equivalence

____ 2. Calculate the $[H_3O^+]$ of a solution that is 0.20 *M* in HF and 0.10 *M* in NaF.
a. 3.2×10^{-4} *M*
b. 4.0×10^{-6} *M*
c. 1.4×10^{-3} *M*
d. 6.3×10^{-5} *M*
e. 5.0×10^{-3} *M*

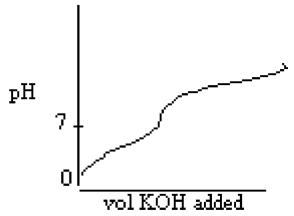
____ 3. Which one of the following combinations **cannot** produce a buffer solution?
a. HNO_2 and $NaNO_2$
b. HCN and NaCN
c. $HClO_4$ and $NaClO_4$
d. NH_3 and $(NH_4)_2SO_4$
e. NH_3 and NH_4Br

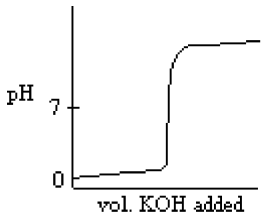
____ 4. If 0.40 g of solid NaOH is added to 1.0 liter of a buffer solution that is 0.10 *M* in CH_3COOH and 0.10 *M* in $NaCH_3COO$, how will the pH of the solution change?
a. The pH increases from 4.74 to 4.83.
b. The pH decreases from 7.00 to 4.83.
c. The pH does not change.
d. The pH decreases from 4.74 to 4.65.
e. The pH increases from 4.74 to 7.00.

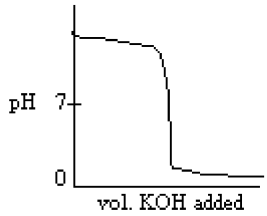
____ 5. It is desired to buffer a solution at pH = 4.30. What molar ratio of CH_3COOH to $NaCH_3COO$ should be used?
   a. 1.2/1
   b. 0.8/1
   c. 0.12/1
   d. 2.8/1
   e. 6.2/1

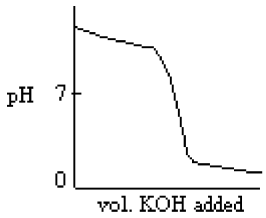
____ 6. The nonionized form of an acid indicator is yellow, and its anion is blue. The K_a of this indicator is 10^{-6}. What will be the approximate pH range over which this indicator changes color?
   a. 3–5
   b. 4–6
   c. 5–7
   d. 8–10
   e. 9–11

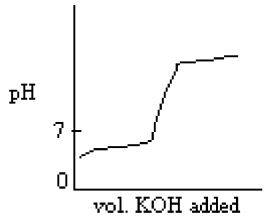
____ 7. Which titration curve could describe the titration of a solution of HCl by addition of a solution of KOH?

a. 

b. 

c. 

d. 

e. 

____ 8. Which of the following solubility product expressions is **incorrect**?

a. Cu_2S, $K_{sp} = [Cu^+][S^{2-}]$
b. Co_2S_3, $K_{sp} = [Co^{3+}]^2[S^{2-}]^3$
c. $Ni(CN)_2$, $K_{sp} = [Ni^{2+}][CN^-]^2$
d. AuI, $K_{sp} = [Au^+][I^-]$
e. $Cr(OH)_3$, $K_{sp} = [Cr^{3+}][OH^-]^3$

____ 9. At 25°C, 1.4×10^{-5} mole of $Cd(OH)_2$ dissolves to give 1.0 liter of saturated aqueous solution. What is the solubility product for $Cd(OH)_2$?
a. 1.7×10^{-5}
b. 2.9×10^{-10}
c. 1.1×10^{-14}
d. 5.8×10^{-15}
e. 4.1×10^{-12}

____ 10. Which of the following has the lowest molar solubility in water at 25°C?
a. $Ni(CN)_2$, $K_{sp} = 3.0 \times 10^{-23}$
b. ZnS, $K_{sp} = 1.1 \times 10^{-21}$
c. PbS, $K_{sp} = 8.4 \times 10^{-28}$
d. $Co_3(AsO_4)_2$, $K_{sp} = 7.6 \times 10^{-29}$
e. CaF_2, $K_{sp} = 3.9 \times 10^{-16}$

