CHEM 1212K

Chapter 14

1. The rate constant for the second order reaction 2 $NO_2(g) \rightleftharpoons N_2O_4(g)$ is 2.79 $M^{-1}min^{-1}$ at 48.0ºC. If the initial concentration of NO_2 is 1.05 *M*, what is the half-life for the reaction, in minutes?

2. Determine the rate law for the reaction given the following data:

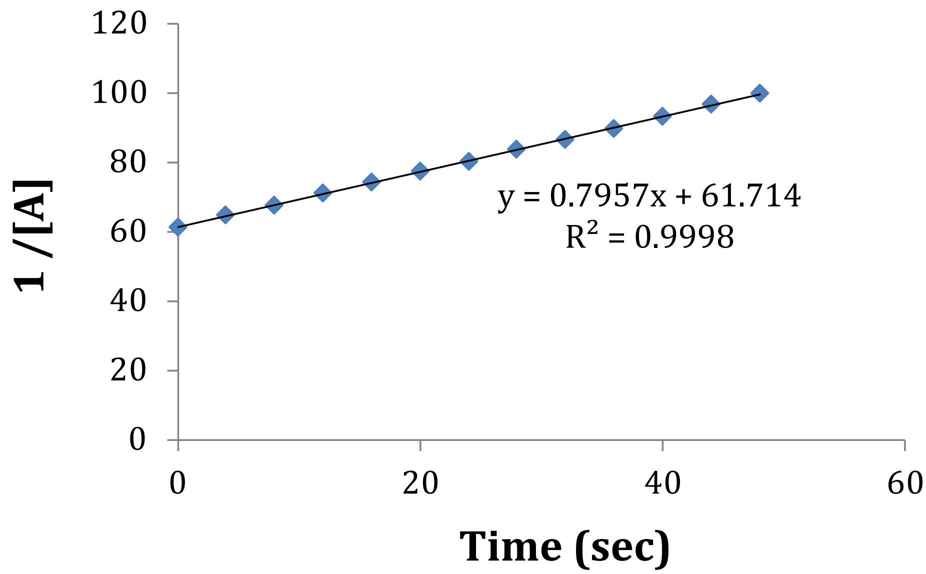
   2A + B $\rightleftharpoons$ products

[A]initial (M)	[B]initial (M)	Initial Rate (M/s)
0.10	0.10	2.0×10^{-2}
0.20	0.10	8.0×10^{-2}
0.30	0.10	1.8×10^{-1}
0.20	0.20	8.0×10^{-2}
0.30	0.30	1.8×10^{-1}

3. A non-steroidal anti-inflammatory drug is metabolized with a first-order rate constant of 3.25 day^{-1}. What percent of the drug remains in the body after 13.0 hours?

4. What are the units for the rate constant for a *seventh* order reaction?

5. Determine the value and units of *k* based on the graph below.



6. Which changes result in the greatest rate for a reaction with the rate law:

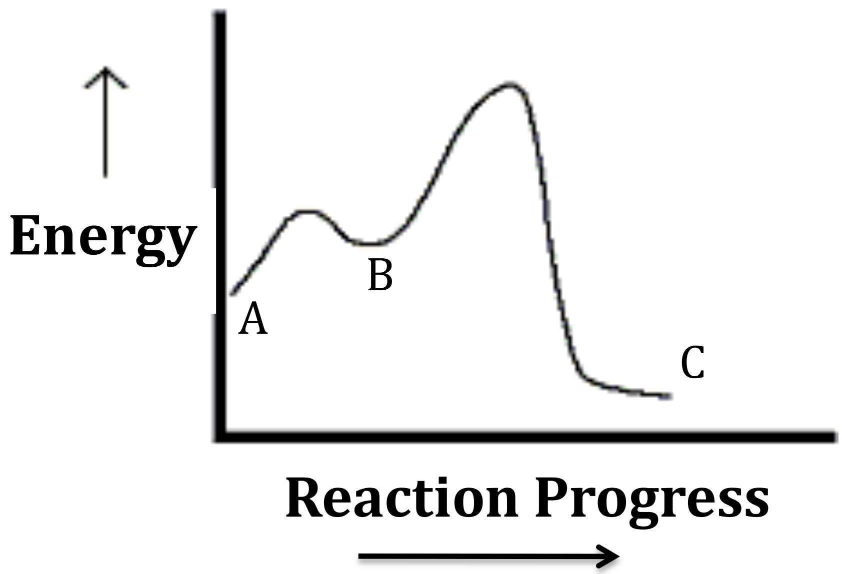
Rate = $k[A][B]^2$?

