Final Exam General Chemistry II Lecture Fall 2018 12/12/18 W 10 am MWF Dr. Hahn Exam # _____

Name Key (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions.

(2 pts print and sign exam)

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (3 pts per question, 33 pts pts total)

1) In the reaction between magnesium and sulfur, the sulfur atoms 1) A

(A) becomes anion
B) share electrons with sulfur
C) become part of polyatomic ions
D) becomes cation

2) Order the intermolecular forces (dipole-dipole, London dispersion, ionic, and hydrogen-bonding) from weakest to strongest 2) B

A) hydrogen-bonding, dipole-dipole, London dispersion, and ionic
(B) London dispersion, dipole-dipole, hydrogen-bonding, and ionic
C) dipole-dipole, London dispersion, ionic, and hydrogen-bonding
D) London dispersion, ionic, dipole-dipole, and hydrogen-bonding

3) An element with the electron configuration [Kr] $5s^2 4d^7$ would belong to which class on the periodic table? 3) B

A) alkaline earth elements
(B) transition metal elements
C) halogens
D) lanthanide/actinide

4) How many valence electrons do alkali metals possess ? 4) B

A) two
(B) one
C) three
D) not enough information to decide

5) Consider the reaction $2H_2 + O_2 \rightarrow 2H_2O$ What is the ratio of the initial rate of the appearance of water to the initial rate of disappearance of oxygen? 5) D

A) 2:2 B) 3:2 C) 1:1 (D) 2:1

6) Which of the following is the equilibrium constant expression (K) for the dissociation of the weak acid HOCl? $HOCl \rightleftharpoons H^+ + OCl^-$ 6) A

(A) $\frac{[H^+][OCl^-]}{[HOCl]}$

B) $[H^+][OCl^-]$

C) $\frac{[H^+][O^{2-}][Cl^-]}{[HOCl]}$

D) $\frac{[HOCl]}{[H^+][OCl^-]}$

7) Which of the following solutions have the highest concentration of sodium ions 7) B

A) 0.10 M Na Cl (B) 0.10 M Na_3N C) 0.20 M Na Cl D) 0.050 M Na_2 S

8) Which of the following has a $\Delta H°_f = 0$ kJ/mol? 8) A

(A) Fe (s) B) $CS_2(l)$ C) $Fe^{2+}(aq)$ D) $H_2O(l)$. E) NO(g)

9) Calculate the pH of 0.271 *M* $HNO_3(aq)$ (a strong acid). $pH = - \log [H^+]$ 9) A

(A) 0.567 B) 0.271 C) 13.73 D) -1.138

10) Which of the following processes represents the first ionization energy of bromine? 10) D

A) $Br_2(g) \longrightarrow Br_2^+(g) + e^-$ B) $Br(g) \longrightarrow Br^{+2}(g) + 2\,e^-$

C) $Br(g) + e^- \longrightarrow Br^-(g)$ (D) $Br(g) \longrightarrow Br^+(g) + e^-$

11) If the reaction $2HI \rightarrow H_2 + I_2$ is first order, which of the following will yield a linear plot? 11) C

A) log [HI] vs time

(C) ln [HI] vs time

B) [HI] vs time

D) 1/[HI] vs time

Part II: Short Answers (34 pts) Show work on all questions for partial and full credit.

1. For the element **F** (flourine) answer the following (8 pts total, 1 pt each)

a) How many protons 9 b) How many electrons for the neutral atom 9

c) Give the symbol in the format ${}^{A}_{Z}X$ for the same element ${}^{19}_{9}F$

d) What group is the element in 7A e) What period is the element in 2

f) What is the likely charge on the element −1 Explain or show work. gp# − 8 = 7 − 8 = −1

g) Is the element a [(metal) or (nonmetal)]

2. If you have a compound made up of the elements **Al and SO_4^{-2}** (6 pts total)

Write the formula for the compound made from those elements. Showing work on how you arrived at the formula. Al Gp 3 → +3 $Al^{+3}(SO_4^{-2})$ $Al_2(SO_4)_3$

3. Write out the **balanced** molecular equation for the reaction below by filling in the blanks. (6 pts)

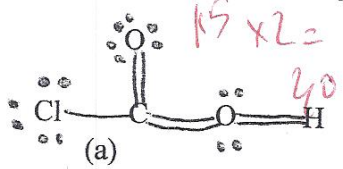
3 $Ba(OH)_2$ (aq) + 2 Li_3PO_4 (aq) → $Ba_3(PO_4)_2$ + 6 LiOH

4. For the compound Cl C O_2 H (8 pts)

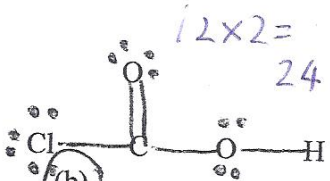
a. Show the valence electron count for drawing a Lewis Dot structure. (4 pts)

