green

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 8:30 am A 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. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts total)

1) How many H+ ions can the acid, H_3PO_4, donate per molecule? 1) B
A) 1 (B) 3 C) 0 D) 2

2) A cation of +2 indicates that an element has 2) C
A) gained two protons.
B) gained two electrons.
(C) lost two electrons.
D) lost two protons.
E) lost two neutrons.

H same EN as C
F is most EN

3) Choose the bond below that is **most** polar. (Greatest EN difference) 3) E
A) H-Br B) H-Cl C) H-I D) C-H (E) H-F
almost zero

4) A substance that can't be chemically broken down into simpler substances is 4) B
A) a heterogeneous mixture.
(B) an element.
C) a homogeneous mixture.
D) an electron.
E) a compound.

5) Identify the compound with covalent bonds. 5) D
A) Li B) KBr C) Kr (D) CH_4 E) NaCl
metallic ionic metallic covalent ionic

6) In which orbital below would an electron (on average) be closest to the nucleus? 6) E
A) 4s B) 5d C) 2p D) 3p (E) 2s

7) Iodine belongs to the _____ group of the periodic table. 7) B
A) alkali metal (B) halogen
C) alkaline earth metal D) noble gas

8) Ag is an example of
A) a compound.
B) a homogeneous mixture.
C) an element.
D) a heterogeneous mixture.

8) C

9) Give the name for H_2SO_4.
A) hyposulfurous acid
B) persulfuric acid
C) sulfuric acid
D) persulfurous acid
E) sulfurous acid

9) C

10) Which of the following exists as a diatomic molecule?
A) lithium
B) hydrogen
C) krypton
D) phosphorus
E) carbon

10) B

11) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed.
A) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$
C) $H^+(aq) + OH^-(aq) + 2\,K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$
D) $2\,K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$
E) No reaction occurs.

acid + base is always $H^+ + OH^- \rightarrow H_2O$ net ionic

11) A

12) Which one of the following compounds is insoluble in water?
A) K_2CO_3 B) $NaNO_3$ C) $PbCl_2$ D) $CaCl_2$

12) C

13) Describe the shape of a p orbital.
A) four balls
B) spherical
C) three balls
D) dumbbell shaped
E) eight balls

13) D

14) Which element can expand its valence shell to accommodate more than eight electrons?
A) Br 4th period B) N 2nd period C) He 1st period D) O 2nd period

2nd period & lower cannot expand octet bc no d orbitals available

14) A

15) An ionic bond is best described as
A) the attraction between 2 metal atoms.
B) the attraction that holds the atoms together in a polyatomic ion.
C) the attraction between 2 nonmetal atoms.
D) the sharing of electrons.
E) the transfer of electrons from one atom to another.

15) E

For $l=1$ $m_l = -1, 0, +1$ or 3 orbitals (p_x, p_y, p_z)

16) What is the maximum number of p orbitals that are possible (number of m_l values for $l = 1$)? 16) A

(A) 3 B) 9 C) 1 D) 7 E) 5

17) The number of cycles that pass through a stationary point in a wave is called 17) E

A) area
B) amplitude
C) wavelength
D) median
(E) frequency

18) The statement, "In a chemical reaction, matter is neither created nor destroyed" is called 18) C

A) the Scientific Method.
B) the Law of Definite Proportions.
(C) the Law of Conservation of Mass.
D) the Law of Multiple Proportions.
E) Dalton's Atomic Theory.

19) What symbol is used to represent the factor 10^3? 19) C

A) micro B) Mega (C) kilo D) nano

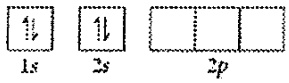
20) Which of the following elements is a metal? 20) A

(A) Fe B) Br C) S D) Kr E) As

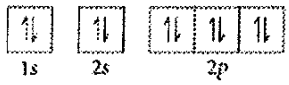
(to left of zigzag line)

21) Choose the orbital diagram that shows a violation of Hund's Rule. 21) D

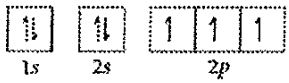
A)



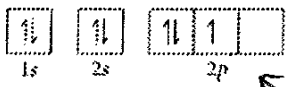
B)



C)

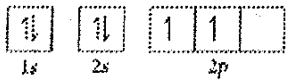


(D)



Hund says 2p should be 1 1 1 not

E)



22) Give the temperature and pressure at STP (standard pressure and atmosphere). 22) B

A) 0K and 1.00 atm
B) 0°C and 1.00 atm
C) 32K and 1 torr Hg
D) 0°C and 1 mm Hg
E) 25°C and 1.00 in Hg

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all compounds. You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

CH_3CH_3 O_2 Fe $NiCl_2$

2. From the list of molecules shown below circle all ionic compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

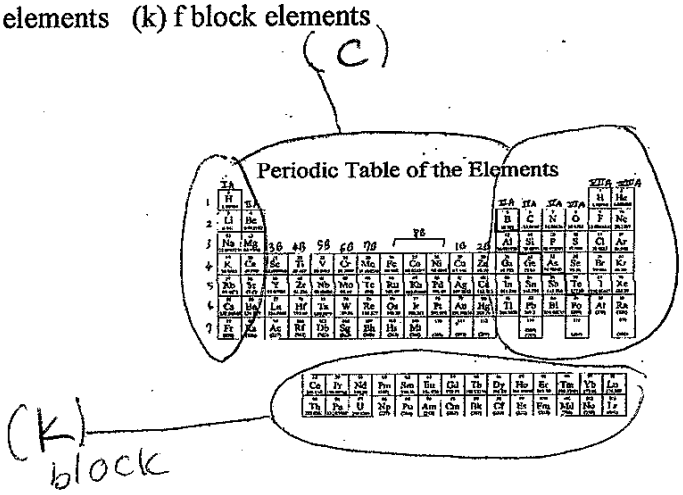
Cl_2 NaCl Na_2SO_4 SF_6

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

Fe Iron oxygen O

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **N**

Group number is (a) IA Period number is (b) 2

number protons (c) 7 number electrons (d) 7 (total # e)

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

K and Se

a. charge on K +1 charge on Se −2 (6 pts, 3 pts each)

Group IA gp. 6 6 − 8 = −2

b. correct formula is K_2Se (1 pts, 2 pts show work) (show work)

K_2Se

$(+1)K + (-2)Se = 0$

$K = 2$ $Se = 1$

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ H_2S(g) + 3\ O_2(g) \rightarrow$ 2 $SO_2(g) + 2\ H_2O\ (g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side
4H, 2S, 6O	2S, 4O, 4H, 2O

8(a). Is the compound Mg S [(soluble) or (insoluble)] (circle one) in water? (3 pt)

(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

$Na_2S(aq) + Mg\ Cl_2(aq) \rightarrow$ MgS [(s) or (aq)] circle one + NaCl [(s) or (aq)] circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ NO_3\ (aq) + KOH\ (aq) \rightarrow$ KNO$_3$ (aq) + H$_2$O (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)

a. What is the **VSEPRT # electron pairs** around the atom with the * ? 4

b. How many **lone pair electrons** (if any) are on the atom with the * ? 2

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?

tetrahedral

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?

bent

e. What is the **bond angle** around the atom with the * ? 109.5°

f. What is the **hybridization** of the atom with the * ? sp^3

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

<u>Part III. Long Answer</u> Please <u>show work</u> for full credit and to receive partial credit. (68 pts)
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction, if you start with 0.255 grams of H_2O (l) , how many liters of product H_2 (g) will you generate at STP ? (22.4 Liters = 1 mole gas at STP) (molar mass H_2O = 18.02 g / mol) [assume that the grams of H_2O (l) is the limiting reagent] (The following reaction is a balanced reaction.)

$Sr\ (s) + 2\ H_2O\ (l) \rightarrow Sr(OH)_2\ (aq) + H_2\ (g)$

$$0.255\text{ g } H_2O \times \frac{1\text{ mol } H_2O}{18.02\text{ g } H_2O} \times \frac{1\text{ mol } H_2}{2\text{ mol } H_2O} \times \frac{22.4\text{ L } H_2}{1\text{ mol } H_2} =$$

$$0.158\text{ L } H_2$$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

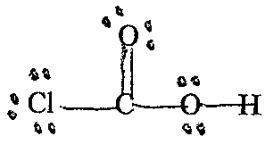
For the molecule $ClCO_2H$ $7\bar{e}$ $4\bar{e}$ O — $6\bar{e}$ H — $1\bar{e}$ (group #)

a. Give the valence electron configuration for the molecule. (show work) (7 pts)

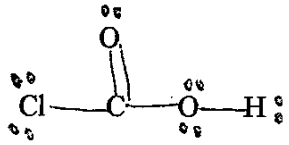
valence $\bar{e}$ = Cl $7\bar{e}$ + C $4\bar{e}$ + 2(O $6\bar{e}$) + H $1\bar{e}$ = $24\bar{e}$

b. Give the Lewis Dot Symbol for the atom  (7 pts)

c. Given the following Lewis Dot Structures, choose the correct Lewis Dot structure by circling the correct number. (6 pts)



(1) $12 \times 2 = 24e$



(2) $11 \times 2 = 22\bar{e}$

d. Explain why the Lewis Dot structure which you **did not choose is incorrect**. For full credit, you must give at least 2 reasons. (6 pts)

① Cl + O do not have octet

② too few $\bar{e}$ only $22\bar{e}$ not $24\bar{e}$

③ H cannot have more than duet (2 $\bar{e}$ total)

3 Other type LA problem. (24 pts total)

a. If you have 13.2 grams of Na OH and dissolve it in distilled water to make a solution of total volume 1.25 Liters, what is the molarity of the solution? (molar mass NaOH = 40.01 grams / mole) (12 pts)

$$M = \frac{\#\ moles}{liter\ soln}$$

$$\#moles = 13.2\ g\ NaOH \times \frac{mol\ NaOH}{40.01\ g\ NaOH} = 0.330\ mol\ NaOH$$

$$M = \frac{0.330\ mol\ NaOH}{1.25\ L} = 0.264\ M$$

b. How many molecules [actually the accurate term would be number of formula units (not molecules) before dissociation] of NaOH do you have in your solution ? (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

$$13.2\ g\ NaOH \times \frac{mol\ NaOH}{40.01\ g\ NaOH} \times \frac{6.022 \times 10^{23}\ molecules}{1\ mol\ NaOH}$$

$$= 1.99 \times 10^{23}\ formula\ units\ of\ NaOH\ before\ dissociation$$

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 8:30 am B 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. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

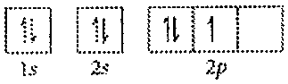
Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts total)

1) Ag is an example of 1) B
A) a compound.
B) an element.
C) a heterogeneous mixture.
D) a homogeneous mixture.