A) doubling the concentration of A and halving the concentration of B
B) doubling the concentration of A and doubling the concentration of B
C) halving the concentration of A and doubling the concentration of B
D) keeping the concentration of A constant and tripling the concentration of B
E) quadrupling the concentration of A and keeping the concentration of B constant

7. The rate of formation of oxygen in the reaction given is is 2.28 M/s. What is the rate of formation of NO_2 in *M*/s?

$$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$$

8. Consider the following reaction diagram. Which of the statements below concerning this diagram is *true*?



A) The reaction has two intermediates.
B) The reaction has one transition state.
C) The overall reaction is A → C.
D) The rate law for the reaction is rate = k[A].
E) Step two has the lowest activation energy of all steps in the mechanism.

9. The rate constant for a reaction is 10.5 s^{-1}. If the initial concentration of reactant is 0.100 M, then how long (in seconds) does it take for one half-life to elapse?

10. What is the rate law for the overall reaction?

$NO(g) + O_2(g) \rightleftharpoons NO_3(g)$	[fast, equilibrium]
$NO_3(g) + NO(g) \rightarrow 2NO_2(g)$	[slow]

11. Which statement below *best* describes the difference between an intermediate and a transition state?

    A) An intermediate cannot be isolated while a transition state can.
    B) A transition state is always higher energy than the reactants while intermediates are always lower energy than the reactants.
    C) A transition state does not persist while an intermediate has a defined lifetime.
    D) An intermediate is always higher energy than a transition state.
    E) None of these statements are true.

Chapter 15

1. Select the equilibrium expression for the reaction:

$$P_4(s) + 3KOH(aq) + 3\ H_2O(l) \rightleftharpoons PH_3(aq) + 3KH_2PO_2\ (aq)$$

A) $K = \dfrac{1}{[P_4][H_2O]^3}$

B) $K = \dfrac{[KOH]^3}{[PH_3][KH_2PO_2]^3}$

C) $K = \dfrac{[PH_3][KH_2PO_2]^3}{[P_4][KOH]^3[H_2O]^3}$

D) $K = \dfrac{[PH_3][KH_2PO_2]^3}{[KOH]^3[H_2O]^3}$

E) $K = \dfrac{[PH_3][KH_2PO_2]^3}{[KOH]^3}$

2. The value of K_p for the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at a given temperature is 0.211. If the equilibrium partial pressure of NO_2 at the same temperature is 0.0172 atm, then what is the equilibrium partial pressure (in atm) of N_2O_4?

3. A mixture of 19.8 atm H_2 and 12.8 atm Br_2 was placed in a vessel at 700. K. At equilibrium, the vessel is found to contain 8.2 atm H_2. What is K_p for the reaction?

$$H_2(g) + Br_2(g) \rightleftharpoons 2\ HBr(g)$$

4. What is the equilibrium partial pressure (in atm) of CO(g) if 4.50 g of C(s) and 0.500 atm of CO_2(g) are placed in a reaction vessel and allowed to reach equilibrium at 1.00×10^3 °C, where K_p = 167.5.

$$C(s) + CO_2(g) \rightleftharpoons 2\ CO(g)$$

5. Which changes to the system will cause the following reaction to shift right (toward products as written) to re-attain equilibrium?

