Dr. Bolaños **CHEM 100 - Exam #2A** **Fall 2014**

Name:_____ Key _____ **Date:** _____

There are 8 questions (with parts) on this examination totaling 105 points (scored out of 100 points). You have 1.5 hours to complete this examination and may only use a basic scientific calculator and the periodic table provided. All work must be shown for credit AND all answers must be expressed with the proper amount of significant figures. An extra sheet is attached that may be used as "scratch" paper. Clearly write your name of this sheet, remove from exam, and submit at the end of the examination period. If you need additional scratch paper, please raise your hand. Please sign the honor code below. If you need further clarification, please raise your hand. Good Luck!

I certify that the work presented in this examination is my own and that the rules set-forth for this examination were followed.

Signature _____

1. Please answer the following True/False questions by circling the appropriate response.
(4 pts. total; 1 pt each)

a. When "excited", electrons move from a lower to higher energy state. (T) F

b. Isotopes have the same atomic mass, but differing atomic numbers. T (F)

c. Strong forces between molecules results in lower melting/boiling points. T (F)

d. Dispersion forces are stronger than dipole-dipole forces. T (F)

2. Please fill-in the appropriate response. **(33 pts. total; 1.5 pts each blank, except m -worth 5 pts)**

a. Iodine has its outermost electron on this energy level ___5___ .

b. The most reactive (strongest desire to react) alkali metal is (symbol) ___Fr___ ; the most reactive halogen is ___F___ (symbol) .

c. Consider Se *and* Te? The smaller atom is ___Se___ and ___Se___ has a greater desire for electrons.

d. Nonmetals always ___gain___ electrons when they react, and are called anions **or** cations. **Circle one.**

e. Bromine has ___7___ valence electron(s) and this Lewis Dot structure: ___:Br:___.

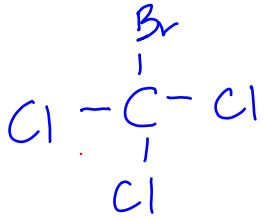
f. The alkali metal on n = 4 *gains* ***or*** *loses* **(circle one)** this number of electron(s) after it reacts ___1___.

g. Which has the greatest energy: Yellow light **or** Indigo light? **Circle one.**

h. Which has the shorter wavelength, *Infrared radiation* **or** *UV radiation*? **Circle one.**

i. A molecule has a total of three electron groups around a central atom, two of which are bonded to atoms. The 3D, Molecular geometry is bent and bond angles are < 120.

j. Is CCl_3Br polar? yes



k. The number of orbitals found on n= 3 is 9, the total number of electrons that can be held in a f-sublevel is 14, the total number of electrons in any orbital is 2, and the total number of electrons that can be held on energy level five is 50.

l. The compound formed between Rb and N is Rb_3N and the compound formed between Cu (II) and Cl is $CuCl_2$.

m. The full electron configuration for Sn is **(5 pts)**:

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

3. Consider the interaction of HBr to another HBr. Evaluate the Lewis Structures, determine polarity, and then determine type of forces (show it) between the two molecules. Use arrows, dashed lines, etc. **(4 pts)**

HBr interacting with HBr - Type of Force is dip - dipole

$\Delta EN_{H\text{-}Br} = 2.8 - 2.1 = 0.7$ (polar!)

4. Using your knowledge of Periodic Trends **(9 pts total, 3 pts each)**:

   a. Rank the elements (N, C, O) in order of increasing atomic size. **(3 pts)**

   O < N < C

   Smallest atom → Largest atom

   b. Please fill-in the trend across the Periodic Table that is governing this atomic size process. **(3 pts)**

   TREND: As you go across the Periodic Table, from left to right, atomic size decreases.

   c. Please **explain WHY** the trend above is seen. **(3 pts)**

   as you go across period, L→R, # protons in nucleus increases. The "e" in atoms on Rt side feel a stronger force pulling them towards nucleus – smaller at !