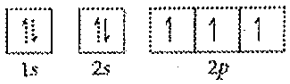
2) A substance that can't be chemically broken down into simpler substances is 2) D
A) a compound.
B) a heterogeneous mixture.
C) an electron.
D) an element.
E) a homogeneous mixture.

3) Choose the orbital diagram that shows a violation of Hund's Rule. 3) A

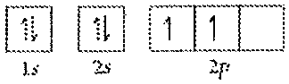
A)



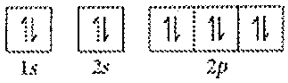
B)



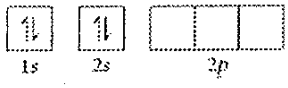
C)



D)



E)



4) The number of cycles that pass through a stationary point in a wave is called 4) E

A) amplitude
B) wavelength
C) area
D) median
E) frequency

5) Give the name for H_2SO_4. 5) E

A) sulfurous acid
B) persulfuric acid
C) persulfurous acid
D) hyposulfurous acid
E) sulfuric acid

6) In which orbital below would an electron (on average) be closest to the nucleus? 6) C

A) 2p B) 4s C) 2s D) 2p E) 5d

7) Which of the following exists as a diatomic molecule? 7) B

A) phosphorus
B) hydrogen
C) krypton
D) lithium
E) carbon

8) Describe the shape of a p orbital. 8) D

A) eight balls
B) spherical
C) three balls
D) dumbbell shaped
E) four balls

9) Give the temperature and pressure at STP (standard pressure and atmosphere). 9) B

A) 0K and 1.00 atm
B) 0°C and 1.00 atm
C) 32K and 1 torr Hg
D) 0°C and 1 mm Hg
E) 25°C and 1.00 in Hg

10) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 10) A

A) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$
C) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$
D) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$
E) No reaction occurs.

11) What symbol is used to represent the factor 10^3? 11) D

A) Mega B) micro C) nano D) kilo

12) Which element can expand its valence shell to accommodate more than eight electrons? 12) D
A) He B) N C) O D) Br

13) What is the maximum number of p orbitals that are possible (number of m_ℓ values for $\ell = 1$)? 13) C
A) 1 B) 7 C) 3 D) 9 E) 5

14) Identify the compound with covalent bonds. 14) E
A) NaCl B) Li C) KBr D) Kr E) CH_4

15) How many H^+ ions can the acid, H_3PO_4, donate per molecule? 15) C
A) 1 B) 2 C) 3 D) 0

16) Choose the bond below that is **most** polar. 16) A
A) H–F B) H–Br C) C–H D) H–Cl E) H–I

17) Which of the following elements is a metal? 17) E
A) As B) S C) Kr D) Br E) Fe

18) The statement, "In a chemical reaction, matter is neither created nor destroyed" is called 18) B
A) the Law of Definite Proportions.
B) the Law of Conservation of Mass.
C) Dalton's Atomic Theory.
D) the Scientific Method.
E) the Law of Multiple Proportions.

19) An ionic bond is best described as 19) B
A) the sharing of electrons.
B) the transfer of electrons from one atom to another.
C) the attraction between 2 metal atoms.
D) the attraction between 2 nonmetal atoms.
E) the attraction that holds the atoms together in a polyatomic ion.

20) A cation of +2 indicates that an element has 20) E
A) lost two neutrons.
B) gained two electrons.
C) gained two protons.
D) lost two protons.
E) lost two electrons.

21) Iodine belongs to the _____ group of the periodic table. 21) D
A) noble gas B) alkaline earth metal
C) alkali metal D) halogen

22) Which one of the following compounds is insoluble in water? 22) D
A) $NaNO_3$ B) K_2CO_3 C) $CaCl_2$ D) $PbCl_2$

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all elements . You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

CH_3CH_3 O_2 Fe $NiCl_2$

2. From the list of molecules shown below circle all covalent compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

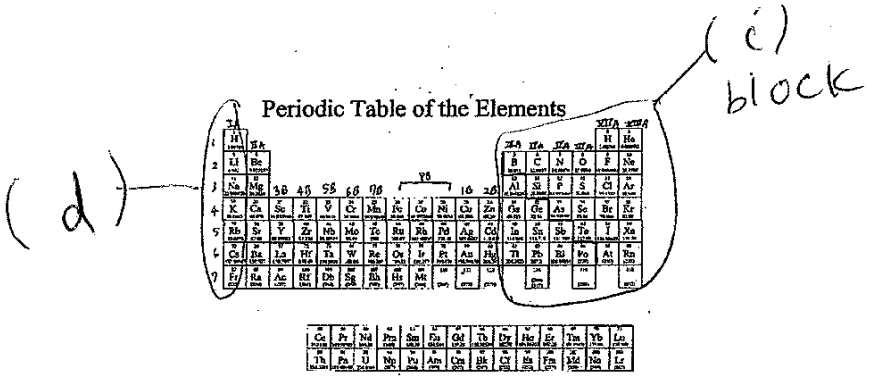
Cl_2 NaCl Na_2SO_4 SF_6

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

Na Sodium sulfur S

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Ca**

Period number is (a) 4 Group number is (b) II A

number protons (c) 20 number electrons (d) 20 (total # e⁻)

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Mg and F

gp. #7 7−8 = −1

a. charge on Mg +2 charge on F −1 (6 pts, 3 pts each)

Group 2

b. correct formula is MgF_2 (1 pts, 2 pts show work) (show work)

$(+2)(Mg) + (-1)F = 0$

(1) (2)

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

CH_4 (g) + 2 O_2 (g) → 1 CO_2 (g) + 2 H_2O (g)

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side
1 C, 4 H, 4 O	1 C, 2 O, 4 H, 2 O

8(a). Is the compound Ba CO_3 [(soluble) or (insoluble)] (circle one) in water? (3 pt)

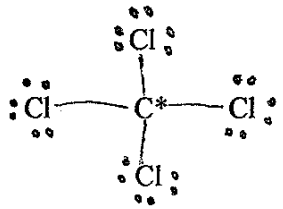
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

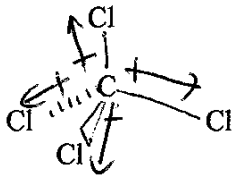
Ba S(aq) + Li_2CO_3(aq) → Ba CO_3 [(s) or (aq)]circle one + Li_2S [(s) or (aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

H Cl (aq) + Li OH (aq) → Li Cl (aq) + H_2O (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)





a. What is the **VSEPRT # electron pairs** around the atom with the * ? 4

b. How many **lone pair electrons** (if any) are on the atom with the * ? zero

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?
tetrahedral

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?
tetrahedral

e. What is the **bond angle** around the atom with the * ? 109.5°

f. What is the **hybridization** of the atom with the * ? sp^3

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction, if you start with 1.577 grams of K (s) , how many liters of product H_2 (g) will you generate at STP ? (22.4 Liters = 1 mole gas at STP) (molar mass K = 39.10 g / mole) [assume that the grams of K(s) is the limiting reagent] (The following reaction is a balanced reaction.)

$2\,K\,(s) + 2H_2O\,(l) \rightarrow 2\,KOH\,(aq) + H_2\,(g)$

$$1.577\ g\ K \times \frac{1\ mol\ K}{39.10\ g\ K} \times \frac{1\ mol\ H_2}{2\ mol\ K} \times \frac{22.4\ l\ H_2}{1\ mol\ H_2} =$$

$$0.4517\ l\ H_2$$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

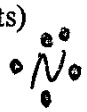
For the molecule HCO NHCl

a. Give the valence electron configuration for the molecule. (show work) (7 pts)

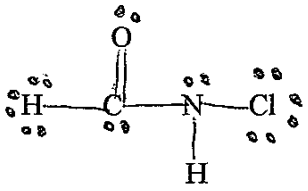
$[2*(1\bar{e})] + 4\bar{e} + 6\bar{e} + 9\bar{e} + 7\bar{e} = 24\bar{e}$

H C O N Cl

b. Give the Lewis Dot Symbol for the atom **N** (7 pts)

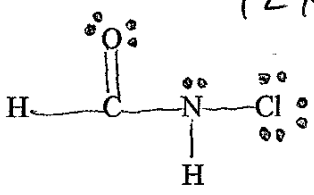


c. Given the following Lewis Dot Structures, choose the correct Lewis Dot structure by circling the correct number. (6 pts)



(1) $15 \times 2 = 30\bar{e}$

$12 \times 2 = 24\bar{e}$



(2) correct

d. Explain why the Lewis Dot structure which you **did not choose is incorrect**. For full credit, you must give at least 2 reasons. (6 pts)

(1) too many $\bar{e}$ in structure ($30\bar{e}$ vs. $24\bar{e}$)