$N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$ $\Delta H° = 58.0$ kJ/mol

I. addition of NO_2
II. addition of N_2O_4 gas
III. increase in temperature

A) I only
B) II only
C) III only
D) I and III
E) I and II
F) II and III

6. A mixture of N_2, H_2, and NH_3 with partial pressures of 0.22 atm, 0.44 atm, and 0.18 atm, respectively, was prepared and heated to 500. K at which temperature K_p = 0.036. Which statement is true?

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$$

A) NH_3 tends to decompose under these conditions.
B) NH_3 tends to form under these conditions.
C) The partial pressure of NH_3 remains constant.
D) Q = 1.86 under these conditions.
E) NH_3 forms regardless of conditions.

7. Which statement is *true*?

   A) All reaction quotients are equilibrium constants.
   B) If K > Q, then the reaction must shift to the reactants (left) to re-attain equilibrium.
   C) If Q < K, then the reaction is nonspontaneous.
   D) Not all equilibrium constants are reaction quotients.
   E) If Q > K, the reaction must proceed in a direction to reduce the amount of products present or increase the amount of reactants.

8. At 425°C, $K = 4.18 \times 10^{-9}$ for the reaction $2HBr(g) \rightleftharpoons H_2(g) + Br_2(g)$. If 0.20 atm of HBr(g), and 0.010 atm of both $H_2(g)$ and $Br_2(g)$ are introduced into a container, then which expression best represents the equilibrium pressure of HBr?

   A) 0.20 – x
   B) 0.20 – 2x
   C) 0.20 + x
   D) 0.20 + 2x
   E) 0.010 + x

9. Molecular iodine decomposes according to the following reaction, for which $K_c = 3.76 \times 10^{-3}$ at 1000°C. If 0.45 mol of I_2 is placed in a 3.0 L container, what is the equilibrium concentration of I(g) at 1000°C?

$$I_2(g) \rightleftharpoons 2I(g)$$

Chapter 16

1. What is the conjugate base of $CH_3NH_3^+$ in H_2O?
   A) $CH_3NH_4^{2+}$
   B) CH_3NH_2
   C) H_3O^+
   D) OH^-
   E) None of these

.

2. Which of the following is the weakest acid?

   A) HCN (pK_a = 9.31)
   B) HIO_3 (pK_a = 0.77)
   C) HF (pK_a = 3.45)
   D) CH_3COOH (pK_a = 4.75)
   E) HNO_2 (pK_a = 3.37)

3. The pH of 0.800 M aqueous benzenesulfonic acid (a monoprotic acid) is 0.51. What is the value of K_a for benzenesulfonic acid?

4. What is the pH of a 0.25 M HBrO(aq) solution? (pK_a = 8.69)

5. The equation that represents K_{a2} for phosphoric acid is:

   A) $HPO_4^{2-}(aq) + H_2O(l) \rightleftharpoons PO_4^{3-}(aq) + H_3O^+(aq)$
   B) $H_2PO_4^-(aq) + H_2O(l) \rightleftharpoons HPO_4^{2-}(aq) + H_3O^+(aq)$.
   C) $H_3PO_4(aq) + 2H_2O(l) \rightleftharpoons HPO_4^{2-}(aq) + 2H_3O^+(aq)$.
   D) $HPO_4^{2-}(aq) + H_2O(l) \rightleftharpoons H_2PO_4^-(aq) + OH^-(aq)$.
   E) $H_3PO_4(aq) + H_2O(l) \rightleftharpoons H_2PO_4^-(aq) + H_3O^+(aq)$.

10. Aqueous solutions of which of the following salts have pH less than 7.00 at 25 ^oC?

   I. NaBr
   II. NH_4Br
   III. NaF
   IV. $FeCl_3$

6. The pH of 0.010 *M* solutions of which acids do NOT have pH = 2.00 at 25 °C?
   HNO_3
   $HClO_3$
   HBr
   HF
   HCl

7. What is the pH of a 0.167 *M* solution of $C_6H_5NH_2$? The K_b of $C_6H_5NH_2$ is 7.4×10^{-10} and the K_a of $C_6H_5NH_3^+$ is 1.4×10^{-5}.