5. Please provide either the chemical name or chemical formula in the following table. *SPELLING COUNTS!* ***(16 pt total; 2 pts each)***

Chemical Formula	Chemical Name
$Ti(NO_3)_2$	titanium (II) nitrate
K_2O	potassium oxide
$Ca_3(PO_4)_2$	calcium phosphate
CBr_4	Carbon tetrabromide
$Cr(OH)_6$	Chromium (VI) hydroxide
BrF_3	Bromine trifluoride
Al_2S_3	aluminum sulfide
SF_6	Sulfur hexafluoride

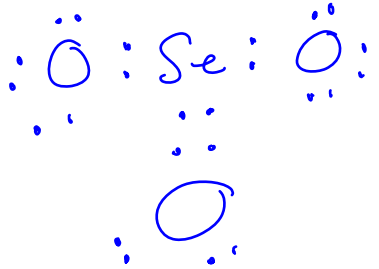
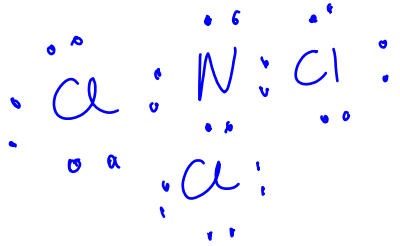
6. Consider SO_2 molecule below. How many electron groups around the central atom? 3 Is this molecule polar? yes **(4 pts)**

$\Delta EN_{S-O} = 3.5 - 2.5 = 1.0$ (polar)

7. Fill out the blanks in the following table. Please designate, in the first column, if the substance is a neutral *element* or an *ion*. In the last column, specify if the *neutral form* of the specified substance is a metal, nonmetal or metalloid. ONLY FILL IN SPECIFED BOXES; OMIT those with "X" drawn through the box. **(12 pts total, each box worth 1 pt)**

Alternate Symbol (include charge and mass number)	Electron Configuration (abbreviated)	Atomic Number	Mass Number	Protons	Neutrons	Electrons
Ra (neutral atom)	$[Rn]7s^2$	88	226	X	138	88
$^{31}P^{3-}$ (ion)	$[Ne]3s^2 3p^6$	X	X	15	16	18
$^{59}Fe^{3+}$ (ion)	X	26	59	~~26~~	33	23

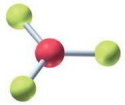
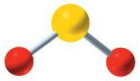
8. Please fill-in the table below for the two compounds provided. Show ALL work in table below (or scratch sheet) for credit. *No work, no credit, so make sure I can follow your notations!* ***(18 pts total, Lewis Structures are 4 pts each, 2 pt for geometry, 1 pt for polar bond(s), 2 pts for polarity.)***

Compound and valence e^-	Lewis Dot Structure	Molecular Geometry	List polar bonds (format: A- X)	Polar or Non-polar Molecule ?
SeO_3 24 val e^-		trigonal planar	ΔEN O-Se = 3.5 - 2.4 = 1.1 (polar!)	nonpolar
NCl_3 26 val e^-		trigonal pyramidal	N-Cl 3.0 - 3.0 = 0	polar

Reference Sheet

ΔEN = (0- 0.4) = nonpolar ΔEN = (0.41-1.8) = polar ΔEN > 1.8 = ionic

TABLE 5.16 Examples of Shapes of Molecules

Molecule	Electron-Dot Formula	Bonded Atoms	Molecular Shape (angle)	
Two (2) electron groups around the central atom				
$BeCl_2$	:Cl:Be:Cl:	2	linear (180°)	
CO_2	:O::C::O:	2	linear (180°)	
Three (3) electron groups around the central atom				
BF_3		3	trigonal planar (120°)	
SO_2		2	bent (120°)	
Four (4) electron groups around the central atom				
CH_4		4	tetrahedral (109.5°)	
NH_3		3	trigonal pyramidal (107°)	
H_2O		2	bent (105°)