(2) H has octet – H can only have duet

(3) C has more than octet – 2nd period elements cannot have more than octet

3 Other type LA problem. (24 pts total)

a. If you have 78.5 grams of Na OH and dissolve it in distilled water to make a solution of total volume 0.555 Liters, what is the molarity of the solution? (molar mass NaOH = 40.01 grams / mole) (12 pts)

$$M = \frac{\#\text{ moles NaOH}}{\text{liter solution}}$$

$$\#\text{ moles NaOH} = 78.5\text{ g NaOH} \times \frac{\text{mol NaOH}}{40.01\text{ g NaOH}}$$

$$\#\text{ moles NaOH} = 1.96\text{ moles NaOH}$$

$$M = \frac{1.96\text{ mol NaOH}}{0.555\text{ l soln.}} = 3.53\text{ M NaOH}$$

b. How many molecules [actually the accurate term would be number of formula units (not molecules) before dissociation] of NaOH do you have in your solution ? (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

$$78.5\text{ g NaOH} \times \frac{\text{mol NaOH}}{40.01\text{ g NaOH}} \times \frac{6.022 \times 10^{23}\text{ molecules NaOH}}{1\text{ mol NaOH}}$$

$$= 1.18 \times 10^{24}\text{ molecules NaOH}$$
(formula units NaOH

gellow

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 9:55 A 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. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr)
(Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts pts total)

1) Give the temperature and pressure at STP (standard pressure and atmosphere). 1) C
A) 32K and 1 torr Hg
B) 0°C and 1 mm Hg
C) 0°C and 1.00 atm
D) 25°C and 1.00 in Hg
E) 0K and 1.00 atm

2) Which of the following are examples of physical change? 2) E
A) salt is dissolved in water
B) water (solid) to water (liquid)
C) water freezes
D) melt solid gold to liquid gold
E) All of these are examples of physical change.

closest to F

3) Which of the following elements is a alkali metal? 3) A
A) K B) N C) Be D) Ce E) Br

4) Of the following elements, which has the highest electronegativity? 4) D
A) Ge B) Si C) Ti D) P

5) The factor 10^{-3} corresponds to which prefix? 5) D
A) deka B) deci C) centi D) milli

6) Which one of the following compounds is soluble in water? 6) C
A) $ZnCO_3$ B) $Cu_3(PO_4)_2$ C) $Pb(NO_3)_2$ D) CoS

7) Give the name for HNO_3. 7) E
A) hydrogen nitrite
B) hydrogen nitrate
C) nitrous acid
D) hydrogen nitride
E) nitric acid

8) Which of the following elements is a nonmetal? 8) B
A) K (B) N C) Be D) Fe E) Ce

9) NO_2 is an example of 9) B
A) a homogeneous mixture. (B) a compound.
C) a heterogeneous mixture. D) an element.

10) A triple covalent bond contains _____ of electrons. 10) E
A) 0 pairs B) 2 pairs C) 4 pairs D) 1 pair (E) 3 pairs

11) A covalent bond is best described as 11) A
(A) the sharing of electrons between atoms.
B) a bond between a metal and a nonmetal.
C) a bond between two polyatomic ions.
D) a bond between a metal and a polyatomic ion.
E) the transfer of electrons.

12) The distance between adjacent crests in a wave is called 12) D
A) median
B) frequency
C) area
(D) wavelength
E) amplitude

13) Which of the following exists as a diatomic molecule? 13) C
A) lithium
B) krypton
(C) bromine
D) carbon
E) phosphorus

14) The total pressure of a gas mixture is the sum of the partial pressure of its components is known as (otherwise in equation form: $P_T = P_a + P_b + P_c$ ...) 14) C
A) Avogadro's Law
B) Charles's Law
(C) Dalton's Law
D) Ideal Gas Law
E) Boyle's Law

15) How many H^+ ions can the acid, H_2SO_4, donate per molecule? 15) A
(A) 2 B) 0 C) 3 D) 1

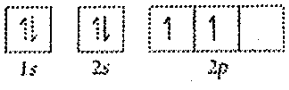
16) Describe the shape of a s orbital. 16) B
A) three balls
(B) spherical
C) four balls
D) dumbbell shaped
E) eight balls

17) The atmospheric pressure is 715 mm Hg. What is the pressure in torr? (torr = mm Hg) 17) D

A) 13.8 torr B) 31.8 torr C) 760 torr (D) 715 torr E) 28.1 torr

18) Choose the orbital diagram that shows an example of violation of the "aufbau principal". 18) D

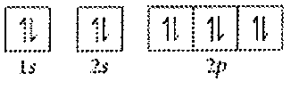
A)



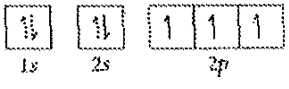
T

add e from bottom up

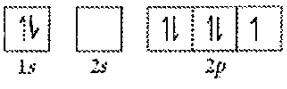
B)



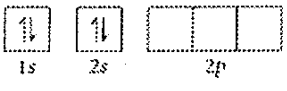
C)



(D)



E)



19) Identify the compound with ionic bonds. 19) D

A) N_2 B) Ne C) CO (D) KBr E) H_2O

20) Identify a cation. 20) A

(A) An atom that has lost an electron.
B) An atom that has gained a neutron.
C) An atom that has gained an electron.
D) An atom that has lost a proton and a neutron.

21) Give the approximate bond angle for a molecule with a tetrahedral shape. → from VSEPRT table 21) C

A) 105° B) 120° (C) 109.5° D) 180° E) 90°

22) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 22) B

A) $H^+(aq) + OH^-(aq) + 2\,K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$

(B) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ ← any acid + base has net ionic

C) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$

D) $2\,K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$

E) No reaction occurs.

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all compounds. You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

Br_2 H_2O Zn $FeCl_2$

2. From the list of molecules shown below circle all ionic compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

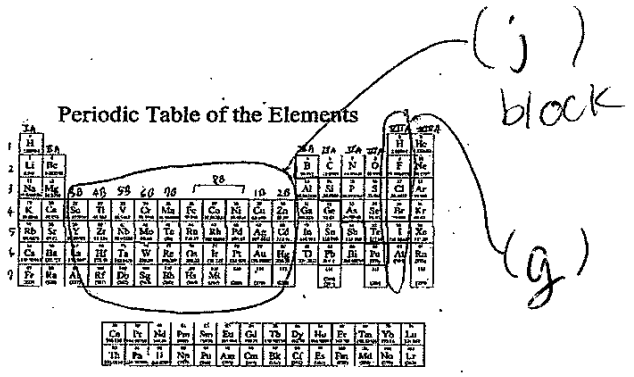
Li_2S NO_2 NH_4Cl O_2

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

I Iodine potassium K

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Si**

Period number is (a) 3 Group number is (b) IV A

number protons (c) 14 number electrons (d) 14 (total # e)

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Al and S group = 3 group = 6 6 − 8 = −2

a. charge on Al +3 charge on S −2 (6 pts, 3 pts each)

b. correct formula is Al_2S_3 (1 pts, 2 pts show work) (show work)

$(+3)(Al) + (-2)(S) = 0$

↑2 ↑3

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ CO\ (g) + O_2\ (g) \rightarrow$ 2 $CO_2(g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side
2C, 2O, 2O	2C, 4O

8 . (a). Is the compound $Al\ PO_4$ [(soluble) or (insoluble)] (circle one) in water? (3 pt)

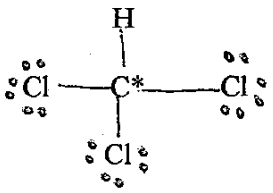
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

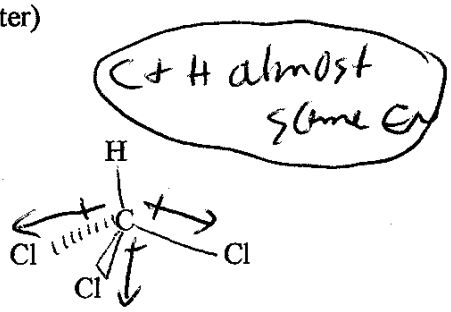
$AlCl_3(aq) + Na_3\ PO_4(aq) \rightarrow$ $AlPO_4$ [(s) or (aq)] circle one + $NaCl$ [(s) or (aq)] circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ F\ (aq) +$ $Na\ OH\ (aq) \rightarrow$ NaF (aq) + H_2O (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)





a. What is the **VSEPRT # electron pairs** around the atom with the * ? 4

b. How many **lone pair electrons** (if any) are on the atom with the * ? Zero

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?
tetrahedral

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?
tetrahedral

e. What is the **bond angle** around the atom with the * ? 109.5°

f. What is the **hybridization** of the atom with the * ? sp^3

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction if you start with 25.7 mL of a 0.15 M solution of the H Cl (aq), what is the theoretical yield of the $CaCl_2$ in grams (assuming that you are able to get out the solid $CaCl_2$ after the end of the reaction by evaporation)? (molar mass $CaCl_2$ = 111.08 grams / mole) (show work)

$2\ HCl\ (aq) + Ca(OH)_2\ (aq) \rightarrow CaCl_2\ (aq) + 2\ H_2O\ (l)$

$$25.7\ \text{mL HCl soln.} \times \frac{0.15\ \text{mol HCl}}{1000\ \text{mL soln.}} \times \frac{1\ \text{mol } CaCl_2}{2\ \text{mol HCl}} \times \frac{111.08\ \text{g } CaCl_2}{1\ \text{mol } CaCl_2} =$$

$0.214\ g\ CaCl_2$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the element **Sb** , (show work if appropriate) (26 pts)

a. What is the atomic mass ? 121,760 (3 pts)

b. What is the atomic number ? 51 (3 pts)

c. How many valence electrons ? 5 (explain or show work) (3 pts)

gp. #5

d. Give the electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}$
$5p^3$

e. Give the valence electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

$5s^2, 5p^3$

f. Give the valence electron configuration diagram in the format ($\frac{\uparrow\downarrow}{1s}$ $\frac{\uparrow\downarrow}{2s}$ $\frac{\uparrow}{2p}$ ____ ____)
(format only gives format and has no information about the answer)
(5 pts)