____ 11. Calculate the concentration of carbonate ion in a saturated solution of calcium carbonate to which calcium chloride has been added until $[Ca^{2+}] = 0.015\ M$ at 25°C. K_{sp} for $CaCO_3 = 2.8 \times 10^{-9}$.
a. $4.2 \times 10^{-11}\ M$
b. $1.9 \times 10^{-7}\ M$
c. $1.2 \times 10^{-5}\ M$
d. $6.3 \times 10^{-13}\ M$
e. $1.5 \times 10^{-2}\ M$

____ 12. A solution contains 0.05 M Au^+, 0.05 M Cu^+, and 0.05 M Ag^+ ions. When solid NaCl is added to the solution, what is the **order** in which the chloride salts will begin to precipitate? $K_{sp(AgCl)} = 1.8 \times 10^{-10}$, $K_{sp(AuCl)} = 2.0 \times 10^{-13}$, $K_{sp(CuCl)} = 1.9 \times 10^{-7}$
a. AuCl > AgCl > CuCl
b. AuCl > AgCl > NaCl
c. AgCl > CuCl > AuCl
d. CuCl > AgCl > AuCl
e. NaCl > CuCl > AgCl

____ 13. A solution is 0.0010 *M* in both Ag^+ and Au^+. Some solid NaCl is added slowly until the second solid compound just begins to precipitate. What is the concentration of Au^+ ions at this point? K_{sp} for AgCl = 1.8×10^{-10} and for AuCl is 2.0×10^{-13}.
a. $2.0 \times 10^{-10}\ M$
b. $4.5 \times 10^{-7}\ M$
c. $1.8 \times 10^{-7}\ M$
d. $3.0 \times 10^{-4}\ M$
e. $1.1 \times 10^{-6}\ M$

____ 14. Solid silver nitrate is added slowly to a solution that is 0.0010 *M* in sodium chloride and 0.0010 *M* in sodium bromide. What % of the bromide ions remain in solution, i.e., unprecipitated, just before silver chloride begins to precipitate? K_{sp} for AgCl = 1.8×10^{-10}, K_{sp} for AgBr = 3.3×10^{-13}
a. 0.18%
b. 0.018%
c. 0.0010%
d. 0.00010%
e. 0.0018%

____ 15. If a solution is to be made 0.010 *M* in $Mg(NO_3)_2$ **and** 0.20 *M* in aqueous NH_3, how many mol/L of NH_4Cl are required to prevent the precipitation of $Mg(OH)_2$ at 25°C? The K_b for aqueous NH_3 is 1.8×10^{-5} and the K_{sp} for $Mg(OH)_2$ is 1.5×10^{-11}.
a. 0.054
b. 0.56
c. 0.092
d. 1.8
e. 0.86

____ 16. In **any** electrochemical cell, the cathode is **always** ____
a. the positive electrode.
b. the negative electrode.
c. the electrode at which some species gains electrons.
d. the electrode at which some species loses electrons.
e. the electrode at which oxidation occurs.

____ 17. The electrolysis of an aqueous sodium chloride solution using inert electrodes produces gaseous chlorine at one electrode. At the other electrode gaseous hydrogen is produced, and the solution becomes basic around the electrode. Which of the following is the equation for the cathode half-reaction in this electrolytic cell?
a. $2Cl^- \rightarrow Cl_2 + 2e^-$
b. $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$
c. $Cl_2 + 2e^- \rightarrow 2Cl^-$
d. $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$
e. none of these

____ 18. An aqueous copper(II) sulfate solution is electrolyzed for 45 minutes. A 3.2 ampere current is used. What mass of copper is produced?
a. 0.95 g
b. 1.9 g
c. 2.8 g
d. 4.6 g
e. 5.5 g

Chapter 21 Values
A table of standard electrode potentials is necessary for many of the following question(s).

____ 19. Which of the following shorthand galvanic cell notations for the zinc – copper standard cell is correct?
$Cu^{2+} + Zn \rightarrow Zn^{2+} + Cu$

a. $Cu^{2+} \mid Cu \parallel Zn \mid Zn^{2+}$
b. $Cu^{2+} \mid Cu \parallel Cu \mid Cu^{2+}$
c. $Cu^{2+} \mid 2e^{-} \parallel 2e^{-} \mid Zn$
d. $Zn \mid Zn^{2+} \parallel Cu^{2+} \mid Cu$
e. $Zn \mid Cu^{2+} \parallel Zn^{2+} \mid Cu$