8. Identify the conjugate acid – base pairs in the reaction below. Acids are listed first in each pair, followed by that acid's conjugate base.

$$HIO_2(aq) + (CH_3)_2NH(aq) \rightleftharpoons IO_2^-(aq) + (CH_3)_2NH_2^+(aq)$$

	Pair One	**Pair Two**
A)	HIO_2 and $(CH_3)_2NH$	IO_2^- and $(CH_3)_2NH_2^+$
B)	HIO_2 and $(CH_3)_2NH_2^+$	IO_2^- and $(CH_3)_2NH$
C)	$(CH_3)_2NH_2^+$ and HIO_2	$(CH_3)_2NH$ and IO_2^-
D)	HIO_2 and IO_2^-	$(CH_3)_2NH_2^+$ and $(CH_3)_2NH$
E)	IO_2^- and HIO_2	$(CH_3)_2NH$ and $(CH_3)_2NH_2^+$

9. Which statement regarding a solution of 0.0100 *M* $NaNO_2$ is *true*?

   A) The pH of the solution is acidic because HNO_2 is a weak acid that undergoes reaction with water to produce H_3O^+ in solution.
   B) The pH of the solution is neutral because it was made from a strong base and a weak acid.
   C) The pH of the solution is basic because NaOH is a strong base that undergoes reaction with water to produce OH^- in solution.
   D) The pH of the solution is acidic because the conjugate acid of NaOH undergoes reaction with water to produce H_3O^+ in solution.
   E) The pH of the solution is basic because the conjugate base of HNO_2 undergoes reaction with water to produce OH^- in solution.

10. At 50.0°C, pK_w = 13.26. What is the pH of pure water at this temperature?

11. What concentration (in molarity) of NH_3 is required to have the same pH as a 0.010 *M* solution of LiOH? The K_b for NH_3 is 1.8 x 10^{-5}.

Chapter 17

1. 100 mL of each of the following solutions is mixed. Which one of the mixed solutions is a buffer?

   A) 1.0 M NH_3(aq) + 0.6 M KOH(aq)
   B) 1.0 M NH_4Cl(aq) + 1.0 M KOH(aq)
   C) 1.0 M NH_3(aq) + 0.4 M HCl(aq)
   D) 1.0 M NH_4Cl(aq) + 0.4 M HCl(aq)
   E) 1.0 M NH_3(aq) + 1.0 M HCl(aq)

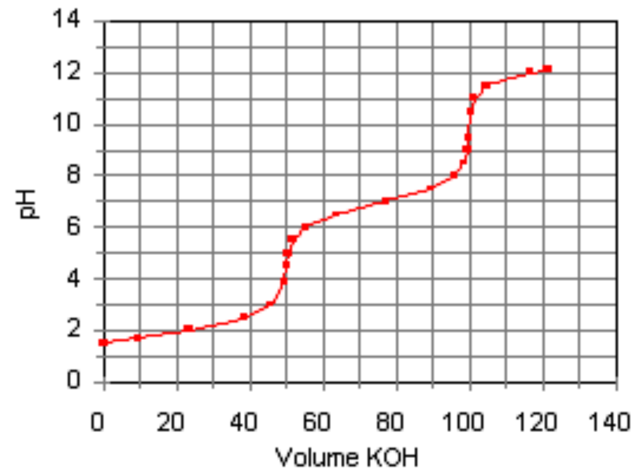
2. Choose the effective pH range of an aniline/anilinium chloride buffer. The value of the K_b for aniline is 4.3 x 10^{-10}.

   A) 3.6–5.6
   B) 8.4–10.4
   C) 1.1–3.1
   D) 5.1–7.1
   E) 10.1–12.1

3. A buffer solution made of NH_3 and NH_4NO_3 (K_b for NH_3 = 1.8x10^{-5}). If the pH of the buffer is 9.26 and the concentration of NH_4NO_3 is 0.175 *M*, then what is the concentration of NH_3 (in molarity) ?