$\frac{\uparrow}{5p}$ $\frac{\uparrow}{5p}$ $\frac{\uparrow}{5p}$

$\frac{\uparrow\downarrow}{5s}$

3 Other type LA problem. (24 pts total)

If you do a reaction which produces 25.2 Liters of a gas CH_4 and collect it in a gas cylinder at 1.022 atmosphere, 299.2 Kelvin.

a. How many molecules of CH_4 do you have in that volume of gas approximately ? (22.4 Liters = 1 mole of gas) (You may assume that the molar volume at STP is close enough at this nonstandard condition to get a good approximate number for this question.) (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

$$25.2\ \ell\ CH_4 \times \frac{1\ mol\ CH_4}{22.4\ \ell\ CH_4} \times \frac{6.022 \times 10^{23}\ molecules\ CH_4}{1\ mol\ CH_4} =$$

$$6.77 \times 10^{23}\ molecules\ CH_4$$

b. If you close the gas cylinder opening and then check the condition of the gas cylinder contents you find that the pressure is 1.52 atmosphere, temperature is 304.2 Kelvin. What is the new volume ? [$(P_2V_2) / (P_1V_1) = T_2 / T_1$] (show work) (12 pts)

$P_1 = 1.022\ atm$ $\quad P_2 = 1.52\ atm$

$V_1 = 25.2\ \ell$ $\quad V_2 = ?$

$T_1 = 299.2\ K$ $\quad T_2 = 304.2\ K$

$$\frac{(1.52\ atm)(V_2)}{(1.022\ atm)(25.2\ \ell)} = \frac{304.2\ K}{299.2\ K}$$

$$V_2 = \left(\frac{304.2\ K}{299.2\ K}\right)\left(\frac{1.022\ atm}{1.52\ atm}\right)(25.2\ \ell) = 17.2\ \ell$$

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 9:55 B 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. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts pts total)

1) Give the name for HNO_3. 1) E

A) hydrogen nitride
B) hydrogen nitrate
C) hydrogen nitrite
D) nitrous acid
(E) nitric acid

2) Identify the compound with ionic bonds. 2) B

A) H_2O (B) KBr C) Ne D) N_2 E) CO

3) A triple covalent bond contains _____ of electrons. 3) D

A) 2 pairs B) 0 pairs C) 4 pairs (D) 3 pairs E) 1 pair

4) Identify a cation. 4) C

A) An atom that has gained an electron.
B) An atom that has gained a neutron.
(C) An atom that has lost an electron.
D) An atom that has lost a proton and a neutron.

5) The factor 10^{-3} corresponds to which prefix? 5) A

(A) milli B) deci C) centi D) deka

6) Which of the following exists as a diatomic molecule? 6) C

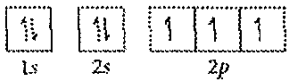
A) phosphorus
B) carbon
(C) bromine
D) krypton
E) lithium

7) How many H^+ ions can the acid, H_2SO_4, donate per molecule? 7) A

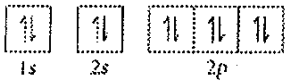
(A) 2 B) 0 C) 3 D) 1

8) Choose the orbital diagram that shows an example of violation of the "aufbau principal". 8) D

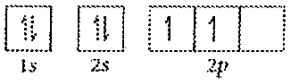
A)



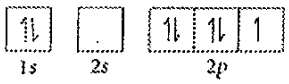
B)



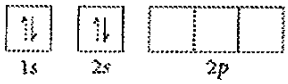
C)



(D)



E)



9) Give the temperature and pressure at STP (standard pressure and atmosphere). 9) A

(A) 0°C and 1.00 atm
B) 25°C and 1.00 in Hg
C) 0°C and 1 mm Hg
D) 0K and 1.00 atm
E) 32K and 1 torr Hg

10) A covalent bond is best described as 10) E

A) a bond between a metal and a nonmetal.
B) a bond between two polyatomic ions.
C) a bond between a metal and a polyatomic ion.
D) the transfer of electrons.
(E) the sharing of electrons between atoms.

11) The total pressure of a gas mixture is the sum of the partial pressure of its components is known as (otherwise in equation form: $P_T = P_a + P_b + P_c$ ...) 11) E

A) Boyle's Law
B) Charles's Law
C) Avogadro's Law
D) Ideal Gas Law
(E) Dalton's Law

12) NO_2 is an example of 12) C

A) an element.
B) a heterogeneous mixture.
(C) a compound.
D) a homogeneous mixture.

13) Give the approximate bond angle for a molecule with a tetrahedral shape. 13) A

(A) 109.5° B) 105° C) 180° D) 90° E) 120°

14) Of the following elements, which has the highest electronegativity? 14) B

A) Ge (B) P C) Si D) Ti

15) The distance between adjacent crests in a wave is called 15) A

(A) wavelength
B) area
C) median
D) amplitude
E) frequency

16) Which of the following elements is a nonmetal? 16) B

A) K (B) N C) Be D) Ce E) Fe

17) Which of the following are examples of physical change? 17) E

A) salt is dissolved in water
B) melt solid gold to liquid gold
C) water freezes
D) water (solid) to water (liquid)
(E) All of these are examples of physical change.

18) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 18) B

A) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$

(B) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

C) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$

D) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$

E) No reaction occurs.

19) Describe the shape of a s orbital. 19) D

A) eight balls
B) four balls
C) three balls
(D) spherical
E) dumbbell shaped

20) The atmospheric pressure is 715 mm Hg. What is the pressure in torr? 20) E

A) 760 torr B) 31.8 torr C) 28.1 torr D) 13.8 torr (E) 715 torr

21) Which of the following elements is a alkali metal? 21) B

A) Ce (B) K C) Be D) N E) Br

22) Which one of the following compounds is soluble in water? 22) B

A) CoS (B) $Pb(NO_3)_2$ C) $Cu_3(PO_4)_2$ D) $ZnCO_3$

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all elements . You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

Br_2 H_2O Zn $FeCl_2$

2. From the list of molecules shown below circle all covalent compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

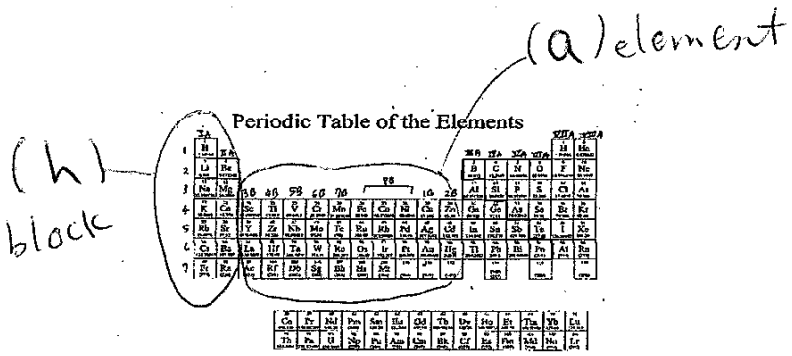
Li_2S NO_2 NH_4Cl O_2

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

N Nitrogen copper Cu

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Bi**

Period number is (a) 6 Group number is (b) V A

number protons (c) 83 number electrons (d) 83 (total #e)

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Ca and N

group #5 5 − 8 = −3

a. charge on Ca +2 charge on N −3 (6 pts, 3 pts each)

a. correct formula is Ca_3N_2 (1 pts, 2 pts show work) (show work)

$(Ca)(+2) + (N)(-3) = 0$

$(3)(+2) + (2)(-3) = 0$

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ SO_2\ (g) + O_2\ (g) \rightarrow$ __2__ $SO_3\ (g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side
2 S, 4 O, 2 O	2 S, 6 O

8(a). Is the compound $Mg(OH)_2$ [(soluble) or (insoluble)] (circle one) in water? (3 pt)

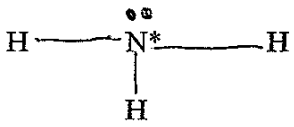
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

$Mg(NO_3)_2(aq) + Ca(OH)_2(aq) \rightarrow$ $Mg(OH)_2$ [(s)or(aq)]circle one + $Ca(NO_3)_2$ [(s)or(aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ I\ (aq) + Li\ OH\ (aq) \rightarrow$ LiI (aq) + H_2O (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)



a. What is the **VSEPRT # electron pairs** around the atom with the * ? 4

b. How many **lone pair electrons** (if any) are on the atom with the * ? 1

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?
tetrahedral

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?
trigonal pyramidal

e. What is the **bond angle** around the atom with the * ? 109.5°

f. What is the **hybridization** of the atom with the * ? sp^3

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction if you start with 35.8 mL of a 0.20 M solution of the H Cl (aq), what is the theoretical yield of the $CaCl_2$ in grams (assuming that you are able to get out the solid $CaCl_2$ after the end of the reaction by evaporation)? (molar mass $CaCl_2$ = 111.08 grams / mole) (show work)

$2\ HCl\ (aq) + Ca(OH)_2\ (aq) \rightarrow CaCl_2\ (aq) + 2\ H_2O\ (l)$

$$35.8\ mL\ HCl\ soln \times \frac{0.20\ mol\ HCl}{1000\ mL\ HCl\ soln} \times \frac{1\ mol\ CaCl_2}{2\ mol\ HCl} \times \frac{111.08\ g\ CaCl_2}{1\ mol\ CaCl_2} =$$

$0.398\ g\ CaCl_2$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the element **Ga** , (show work if appropriate) (26 pts)

a. What is the atomic mass ? 69.723 (3 pts)

b. What is the atomic number ? 31 (3 pts)

c. How many valence electrons ? 3 (explain or show work) (3 pts)

