Name: ___KEY_____ Section: _____

CHM 150 Exam 2: Chapters 7, 10, and Nomenclature

1. (9 pts) Write the correct formula for the following compounds:
   a. ammonium fluoride __NH_4F_____
   b. diphosphorous pentasulfide __P_2S_5_____
   c. hydrochloric acid __HCl (aq)_____
   d. magnesium chlorite __$Mg(ClO_2)$_____
   e. iron (III) hydroxide __$Fe(OH)_3$_____

2. (9 pts) Write the correct name for the following compounds:
   a. CoP _cobalt (III) phosphide_____
   b. SO_2 _sulfur dioxide_____
   c. Ag_3N _silver nitride_____
   d. $CaBr_2$ _calcium bromide_____
   e. HNO_3 (aq) _nitric acid_____

3. (4 pts) What charge will the following atoms have when they become ions?

   a. Ca _+2_____ b. Cl __-1_____ c. K __+1_____ d. Ga __+3____

4. (3 pts) Circle all of the following compounds that are ***covalent***:

   Li_2O **N_2O_3** MnS **IBr** CaS **PF_5**

_D_ 5. (3 pts) The measure of attraction that an atom has for the electrons in a covalent bond is called
   a. electron affinity
   b. ionization energy
   c. hybridization
   d. **electronegativity**
   e. London forces

6. (4 pts) Indicate the polarity of each covalent bond using an arrow and delta notation (δ^- or δ^+):

No arrow	arrow toward F	arrow toward Cl	arrow toward Cl
H—C	N—F	Cl—I	P—Cl

_C_ 7. (3 pts) The electronegativity for H is 2.1 and for Si is 1.8. Based on these values, SiH_4 would be expected to
   a. be ionic and contain H- ions.
   b. be ionic and contain H+ ions.
   c. **have polar covalent bonds with partial negative charges on the H atoms.**
   d. have polar covalent bonds with partial positive charges on the H atoms.

Name: ___KEY_____ Section: _____

_B_ 8. (3 pts) The Lewis structure for phosphine, PH_3, has

a. 3 bonding pairs
b. **3 bonding pairs and 1 lone pair**
c. 2 bonding pairs and 2 lone pairs
d. 4 bonding pairs
e. 4 lone pairs

9. (3 pts) Which of the molecules below would have the same Lewis Dot Structure as ClO_3^-? Circle all that apply. Hint: You do not need to draw the structures to answer this question.

IO_3^- CO_3^{2-} **BrO_3^-** SO_3 **SO_3^{2-}**

_A_ 10. (3 pts) Which bond should be the longest?

a. **N – N**
b. N = N
c. N ≡ N
d. They should all be the same length.

11. (8 points) Indicate whether each statement is true (T) or false (F).

T **F** Carbon can have an expanded octet.

T F In general, triple bonds are stronger than single bonds.

T **F** A molecule with AB_3E notation has 3 electron domains and will have trigonal planar geometry.

T **F** Sigma bonds are only found in single bonds.

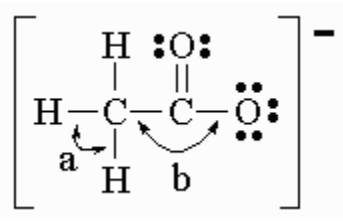
T **F** Pi bonds are formed from unhybridized ***s*** orbitals.

T F A triple bond contains 1σ bond and 2π bonds.

T F Ice (solid water) is less dense than liquid water.

T **F** Liquids with *higher* vapor pressures boil at *higher* temperatures compared with liquids with lower vapor pressures.

_C_12. (3 pts) Which answer correctly states the approximate (~) values of the bond angles, a and b, in the ion illustrated below?



a. a is ~90° and b is ~180°
b. a is ~109.5° and b is ~109.5°
c. **a is ~109° and b is ~120°**
d. a is ~120° and b is ~109.5°
e. a is ~109.5° and b is ~180°

Name: ___KEY_____ Section: _____

13. (10 pts) Please draw all possible Lewis Dot Structures for IO_2^- and answer the following questions:

2 lone e- pairs on I, 2 single bonds to O, full octets on each O, brackets with charge

ABE notation: __AB_2E_2_____ Number of electron domains: __4_____
Molecular shape:__bent_____ Is the molecule polar (Circle one)? **Yes** No
What is the bond angle?__<109.5°_____
What is the hybridization of the central atom:__sp^3_____
How many sigma (σ) and pi (π) bonds are there? ___2_____ σ ____0____ π

14. (13 pts) Please draw all possible Lewis Dot Structures for SO_3 and answer the following questions:

3 resonance structures: 2 single bonds, 1 double bond, complete octets on each O

ABE notation: __AB_3_____ Number of electron domains: __3_____
Molecular shape:__trigonal planar___ Is the molecule polar (Circle one)? Yes **No**
What is the bond angle?__120°_____
What is the hybridization of the central atom:_sp^2_____
How many sigma (σ) and pi (π) bonds are there? __3_____ σ ____1____ π

15. (3 pts) Indicate the hybridization of a central atom with following number of electron (e^-) domains:

2 e^- domains: _**sp**____ 5 e- domains: __**sp^3d**___ 6 e- domains: _**sp^3d^2**_

16. (5 pts) Identify the **strongest type** of intermolecular force in each of the following (London, Dipole-Dipole, Hydrogen Bridging, or Ion-Ion). Use these substances to answer the next 2 questions.

NaCl __ion-ion_____ NH_3 __hydrogen bridging_____

CO_2 __London Forces_____ CH_2O __dipole-dipole___

C_2H_6 __London Forces____

17. (2 pts) Which of the substances (from the question above) should have the **highest** boiling point? _NaCl__

18. (2 pts) Which of the substances (from the same list) should have the **highest** vapor pressure? __CO_2_____

19. (1 pt) Knowing that bromine is a liquid, chlorine is a gas, and iodine is a solid at room temperature (25°C) and normal atmospheric pressure (1atm), predict what state of matter Astatine (At) should be under those same conditions.
Astatine will be a solid. It is larger than I_2 and will have stronger forces, therefore if I_2 is a solid, At will be as well.

Name: ___KEY_____ Section: _____

_A_ 20. (3 pts) The vapor pressure of a liquid increases with an increase in temperature. Which of the following statements best explains this increase?

a. **The average kinetic energy of molecules is greater, thus more molecules can enter the gaseous state.**
b. The number of gaseous molecules above the liquid remains constant, but these molecules have greater average kinetic energy.
c. The faster-moving molecules in the liquid exert a greater pressure.
d. All the molecules have greater kinetic energies.
e. The intermolecular forces between the molecules decrease at higher temperatures.

_C_ 21. (3 pts) The measure of a liquid's resistance to flow is

a. London forces
b. Dipole-Dipole forces
c. **viscosity**
d. vapor pressure
e. surface tension

_B_ 22. (3 pts) When a gas becomes a solid, the phase change is called _____.

a. sublimation
b. **deposition**
c. vaporization
d. freezing
e. melting

Extra Credit: (5 pts) Draw a phase diagram that meets the following criteria: normal melting point is 10°C, normal boiling point is 50°C, triple point is at 0.5 atm of pressure and 5°C, and the solid phase is more dense than the liquid phase. Label the phases and axes. Indicate approximate pressure (in atm) and temperature (in ^{o}C) values on the axes.

Will be drawn in class when you get the exams back. It's too hard to describe or try to draw on a computer!!!!