4. A buffer solution contains 0.0200 M acetic acid and 0.0200 M sodium acetate. What is the pH after 0.0020 mol of NaOH are added to 1.00 L of this buffer? pK_a = 4.75 for acetic acid. Assume no change in volume.

5. The complete titration curve for the titration of a weak acid with 0.100 M KOH(aq) is given below. Which acid is the analyte?



A) H_2SO_3 (pK_{a1} ~ 2.0 and pK_{a2} ~ 6.9)
B) HCN (pK_{a1} ~ 2.9)
C) H_3PO_4 (pK_{a1} ~ 2.0, pK_{a2} ~ 7.2, and pK_{a3} ~12.3)
D) H_2CO_3 (pK_{a1} ~ 6.4 and pK_{a2} ~ 10.3)
E) $H_2C_2O_4$ (pK_{a1} ~ 1.2 and pK_{a2} ~ 4.2)

6. The solubility of which of the following will *decrease* with addition of 0.10 M NaCl? Select all that apply.

I. $PbCl_2$
II. Na_2CO_3
III. $Ca(NO_3)_2$
IV. K_3PO_4

7. A 25.0 mL sample of 0.20 *M* HNO_2 was titrated with 0.20 *M* KOH. What is the pH of the system when 12.5 mL of KOH have been added? K_a HNO_2 = 4.3×10^{-4} and K_b NaOH = 1×10^{10}

8. What is the molar solubility of $Fe(OH)_3$ if its K_{sp} is $2.0x10^{-39}$?

9. In the titration of H_3AsO_4 with LiOH, it was determined that the first equivalence point occurred when 25.0 mL of LiOH was added. What *total* volume of LiOH must be added to reach the third equivalence point?

10. A diprotic acid, H_2A, has the following acid dissociation constants: $K_{a1} = 1.1 \times 10^{-3}$ and $K_{a2} = 2.5 \times 10^{-6}$. Which combination of species would you use to make a buffer solution whose pH is 5.80?

    A) NaHA / H_2A
    B) Na_2A / NaHA
    C) H_2A / NaHA / Na_2A
    D) H_2A / Na_2A
    E) H_2A and its conjugates cannot be used to form a buffer of pH = 5.80

11. What ratio of $[A^-]$ to [HA] is needed to produce a solution with pH = 8.00 if the K_a of the acid is 3.5×10^{-8}?

12. What is the pH of an aqueous solution that is 0.011 M HF ($K_a = 3.5 \times 10^{-4}$) and 0.015 M NaF?

13. What is the pH of a solution composed of 0.13 *M* $H_2PO_4^-$ and 0.20 *M* HPO_4^{2-} if the K_a for $H_2PO_4^-$ is 6.2×10^{-8} and the K_a for HPO_4^{2-} is 4.8×10^{-13}.

Chapter 19

7. Which is the strongest oxidizing agent?

$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	$E^o = +0.80$ V
$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$	$E^o = +0.77$ V
$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$	$E^o = +0.34$ V

A) Ag
B) Cu^{2+}
C) Cu
D) Ag^+
E) Fe^{2+}

8. Consider the reaction $2Ag^+(aq) + Cu(s) \rightleftharpoons Cu^{2+}(aq) + 2Ag(s)$
Calculate the value of E^o_{cell} for the given reaction above given:

$Ag^+ + e^- \longrightarrow Ag$	$E^o = +0.80$ V
$Cu^{2+} + 2e^- \longrightarrow Cu$	$E^o = +0.34$ V

9. What is the coefficient for CO_2 when the following reaction is balanced in acidic solution? $Cr_2O_7^{2-}(aq) + C_2O_4^{2-}(aq) \longrightarrow Cr^{3+}(aq) + CO_2(g)$

10. What is the oxidation state of Cl in $Al(ClO_3)_3$?

11. What mass (in grams) of chromium metal can be plated out by passing a total charge of 1.06×10^5 C through an electrolytic cell containing a solution of $Cr(NO_3)_3$?