Gp. IIIA → 3 valence $\bar{e}$

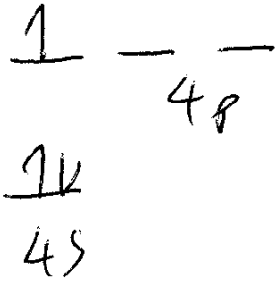
d. Give the electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^1$

e. Give the valence electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

$4s^2, 4p^1$

f. Give the valence electron configuration diagram in the format ($\underline{\uparrow\downarrow}_{1s}$ $\underline{\uparrow\downarrow}_{2s}$ $\underline{\uparrow}_{2p}$ ___ ___)
(format only gives format and has no information about the answer)
(5 pts)



3 Other type LA problem. (24 pts total)

If you do a reaction which produces 1.77 Liters of a gas CH_4 and collect it in a gas cylinder at 0.982 atmosphere, 278.2 Kelvin.

a. How many molecules of CH_4 do you have in that volume of gas approximately ? (22.4 Liters = 1 mole of gas) (You may assume that the molar volume at STP is close enough at this nonstandard condition to get a good approximate number for this question.) (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

$$1.77\ \ell\ CH_4 \times \frac{1\ mol\ CH_4}{22.4\ \ell\ CH_4} \times \frac{6.022 \times 10^{23}\ molecules\ CH_4}{1\ mol\ CH_4} =$$

$$4.76 \times 10^{22}\ molecules\ CH_4$$

b. If you close the gas cylinder opening and then check the condition of the gas cylinder contents you find that the pressure is 2.75 atmosphere, temperature is 270.2 Kelvin. What is the new volume ? [$(P_2V_2) / (P_1V_1) = T_2 / T_1$] (show work) (12 pts)

$P_1 = 0.982\ atm$ $P_2 = 2.75\ atm$

$V_1 = 1.77\ \ell$ $V_2 = ?$

$T_1 = 278.2\ K$ $T_2 = 270.2\ K$

$$\frac{(2.75\ atm)(V_2)}{(0.982\ atm)(1.77\ \ell)} = \frac{270.2\ K}{278.2\ K}$$

$$V_2 = \left(\frac{270.2\ K}{278.2\ K}\right)\left(\frac{0.982\ atm}{2.75\ atm}\right)(1.77\ \ell) = 0.614\ \ell$$

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 8:30 am A Dr. Hahn Exam # _____

Name_____ (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [(P_2V_2) / (P_1 V_1)=T_2/T_1]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts total)

1) How many H+ ions can the acid, H_3PO_4, donate per molecule? 1) _____
A) 1 B) 3 C) 0 D) 2

2) A cation of +2 indicates that an element has 2) _____
A) gained two protons.
B) gained two electrons.
C) lost two electrons.
D) lost two protons.
E) lost two neutrons.

3) Choose the bond below that is **most** polar. 3) _____
A) H–Br B) H–Cl C) H–I D) C–H E) H–F

4) A substance that can't be chemically broken down into simpler substances is 4) _____
A) a heterogeneous mixture.
B) an element.
C) a homogeneous mixture.
D) an electron.
E) a compound.

5) Identify the compound with covalent bonds. 5) _____
A) Li B) KBr C) Kr D) CH_4 E) NaCl

6) In which orbital below would an electron (on average) be closest to the nucleus? 6) _____
A) 4s B) 5d C) 2p D) 2p E) 2s

7) Iodine belongs to the _____ group of the periodic table. 7) _____
A) alkali metal B) halogen
C) alkaline earth metal D) noble gas

8) Ag is an example of 8) _____

A) a compound.
B) a homogeneous mixture.
C) an element.
D) a heterogeneous mixture.

9) Give the name for H_2SO_4. 9) _____

A) hyposulfurous acid
B) persulfuric acid
C) sulfuric acid
D) persulfurous acid
E) sulfurous acid

10) Which of the following exists as a diatomic molecule? 10) _____

A) lithium
B) hydrogen
C) krypton
D) phosphorus
E) carbon

11) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 11) _____

A) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$
C) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$
D) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$
E) No reaction occurs.

12) Which one of the following compounds is insoluble in water? 12) _____

A) K_2CO_3 B) $NaNO_3$ C) $PbCl_2$ D) $CaCl_2$

13) Describe the shape of a p orbital. 13) _____

A) four balls
B) spherical
C) three balls
D) dumbbell shaped
E) eight balls

14) Which element can expand its valence shell to accommodate more than eight electrons? 14) _____

A) Br B) N C) He D) O

15) An ionic bond is best described as 15) _____

A) the attraction between 2 metal atoms.
B) the attraction that holds the atoms together in a polyatomic ion.
C) the attraction between 2 nonmetal atoms.
D) the sharing of electrons.
E) the transfer of electrons from one atom to another.

16) What is the maximum number of p orbitals that are possible (number of m_l values for $l = 1$)? 16) _____

A) 3 B) 9 C) 1 D) 7 E) 5

17) The number of cycles that pass through a stationary point in a wave is called 17) _____

A) area
B) amplitude
C) wavelength
D) median
E) frequency

18) The statement, "In a chemical reaction, matter is neither created nor destroyed" is called 18) _____

A) the Scientific Method.
B) the Law of Definite Proportions.
C) the Law of Conservation of Mass.
D) the Law of Multiple Proportions.
E) Dalton's Atomic Theory.

19) What symbol is used to represent the factor 10^3? 19) _____

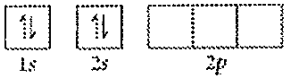
A) micro B) Mega C) kilo D) nano

20) Which of the following elements is a metal? 20) _____

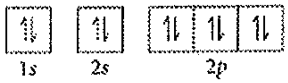
A) Fe B) Br C) S D) Kr E) As

21) Choose the orbital diagram that shows a violation of Hund's Rule. 21) _____

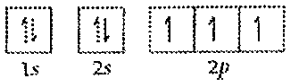
A)



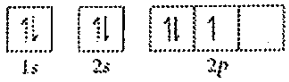
B)



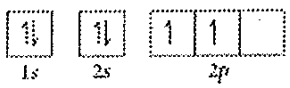
C)



D)



E)



22) Give the temperature and pressure at STP (standard pressure and atmosphere). 22) _____

A) 0K and 1.00 atm
B) 0°C and 1.00 atm
C) 32K and 1 torr Hg
D) 0°C and 1 mm Hg
E) 25°C and 1.00 in Hg

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all compounds. You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

CH_3CH_3 O_2 Fe $NiCl_2$

2. From the list of molecules shown below circle all ionic compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

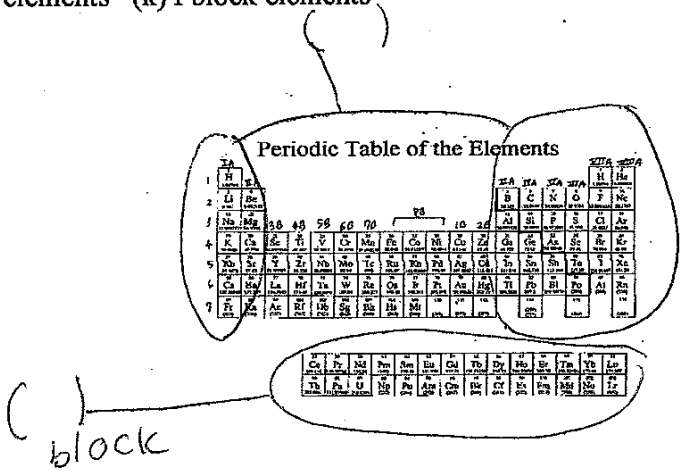
Cl_2 NaCl Na_2SO_4 SF_6

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

Fe _____ oxygen _____

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **N**

Group number is (a) _____ Period number is (b) _____

number protons (c)_____ number electrons (d) _____

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

K and Se

a. charge on K _____ charge on Se _____ (6 pts, 3 pts each)

b. correct formula is _____ (1 pts, 2 pts show work) (show work)

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ H_2S(g) + 3\ O_2(g) \rightarrow$ _____ $SO_2(g) + 2\ H_2O\ (g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side

8(a). Is the compound Mg S [(soluble) or (insoluble)] (circle one) in water? (3 pt)

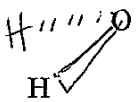
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product.** The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

$Na_2S(aq) + Mg\ Cl_2(aq) \rightarrow$ _____ [(s) or (aq)]circle one + _____ [(s) or (aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ NO_3\ (aq) + KOH\ (aq) \rightarrow$ _____ (aq) + _____ (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)



a. What is the **VSEPRT # electron pairs** around the atom with the * ? _____

b. How many **lone pair electrons** (if any) are on the atom with the * ? _____

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?

_____

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?

_____

e. What is the **bond angle** around the atom with the * ?_____

f. What is the **hybridization** of the atom with the * ? _____

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction, if you start with 0.255 grams of H_2O (l) , how many liters of product H_2 (g) will you generate at STP ? (22.4 Liters = 1 mole gas at STP) (molar mass H_2O = 18.02 g / mol) [assume that the grams of H_2O (l) is the limiting reagent] (The following reaction is a balanced reaction.)

$$Sr\ (s) + 2\ H_2O\ (l) \rightarrow Sr(OH)_2\ (aq) + H_2\ (g)$$

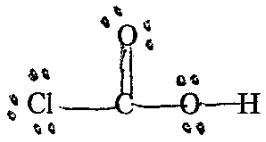
2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the molecule $ClCO_2H$

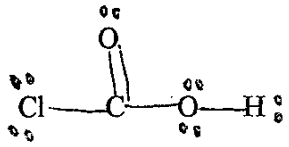
a. Give the valence electron configuration for the molecule. (show work) (7 pts)

b. Give the Lewis Dot Symbol for the atom **O** (7 pts)

c. Given the following Lewis Dot Structures, choose the correct Lewis Dot structure by circling the correct number. (6 pts)



(1)



(2)

d. Explain why the Lewis Dot structure which you **did not choose is incorrect**. For full credit, you must give at least 2 reasons. (6 pts)

3 Other type LA problem. (24 pts total)

a. If you have 13.2 grams of Na OH and dissolve it in distilled water to make a solution of total volume 1.25 Liters, what is the molarity of the solution? (molar mass NaOH = 40.01 grams / mole) (12 pts)

b. How many molecules [actually the accurate term would be number of formula units (not molecules) before dissociation] of NaOH do you have in your solution ? (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 8:30 am B Dr. Hahn Exam # _____

Name_____ (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = °C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

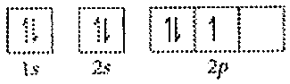
Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts total)

1) Ag is an example of 1) _____
A) a compound.
B) an element.
C) a heterogeneous mixture.
D) a homogeneous mixture.