____ 20. A voltaic cell is constructed by immersing a strip of copper metal in 1.0 *M* $CuSO_4$ solution and a strip of aluminum in 0.50 *M* $Al_2(SO_4)_3$ solution. A wire and a salt bridge complete the circuit. The aluminum strip loses mass, and the concentration of aluminum ions in the solution increases. The copper electrode gains mass, and the concentration of copper ions decreases. What is the cell potential?
a. +1.28 V
b. +2.00 V
c. +2.34 V
d. +2.50 V
e. +3.66 V

____ 21. Calculate the cell potential for the following voltaic cell.
$Cr|Cr^{3+}(1.0 \times 10^{-2}\ M)\|Co^{2+}(1.0 \times 10^{-5}\ M)|Co$

a. +0.35 V
b. +0.91 V
c. +0.57 V
d. +0.28 V
e. −1.13 V

____ 22. What is ΔG^0 at 25°C for the reaction below? (F = 96,500 J/V•mol e^-)
$Cu^{2+} + Cd \rightarrow Cu + Cd^{2+}$

a. −71.1 kJ
b. −143 kJ
c. 597 kJ
d. 193 kJ
e. +71.1 kJ

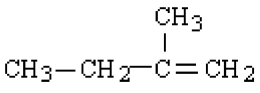
____ 23. The equilibrium constant, at 25°C, for the reaction below is 1.99×10^{20}. What is E^0 for this reaction?
$NO_3^- + 3H^+ + Cu \rightarrow Cu^{2+} + HNO_2 + H_2O$

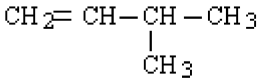
a. 0.090 V
b. 0.60 V
c. 0.88 V
d. 1.05 V
e. 0.21 V

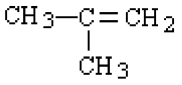
____ 24. What is the molecular formula for heptane?

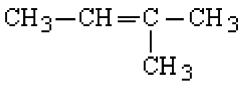
a. C_7H_{14}
b. C_7H_{12}
c. C_9H_{18}
d. C_7H_{16}
e. C_9H_{20}

____ 25. Which of the following is the correct formula for 2-methyl-1-butene?

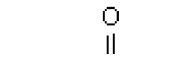
a. 

b. 

c. 

d. 

e. none of these

____ 26.  is an example of a(n) ____.

a. acid
b. aldehyde
c. phenol
d. ketone
e. ether

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Answer Section

MULTIPLE CHOICE

1. ANS: C PTS: 1 TOP: The Common Ion Effect and Buffer Solutions
2. ANS: C PTS: 1 TOP: The Common Ion Effect and Buffer Solutions
3. ANS: C PTS: 1 TOP: Buffering Action
4. ANS: A PTS: 1 TOP: Buffering Action
5. ANS: D PTS: 1 DIF: Harder Question
   TOP: Preparation of Buffer Solutions
6. ANS: C PTS: 1 TOP: Acid-Base Indicators
7. ANS: B PTS: 1 TOP: Strong Acid/Strong Base Titration Curves
8. ANS: A PTS: 1 TOP: Solubility Product Constants
9. ANS: C PTS: 1 TOP: Determination of Solubility Product Constants
10. ANS: C PTS: 1 TOP: Uses of Solubility Product Constants
11. ANS: B PTS: 1 TOP: Uses of Solubility Product Constants
12. ANS: A PTS: 1 TOP: Fractional Precipitation
13. ANS: E PTS: 1 TOP: Fractional Precipitation
14. ANS: A PTS: 1 TOP: Fractional Precipitation
15. ANS: C PTS: 1
    TOP: Simultaneous Equilibria Involving Slightly Soluble Compounds
16. ANS: C PTS: 1 TOP: Electrodes
17. ANS: B PTS: 1 TOP: The Electrolysis of Aqueous Salt Solutions
18. ANS: C PTS: 1
    TOP: Counting Electrons: Coulometry and Faraday's Law of Electrolysis
19. ANS: D PTS: 1 TOP: The Zinc – Copper Cell
20. ANS: B PTS: 1 TOP: Uses of Standard Electrode Potentials
21. ANS: A PTS: 1 TOP: The Nernst Equation
22. ANS: B PTS: 1 TOP: The Relationship of E°cell to Delta G° and K
23. ANS: B PTS: 1 TOP: The Relationship of E°cell to Delta G° and K
24. ANS: D PTS: 1 TOP: Alkanes and Cycloalkanes
25. ANS: A PTS: 1 TOP: Alkenes
26. ANS: B PTS: 1 TOP: Aldehydes and Ketones