12. If the reaction $CH_3OH(aq) + Cr_2O_7^{2-}(aq) \longrightarrow CH_2O(l) + Cr^{3+}(aq)$ is balanced *in base* then what is the coefficient for water, and on which side does it appear?

13. A galvanic cell is constructed using gold (Au) and magnesium (Mg) half-cells. Which statement is *true*?

Half-reaction	E° (Volts)
$Au^{3+} + 3e^- \longrightarrow Au_{(s)}$	+1.50
$Cu^+ + e^- \longrightarrow Cu_{(s)}$	+0.52
$Pb^{2+} + 2e^- \longrightarrow Pb_{(s)}$	-0.13
$Fe^{2+} + 2e^- \longrightarrow Fe_{(s)}$	-0.44
$Cr^{3+} + 3e^- \longrightarrow Cr_{(s)}$	-0.74
$Al^{3+} + 3e^- \longrightarrow Al_{(s)}$	-1.66
$Mg^{2+} + 2e^- \longrightarrow Mg_{(s)}$	-2.37
$Rb^+ + e^- \longrightarrow Rb_{(s)}$	-2.98

A) Electrons flow from the Au half-cell to the Mg half-cell.
B) At the cathode, Mg(s) is produced.
C) Three electrons are transferred in this reaction.
D) Au^{3+} is produced at the anode.
E) Ions flow into the cathode and the anode from the salt bridge.

14. Which of the answer options is the *strongest* reducing agent?

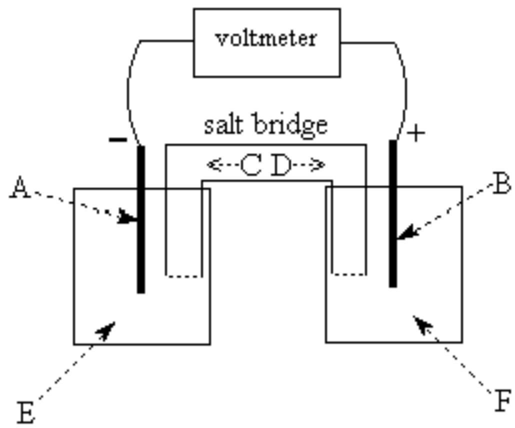
Half-reaction	E° (Volts)
$Au^{3+} + 3e^- \rightarrow Au_{(s)}$ +1.50	
$Cu^+ + e^- \rightarrow Cu_{(s)}$	+0.52
$Pb^{2+} + 2e^- \rightarrow Pb_{(s)}$	-0.13
$Fe^{2+} + 2e^- \rightarrow Fe_{(s)}$	-0.44
$Cr^{3+} + 3e^- \rightarrow Cr_{(s)}$	-0.74
$Al^{3+} + 3e^- \rightarrow Al_{(s)}$	-1.66
$Mg^{2+} + 2e^- \rightarrow Mg_{(s)}$	-2.37
$Rb^+ + e^- \rightarrow Rb_{(s)}$	-2.98

A) Cu^+
B) Cu(s)
C) Al(s)
D) Al^{3+}
E) Fe^{2+}

15. The galvanic cell shown below uses the half-cells Mg^{2+}/Mg and Zn^{2+}/Zn, and a salt bridge containing KCl(aq). The voltmeter gives a positive voltage reading. Which statement correctly identifies the anode and cathode compartments and the reactions that occur in them?