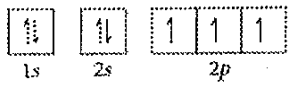
2) A substance that can't be chemically broken down into simpler substances is 2) _____
A) a compound.
B) a heterogeneous mixture.
C) an electron.
D) an element.
E) a homogeneous mixture.

3) Choose the orbital diagram that shows a violation of Hund's Rule. 3) _____

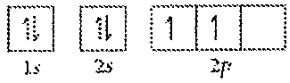
A)



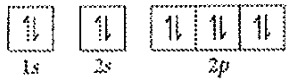
B)



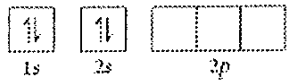
C)



D)



E)



4) The number of cycles that pass through a stationary point in a wave is called 4) _____

A) amplitude
B) wavelength
C) area
D) median
E) frequency

5) Give the name for H_2SO_4. 5) _____

A) sulfurous acid
B) persulfuric acid
C) persulfurous acid
D) hyposulfurous acid
E) sulfuric acid

6) In which orbital below would an electron (on average) be closest to the nucleus? 6) _____

A) 2p B) 4s C) 2s D) 2p E) 5d

7) Which of the following exists as a diatomic molecule? 7) _____

A) phosphorus
B) hydrogen
C) krypton
D) lithium
E) carbon

8) Describe the shape of a p orbital. 8) _____

A) eight balls
B) spherical
C) three balls
D) dumbbell shaped
E) four balls

9) Give the temperature and pressure at STP (standard pressure and atmosphere). 9) _____

A) 0K and 1.00 atm
B) 0°C and 1.00 atm
C) 32K and 1 torr Hg
D) 0°C and 1 mm Hg
E) 25°C and 1.00 in Hg

10) Give the <u>net ionic equation</u> for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 10) _____

A) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
B) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$
C) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$
D) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$
E) No reaction occurs.

11) What symbol is used to represent the factor 10^3? 11) _____

A) Mega B) micro C) nano D) kilo

12) Which element can expand its valence shell to accommodate more than eight electrons? 12) _____
A) He B) N C) O D) Br

13) What is the maximum number of p orbitals that are possible (number of m_ℓ values for $\ell = 1$)? 13) _____
A) 1 B) 7 C) 3 D) 9 E) 5

14) Identify the compound with covalent bonds. 14) _____
A) NaCl B) Li C) KBr D) Kr E) CH_4

15) How many H+ ions can the acid, H_3PO_4 , donate per molecule? 15) _____
A) 1 B) 2 C) 3 D) 0

16) Choose the bond below that is **most** polar. 16) _____
A) H–F B) H–Br C) C–H D) H–Cl E) H–I

17) Which of the following elements is a metal? 17) _____
A) As B) S C) Kr D) Br E) Fe

18) The statement, "In a chemical reaction, matter is neither created nor destroyed" is called 18) _____
A) the Law of Definite Proportions.
B) the Law of Conservation of Mass.
C) Dalton's Atomic Theory.
D) the Scientific Method.
E) the Law of Multiple Proportions.

19) An ionic bond is best described as 19) _____
A) the sharing of electrons.
B) the transfer of electrons from one atom to another.
C) the attraction between 2 metal atoms.
D) the attraction between 2 nonmetal atoms.
E) the attraction that holds the atoms together in a polyatomic ion.

20) A cation of +2 indicates that an element has 20) _____
A) lost two neutrons.
B) gained two electrons.
C) gained two protons.
D) lost two protons.
E) lost two electrons.

21) Iodine belongs to the _____ group of the periodic table. 21) _____
A) noble gas B) alkaline earth metal
C) alkali metal D) halogen

22) Which one of the following compounds is insoluble in water? 22) _____
A) $NaNO_3$ B) K_2CO_3 C) $CaCl_2$ D) $PbCl_2$

<u>Part II Short Answer</u>: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all elements . You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

CH_3CH_3 O_2 Fe $NiCl_2$

2. From the list of molecules shown below circle all covalent compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

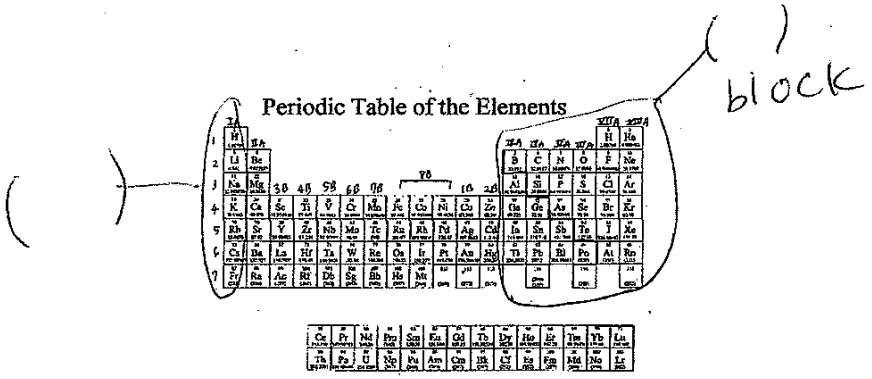
Cl_2 NaCl Na_2SO_4 SF_6

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

Na _____ sulfur _____

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Ca**

Period number is (a)_____ Group number is (b) _____

number protons (c)_____ number electrons (d) _____

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Mg and F

a. charge on Mg _____ charge on F _____ (6 pts, 3 pts each)

b. correct formula is _____ (1 pts, 2 pts show work) (show work)

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

CH_4 (g) + 2 O_2 (g) → _____ CO_2 (g) + 2 H_2O (g)

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side

8(a). Is the compound Ba CO_3 [(soluble) or (insoluble)] (circle one) in water? (3 pt)

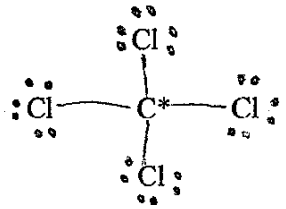
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

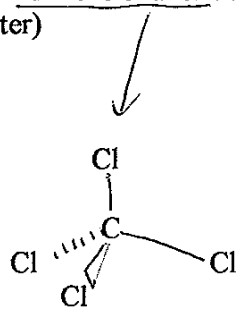
Ba S(aq) + Li_2CO_3(aq) → _____ [(s) or (aq)]circle one + _____[(s) or (aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

H Cl (aq) + Li OH (aq) → _____ (aq) + _____ (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)





a. What is the **VSEPRT # electron pairs** around the atom with the * ? _____

b. How many **lone pair electrons** (if any) are on the atom with the * ? _____

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?

_____

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?

_____

e. What is the **bond angle** around the atom with the * ?_____

f. What is the **hybridization** of the atom with the * ? _____

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction, if you start with 1.577 grams of K (s) , how many liters of product H_2 (g) will you generate at STP ? (22.4 Liters = 1 mole gas at STP) (molar mass K = 39.10 g / mole) [assume that the grams of K(s) is the limiting reagent] (The following reaction is a balanced reaction.)

$2\,K\,(s) + 2H_2O\,(l) \rightarrow 2\,KOH\,(aq) + H_2\,(g)$

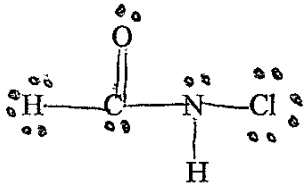
2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the molecule HCO NHCl

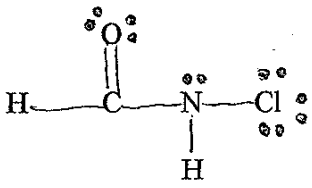
a. Give the valence electron configuration for the molecule. (show work) (7 pts)

b. Give the Lewis Dot Symbol for the atom **N** (7 pts)

c. Given the following Lewis Dot Structures, choose the correct Lewis Dot structure by circling the correct number. (6 pts)



(1)



(2)

d. Explain why the Lewis Dot structure which you **did not choose is incorrect**. For full credit, you must give at least 2 reasons. (6 pts)

3 Other type LA problem. (24 pts total)

a. If you have 78.5 grams of Na OH and dissolve it in distilled water to make a solution of total volume 0.555 Liters, what is the molarity of the solution? (molar mass NaOH = 40.01 grams / mole) (12 pts)

b. How many molecules [actually the accurate term would be number of formula units (not molecules) before dissociation] of NaOH do you have in your solution ? (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 9:55 A Dr. Hahn Exam # _____

Name_____ (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = ^{o}C + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts pts total)

1) Give the temperature and pressure at STP (standard pressure and atmosphere). 1) _____
A) 32K and 1 torr Hg
B) 0°C and 1 mm Hg
C) 0°C and 1.00 atm
D) 25°C and 1.00 in Hg
E) 0K and 1.00 atm

2) Which of the following are examples of physical change? 2) _____
A) salt is dissolved in water
B) water (solid) to water (liquid)
C) water freezes
D) melt solid gold to liquid gold
E) All of these are examples of physical change.