7 + 4 + 2(6) + 1 = 24

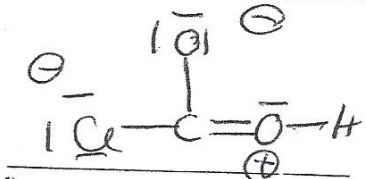
b. Given the following two Lewis Dot structures, which is the correct Lewis Dot structure. Circle the letter of the correct structure (2 pt)



(a)



(b)



(d) resonance structure

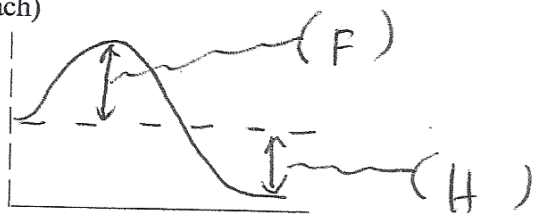
c. Give **one reasons** why the structure that you said is incorrect is wrong. (1 pts)

① H more than duet ② wrong # e⁻ - too many e⁻

② O more than octet

d. Draw one resonance structure of what you believe is the correct Lewis Dot Structure in the space above labeled (d) (1 pt)

5. Given the following reaction energy diagram, fill in the blanks with the letters to match:
(A) Energy (B) progress of reaction or time (C) reactant (D) product (E) transition state (F) activation energy (G) activation energy of a catalyzed reaction (H) overall energy of the reaction (6 pts, 2 pts each)



Part III: Long Answers (33 pts) Show work on all questions for partial and full credit even on questions which do not specify.

1. a. For the element **O**, give the valence electron configuration in the format $1s^2$, $2s^2$ ….. (5 pts)

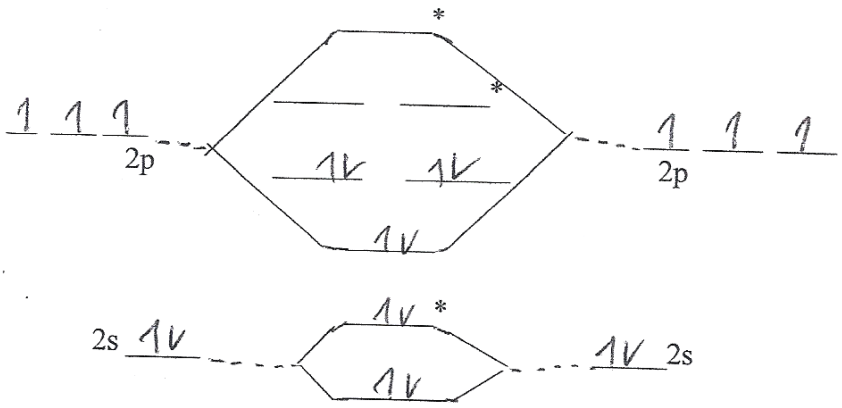
$2s^2, 2p^4$

Not Valence −2

b. How many **valence electrons** is in the element **O**? (3 pts) 6

c. For the molecule O_2 the MO diagram is shown below.

O +1 → 5e



Fill in your MO diagram (above) with the correct number of electrons using up and down arrows for the electrons for the molecule O_2^{+2}. (3 pts) 6 × 2 = 12 − 2 = 10 e

e. Is the molecule O_2^{+2} stable according to your MO diagram which you filled above ? [(yes) or (no)] (circle one) and explain briefly. (3 pts)

bond order is 3

2. For the reaction shown below (13 pts)

$2\ NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2\ H_2O$

If you have 250.2 mL of 0.50 M of the Na OH, assuming complete reaction and excess H_2SO_4 how many grams of the Na_2SO_4 should you make ? (M = # moles solute / liter of solution)

$$250.2\text{ mL} \times \frac{0.50\text{ mol NaOH}}{1000\text{ mL soln}} \times \frac{1\text{ mol } Na_2SO_4}{2\text{ mol NaOH}} \times \frac{142.1\text{ g } Na_2SO_4}{1\text{ mol } Na_2SO_4}$$

$$= 8.888\text{ g } Na_2SO_4$$

attempt 2

3. The overall reaction is $A + B \rightarrow C$

[A] (mol/L)	[B] (mol/L)	Initial Rate of Formation of C (mol/L·s)	Experiment Run #
0.10	0.10	1.00	1
0.10	0.20	4.00	2
0.20	0.20	8.00	3

The reaction is irreversible. The above data is enough to obtain the value of x and y. Show your setup for how you would solve for x. (6 pts)

Rate = $k\,[A]^x\,[B]^y$

attempt 2

$$\frac{\text{rate}_3}{\text{rate}_2} = \frac{8.00}{4.00} = \frac{k\,[0.20]^x\,[0.20]^y}{k\,[0.1]^x\,[0.20]^y}$$

$$2 = \left[\frac{0.20}{0.1}\right]^x$$

$$2 = [2]^x \qquad x = 1$$