$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$, E° = -2.37

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$, E° = -0.76 V



A) A and E represent the cathode: $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$
B) B and F represent the cathode: $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$
C) A and E represent the anode: $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$
D) B and F represent the anode: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$
E) B and F represent the cathode: $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$

16. The pH for a galvanic cell with the reaction is 2.75, and its cell potential (E_{cell}) is +0.84 V. If the concentration of Fe^{2+} is 0.10 *M* and the partial pressure of H_2 is 1.00 atm, then what is the concentration of Fe^{3+} at 298K?

$$H_2(g) + 2Fe^{3+} \longrightarrow 2H^+(aq) + 2Fe^{2+}$$

$Fe^{3+} + e^- \longrightarrow Fe^{2+}$	$E^o = +0.80$ V
$2H^+ + 2e^- \longrightarrow H_2$	$E^o = 0.00$ V
$Fe^{2+} + 2e^- \longrightarrow Fe(s)$	$E^o = -0.44$ V

Chapter 22

1. Identify the following components of $Na_4[CoBr_4(ox)]$.
   Coordination compound: $Na_4[CoBr_4(ox)]$
   Coordination complex: $[CoBr_4(ox)]^{4-}$
   Lewis acid: Co^{2+}
   Ligands: Br^- and oxalate ion
   Charge on the cobalt ion: +2
   Coordination number = 6

2. Propose a coordination isomer (also called an ionization isomer) for the compound $[Cr(NH_3)_5SO_4]Br$

3. Which coordination complex should be *least* stable?
   A) $[Rh(bipy)_3]^{2+}$ where bipy = bipyridine
   B) $[Rh(C_4H_{13}N_3)_2]^{2+}$ where $C_4H_{13}N_3$ = diethylenetriamine
   C) $[Rh(OH)_2(CN)_4]^{2-}$
   D) $[Rh(NH_3)_2(ox)_2]^{2-}$ where ox = oxalate ion
   E) $[Rh(NH_3)_3(C_4H_{13}N_3)]^{2+}$

4. Which types of isomerism are *possible* for the coordination complex $[Co(en)_2Cl_2]^+$? Select all that apply.

   A) Geometric isomerism (also call diastereoisomerism)
   B) Linkage isomerism
   C) Ionization isomerism
   D) Optical isomerism
   The cis isomer is chiral and has an optical isomer; the trans isomer is achiral and does not have an optical isomer.

5. Which compounds or complexes are chiral? Select all that apply.
   A) $[Pt(NH_3)_2Br_2]$ (square planar)
   B) $[Cr(ox)_3]^{3-}$
   C) $[Fe(OH_2)_2(en)Cl_2]^+$
   D) $[CoBr_2Cl_2]^{2-}$
   E) $[Cu(NH_3)_5(ONO)]Cl_2$
   F) $[Fe(NH_3)(OH_2)Cl(OH)]^+$ (tetrahedral)

6. The coordination compound $K_4[Fe(L)_6]$ contains the monodentate ligand L^-. The coordination compound is *not* attracted to a magnetic field. Identify the behavior of L^- in this coordination compound as weak-field or strong-field.

7. Determine the number of unpaired electrons for the transition metal cation in the coordination compound $[Fe(CO)_4]Cl_3$. The coordination complex in this compound is tetrahedral.

8. Which statements are true regarding the isomers of coordination complexes? Select all that apply.

   A) Square planar, tetrahedral, and octahedral complexes all can have optical isomers.
   B) Only square planar and octahedral complexes can have geometric isomers (also called diastereoisomers)
   C) Coordination *complexes* cannot have coordination isomers (also called ionization isomers)
   D) All tetrahedral complexes that have four different ligands are chiral.
   E) All octahedral complexes with bidentate ligands are chiral.
   F) All octahedral complexes with bidentate ligands have geometric isomers (diastereoisomers)
   G) For a coordination complex to have a linkage isomer, it must contain a bidentate ligand.

9. The coordination complex $[M(OH_2)_6]^{3+}$ *transmits* light with λ_{max} = 570nm. The coordination complex $[M(L)_6]^{3+}$ includes the same metal cation as the Lewis acid and *transmits* light with λ_{max} = 450nm. Which statements are true regarding ligands OH_2 (also written H_2O) and L? Select all that apply.