3) Which of the following elements is a alkali metal? 3) _____
A) K B) N C) Be D) Ce E) Br

4) Of the following elements, which has the highest electronegativity? 4) _____
A) Ge B) Si C) Ti D) P

5) The factor 10^{-3} corresponds to which prefix? 5) _____
A) deka B) deci C) centi D) milli

6) Which one of the following compounds is soluble in water? 6) _____
A) $ZnCO_3$ B) $Cu_3(PO_4)_2$ C) $Pb(NO_3)_2$ D) CoS

7) Give the name for HNO_3. 7) _____
A) hydrogen nitrite
B) hydrogen nitrate
C) nitrous acid
D) hydrogen nitride
E) nitric acid

8) Which of the following elements is a nonmetal? 8) _____

A) K B) N C) Be D) Br E) Ce

9) NO_2 is an example of 9) _____

A) a homogeneous mixture.
B) a compound.
C) a heterogeneous mixture.
D) an element.

10) A triple covalent bond contains _____ of electrons. 10) _____

A) 0 pairs B) 2 pairs C) 4 pairs D) 1 pair E) 3 pairs

11) A covalent bond is best described as 11) _____

A) the sharing of electrons between atoms.
B) a bond between a metal and a nonmetal.
C) a bond between two polyatomic ions.
D) a bond between a metal and a polyatomic ion.
E) the transfer of electrons.

12) The distance between adjacent crests in a wave is called 12) _____

A) median
B) frequency
C) area
D) wavelength
E) amplitude

13) Which of the following exists as a diatomic molecule? 13) _____

A) lithium
B) krypton
C) bromine
D) carbon
E) phosphorus

14) The total pressure of a gas mixture is the sum of the partial pressure of its components is known as (otherwise in equation form: $P_T = P_a + P_b + P_c$ ...) 14) _____

A) Avogadro's Law
B) Charles's Law
C) Dalton's Law
D) Ideal Gas Law
E) Boyle's Law

15) How many H^+ ions can the acid, H_2SO_4, donate per molecule? 15) _____

A) 2 B) 0 C) 3 D) 1

16) Describe the shape of a s orbital. 16) _____

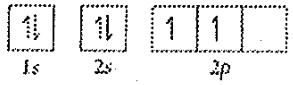
A) three balls
B) spherical
C) four balls
D) dumbbell shaped
E) eight balls

17) The atmospheric pressure is 715 mm Hg. What is the pressure in torr? 17) _____

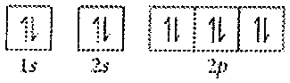
A) 13.8 torr B) 31.8 torr C) 760 torr D) 715 torr E) 28.1 torr

18) Choose the orbital diagram that shows an example of violation of the "aufbau principal". 18) _____

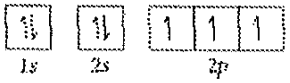
A)



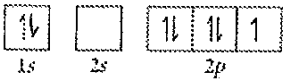
B)



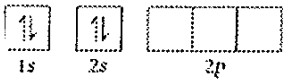
C)



D)



E)



19) Identify the compound with ionic bonds. 19) _____

A) N_2 B) Ne C) CO D) KBr E) H_2O

20) Identify a cation. 20) _____

A) An atom that has lost an electron.
B) An atom that has gained a neutron.
C) An atom that has gained an electron.
D) An atom that has lost a proton and a neutron.

21) Give the approximate bond angle for a molecule with a tetrahedral shape. 21) _____

A) 105° B) 120° C) 109.5° D) 180° E) 90°

22) Give the <u>net ionic equation</u> for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 22) _____

A) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$

B) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

C) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$

D) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$

E) No reaction occurs.

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all compounds. You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

Br_2 H_2O Zn $FeCl_2$

2. From the list of molecules shown below circle all ionic compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

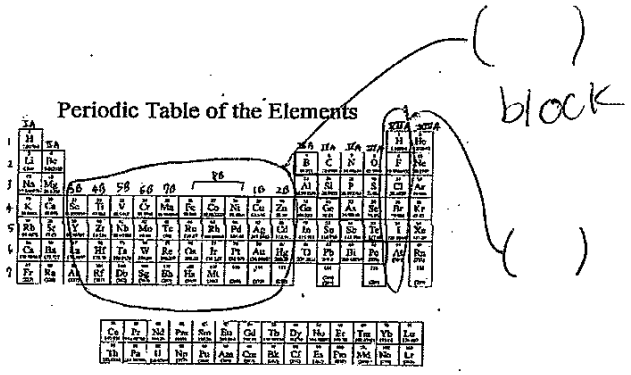
Li_2S NO_2 NH_4Cl O_2

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

I _____ potassium _____

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Si**

Period number is (a) _____ Group number is (b) _____

number protons (c)_____ number electrons (d) _____

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Al and S

a. charge on Al _____ charge on S _____ (6 pts, 3 pts each)

b. correct formula is _____ (1 pts, 2 pts show work) (show work)

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ CO\ (g) + O_2\ (g) \rightarrow$ _____ $CO_2(g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side

8 . (a). Is the compound $Al\ PO_4$ [(soluble) or (insoluble)] (circle one) in water? (3 pt)

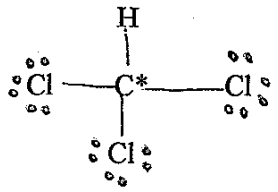
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

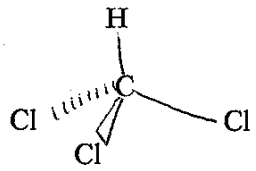
$AlCl_3(aq) + Na_3\ PO_4(aq) \rightarrow$ _____ [(s)or(aq)]circle one + _____ [(s)or(aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ F\ (aq) +\ Na\ OH\ (aq) \rightarrow$ _____ (aq) + _____ (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)





a. What is the **VSEPRT # electron pairs** around the atom with the * ? _____

b. How many **lone pair electrons** (if any) are on the atom with the * ? _____

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?

_____

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?

_____

e. What is the **bond angle** around the atom with the * ?_____

f. What is the **hybridization** of the atom with the * ? _____

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction if you start with 25.7 mL of a 0.15 M solution of the H Cl (aq), what is the theoretical yield of the $CaCl_2$ in grams (assuming that you are able to get out the solid $CaCl_2$ after the end of the reaction by evaporation)? (molar mass $CaCl_2$ = 111.08 grams / mole) (show work)

$2\ HCl\ (aq) + Ca(OH)_2\ (aq) \rightarrow CaCl_2\ (aq) + 2\ H_2O\ (l)$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the element **Sb** , (show work if appropriate) (26 pts)

a. What is the atomic mass ? _____ (3 pts)

b. What is the atomic number ? _____ (3 pts)

c. How many valence electrons ?_____ (explain or show work) (3 pts)

d. Give the electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

e. Give the valence electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

f. Give the valence electron configuration diagram in the format ($\underset{1s}{\uparrow\downarrow}$ $\underset{2s}{\uparrow\downarrow}$ $\underset{2p}{\uparrow}$ ____ ____) (format only gives format and has no information about the answer) (5 pts)

3 Other type LA problem. (24 pts total)

If you do a reaction which produces 25.2 Liters of a gas CH_4 and collect it in a gas cylinder at 1.022 atmosphere, 299.2 Kelvin.

a. How many molecules of CH_4 do you have in that volume of gas approximately ? (22.4 Liters = 1 mole of gas) (You may assume that the molar volume at STP is close enough at this nonstandard condition to get a good approximate number for this question.) (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

b. If you close the gas cylinder opening and then check the condition of the gas cylinder contents you find that the pressure is 1.52 atmosphere, temperature is 304.2 Kelvin. What is the new volume ? [$(P_2V_2) / (P_1V_1) = T_2 / T_1$] (show work) (12 pts)

Final General Chemistry I Lecture Spring 2014 4/24/14 Thursday form 9:55 B Dr. Hahn Exam # _____

Name_____ (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper page and clearly tell me where the remaining answer can be found. **If you don't tell me to look on the scratch paper for answers, I will not even look at the scratch paper.** (Avogadro's number = 6.022×10^{23} (1 atm = 760 mm Hg = 760 torr) (Kelvin = ^oC + 273.15)(PV=nRT, R = 0.08206 (L atm)/(mol K)] [$(P_2V_2) / (P_1 V_1)=T_2/T_1$]

If you are a graduating senior, please circle **(graduating senior)** here so that I submit your grades on time for graduation.

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, ## pts pts total)

1) Give the name for HNO_3. 1) _____

A) hydrogen nitride
B) hydrogen nitrate
C) hydrogen nitrite
D) nitrous acid
E) nitric acid

2) Identify the compound with ionic bonds. 2) _____

A) H_2O B) KBr C) Ne D) N_2 E) CO

3) A triple covalent bond contains _____ of electrons. 3) _____

A) 2 pairs B) 0 pairs C) 4 pairs D) 3 pairs E) 1 pair

4) Identify a cation. 4) _____

A) An atom that has gained an electron.
B) An atom that has gained a neutron.
C) An atom that has lost an electron.
D) An atom that has lost a proton and a neutron.

5) The factor 10^{-3} corresponds to which prefix? 5) _____

A) milli B) deci C) centi D) deka

6) Which of the following exists as a diatomic molecule? 6) _____

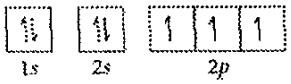
A) phosphorus
B) carbon
C) bromine
D) krypton
E) lithium

7) How many H+ ions can the acid, H_2SO_4, donate per molecule? 7) _____

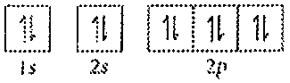
A) 2 B) 0 C) 3 D) 1

8) Choose the orbital diagram that shows an example of violation of the "aufbau principal". 8) _____

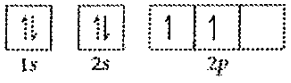
A)



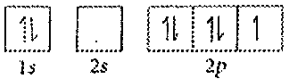
B)



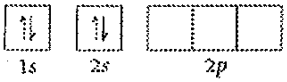
C)



D)



E)



9) Give the temperature and pressure at STP (standard pressure and atmosphere). 9) _____

A) 0°C and 1.00 atm
B) 25°C and 1.00 in Hg
C) 0°C and 1 mm Hg
D) 0K and 1.00 atm
E) 32K and 1 torr Hg

10) A covalent bond is best described as 10) _____

A) a bond between a metal and a nonmetal.
B) a bond between two polyatomic ions.
C) a bond between a metal and a polyatomic ion.
D) the transfer of electrons.
E) the sharing of electrons between atoms.

11) The total pressure of a gas mixture is the sum of the partial pressure of its components is known as (otherwise in equation form: $P_T = P_a + P_b + P_c$ ...) 11) _____

A) Boyle's Law
B) Charles's Law
C) Avogadro's Law
D) Ideal Gas Law
E) Dalton's Law

12) NO_2 is an example of 12) _____

A) an element.
B) a heterogeneous mixture.
C) a compound.
D) a homogeneous mixture.

13) Give the approximate bond angle for a molecule with a tetrahedral shape. 13) _____

A) 109.5° B) 105° C) 180° D) 90° E) 120°

14) Of the following elements, which has the highest electronegativity? 14) _____
A) Ge B) P C) Si D) Ti

15) The distance between adjacent crests in a wave is called 15) _____
A) wavelength
B) area
C) median
D) amplitude
E) frequency

16) Which of the following elements is a nonmetal? 16) _____
A) K B) N C) Be D) Ce E) Br

17) Which of the following are examples of physical change? 17) _____
A) salt is dissolved in water
B) melt solid gold to liquid gold
C) water freezes
D) water (solid) to water (liquid)
E) All of these are examples of physical change.

18) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of H_2SO_4 and KOH are mixed. 18) _____
A) $2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$
B) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
C) $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$
D) $H^+(aq) + OH^-(aq) + 2\ K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$
E) No reaction occurs.

19) Describe the shape of a s orbital. 19) _____
A) eight balls
B) four balls
C) three balls
D) spherical
E) dumbbell shaped

20) The atmospheric pressure is 715 mm Hg. What is the pressure in torr? 20) _____
A) 760 torr B) 31.8 torr C) 28.1 torr D) 13.8 torr E) 715 torr

21) Which of the following elements is a alkali metal? 21) _____
A) Ce B) K C) Be D) N E) Br

22) Which one of the following compounds is soluble in water? 22) _____
A) CoS B) $Pb(NO_3)_2$ C) $Cu_3(PO_4)_2$ D) $ZnCO_3$

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (86 pts)

1 From the given list, circle all elements . You may want to look at the periodic table if you are unfamiliar with the symbols for the elements. (8 pts, 2 pts each)

Br_2 H_2O Zn $FeCl_2$

2. From the list of molecules shown below circle all covalent compounds. I am asking you to circle (or to not circle) the entire compound not parts of a compound formula. (8 pts, 2 pt each)

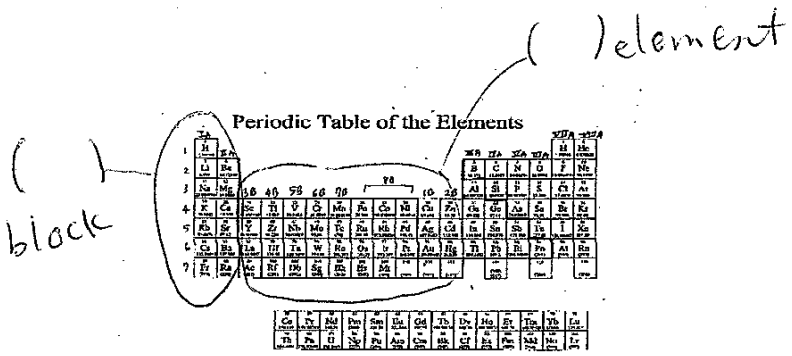
Li_2S NO_2 NH_4Cl O_2

3 For the following either fill in the blank with the element symbol or the word for the element name. (I do not count off for small spelling errors in naming elements.) (6 pts, 3 pts each)

N _____ copper _____

4 Fill in each parenthesis with **one** of the following letters. The letters may be used once, many times or not at all. (You must use one of the letters shown below. If you reply for instance for **d block** as d instead of (j), I will count off full credit.) (10 pts total, 5 pts each)

(a)transition metal elements (b) chalcogen (c) main group element (d) alkali metals (e) actinide / lanthanide (f) alkaline earth metals (g) halogens (h) s block elements (i) p block elements (j) d block elements (k) f block elements



5 For the following questions, use the exact designation as shown on the periodic table which you have in front of you attached to your exam. Do not use the labels from the periodic table on the wall of the room or any other labeling other than the exact labels from the periodic table you have with your exam. Do not convert roman numbers to Arabic numbers or visa versa. (i.e. do not convert roman numeral V to Arabic number 5 or 5 to V) (12 pts total, 3 pts each)

For the element **Bi**

Period number is (a) _____ Group number is (b) _____

number protons (c)_____ number electrons (d) _____

6 Write the correct ionic formula for the following elements. To write the correct ionic formula, you are going to do (a) & (b) below. If you show work you may earn some partial credit on part (a). You must show work for part (b) (9 pts total, 3 pts each)

Ca and N

a. charge on Ca _____ charge on N _____ (6 pts, 3 pts each)

a. correct formula is _____ (1 pts, 2 pts show work) (show work)

7 a. Balance the following reaction by filling in the blanks. The blanks cannot be filled with a zero. You may leave the blank empty which means the number one goes in the blank. (3 pts per blank)

$2\ SO_2\ (g) + O_2\ (g) \rightarrow$ _____ $SO_3\ (g)$

b. Please show how many of each type of atom is in both sides of the equation after you complete balancing the reaction. (6 pts)

atoms in reactant side	atoms on product side

8(a). Is the compound $Mg(OH)_2$ [(soluble) or (insoluble)] (circle one) in water? (3 pt)

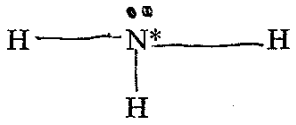
(b) Write out the molecular form of the following precipitation reaction giving the expected products **by (1) filling in the blanks** and then **(2) circling either (s) or (aq) by each product**. The reaction does not need to be balanced. (6 pts total, 2 pt each blank, 1 pt each circling)

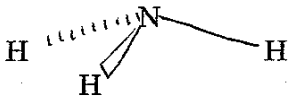
$Mg(NO_3)_2(aq) + Ca(OH)_2(aq) \rightarrow$ _____[(s)or(aq)]circle one +_____[(s)or(aq)]circle one

9. Complete the following acid base reaction. (6 pts total, 3 pts per blank)

$H\ I\ (aq) + Li\ OH\ (aq) \rightarrow$ _____ (aq) + _____ (l)

10. Given the following Lewis Dot structure and the following 3 dimensional structure complete the following mostly about the atom with the * (9 pts total, 1 pt per letter)





a. What is the **VSEPRT # electron pairs** around the atom with the * ? _____

b. How many **lone pair electrons** (if any) are on the atom with the * ? _____

c. What is the **VSEPRT geometry of electron pairs** around the atom with the * ?

_____

d. What is the **VSEPRT geometry of the molecule** around the atom with the * ?

_____

e. What is the **bond angle** around the atom with the * ? _____

f. What is the **hybridization** of the atom with the * ? _____

g. **Draw dipole moment arrows** on all bonds from the atom with the * on the 3 dimensional structure.

h. **Vector sum of the dipole moment arrows** is [(zero) or (not zero)] (circle one)

i. Is the molecule as a whole [(polar) or (nonpolar)] ? (circle one)

Part III. Long Answer **Please show work for full credit and to receive partial credit. (68 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work

1. This is the Dimensional Analysis problem. Problems are written to give a particular answer illustrating certain concepts in the calculation and may not be experimentally reasonable. (18 pts)

For the following reaction if you start with 35.8 mL of a 0.20 M solution of the H Cl (aq), what is the theoretical yield of the $CaCl_2$ in grams (assuming that you are able to get out the solid $CaCl_2$ after the end of the reaction by evaporation)? (molar mass $CaCl_2$ = 111.08 grams / mole) (show work)

$2\ HCl\ (aq) + Ca(OH)_2\ (aq) \rightarrow CaCl_2\ (aq) + 2\ H_2O\ (l)$

2 electron configuration, Lewis Dot, type LA problem (26 pts total)

For the element **Ga** , (show work if appropriate) (26 pts)

a. What is the atomic mass ? _____ (3 pts)

b. What is the atomic number ? _____ (3 pts)

c. How many valence electrons ?_____ (explain or show work) (3 pts)

d. Give the electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

e. Give the valence electron configuration in the format ($1s^2$, $2s^2$, ... format only gives format & has no information about what the answer looks like.) (6 pts)

f. Give the valence electron configuration diagram in the format ($\underset{1s}{\uparrow\downarrow}$ $\underset{2s}{\uparrow\downarrow}$ $\underset{2p}{\uparrow}$ ____ ____) (format only gives format and has no information about the answer) (5 pts)

3 Other type LA problem. (24 pts total)

If you do a reaction which produces 1.77 Liters of a gas CH_4 and collect it in a gas cylinder at 0.982 atmosphere, 278.2 Kelvin.

a. How many molecules of CH_4 do you have in that volume of gas approximately ? (22.4 Liters = 1 mole of gas) (You may assume that the molar volume at STP is close enough at this nonstandard condition to get a good approximate number for this question.) (Avogadro's number = 6.022×10^{23}) (show work) (12 pts)

b. If you close the gas cylinder opening and then check the condition of the gas cylinder contents you find that the pressure is 2.75 atmosphere, temperature is 270.2 Kelvin. What is the new volume ? [$(P_2V_2) / (P_1V_1) = T_2 / T_1$] (show work) (12 pts)