   A) H_2O is acts as a strong-field ligand in this complex.
   B) There is less repulsion between L ligands and the *d* electrons of M^{3+} than between H_2O ligands and the *d* electrons of M^{3+}.
   C) L results in a low-spin complex and H_2O results in a high-spin complex.
   D) H_2O is a stronger-field ligand than L.
   E) The magnitude of the crystal field splitting is smaller in the complex containing L ligands than in the complex containing H_2O ligands.
   F) $[M(OH_2)_6]^{3+}$ appears orange as an aqueous solution.

10. Arrange the coordination complexes in the order of increasing wavelength of maximum *absorption*.

$$[Ni(py)_4]^{3+},\ [NiBr_4]^-,\ [Ni(NO_2)_4]^-$$

Chapter XX

1. Identify the electrophilic center of each molecule.
   A) SO_3
   B) BF_3
   C) NH_4^+
   D) $SOCl_2$ (S is the central atom with a double bond to O and single bonds to each Cl)
   E) CH_2O (C with a double bond to O and single bonds to both H)
   F) NO_2^+

2. Identify the nucleophilic center of each molecule
   A) NH_3
   B) PH_3
   C) CH_3NH_2
   D) CH_3OH
   E) CH_3Cl
   F) OH^-

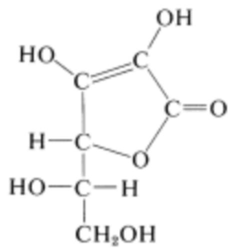
3. Identify the oxidation state of hydrogen in each binary hydride.
   A) MgH_2
   B) HCl
   C) H_2S
   D) NaH
   E) CH_4
   F) FeH_3

4. Determine whether an aqueous solution of each oxide would be acidic or basic.
   A) SO_3
   B) MgO
   C) NO_2
   D) CO_2
   E) Na_2O
   F) Fe_2O_3

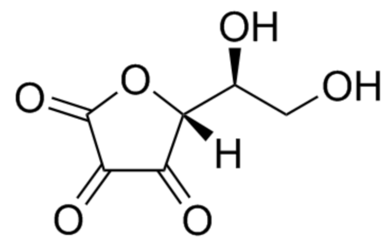
5. Determine the products of the reaction of FeH_2 and H_2O.

6. How is the hydride reaction in question 5 best characterized?
   A) Homolytic cleavage
   B) Heterolytic cleavage by hydride transfer
   C) Heterolytic cleavage by proton transfer
   D) Both homolytic and heterolytic cleavage
   E) Both heterolytic cleavage by hydride transfer and heterolytic cleavage by proton transfer

7. Identify the reactant oxidize, the reactant reduced, the oxidizing agent, and the reducing agent in the following chemical reaction that features ascorbic acid ($C_6H_8O_6$) and dehydroascorbic acid ($C_6H_6O_6$)



L-ascorbic acid



$$C_6H_8O_6 + 2\ H^+ + 2\ NO_2^- \longrightarrow C_6H_6O_6 + 2\ H_2O + 2\ NO$$

Species oxidized = reducing agent = $C_6H_8O_6$ (specifically, the C atom)
Species reduced = oxidizing agent ; NO_2^- (specifically, the N atom)

8. Predict the products of the reaction between NH_3 and LiH.

9. Which statements are true regarding allotropes of carbon? Select all that apply.
   A) All electrons in graphite are part of sigma bonds.
   B) All C atoms in diamond are sp^2 hybridized.
   C) The lack of unhybridized *p* orbitals in graphite facilitates its ability to conduct electricity.
   D) All electrons in diamond are part of sigma bonds.
   E) All C atoms in graphite are sp^2 hybridized.
   F) The unhybridized *p* orbitals in diamond prohibit is ability to conduct electricity.

10. Predict the products of the reaction of SO_2(g) with NaOH(aq).

11. Predict the products of the reaction of K_2O and H_2O(l)

12. SnO is an amphoteric oxide. Predict the products of its reaction with *two* HCl(aq).