

CHM 151 Exam 2: Chapters 7, 10, and Nomenclature

1. (8 pts) Write the correct formula for the following compounds:

- a. ammonium fluoride NH₄F
- b. diphosphorous pentasulfide P₂S₅
- c. hydrochloric acid HCl (aq)
- d. magnesium chlorite Mg(ClO₂)

2. (8 pts) Write the correct name for the following compounds:

- a. CoP cobalt (III) phosphide
- b. SO₂ sulfur dioxide
- c. CaBr₂ calcium bromide
- d. HNO₃ (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. (6 pts) Circle all of the following compounds that are *covalent*:

Li₂O N₂O₃ MnS IBr CaS PF₅

D 5. (4 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

B 7. (4 pts) The Lewis structure for phosphine, PH₃, 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

8. (5 pts) Which of the molecules below would have the same Lewis Dot Structure as ClO₃⁻? Circle all that apply. Hint: You do not need to draw the structures to answer this question.

IO₃⁻ CO₃²⁻ BrO₃⁻ SO₃ SO₃²⁻

A 9. (4 pts) Which bond should be the longest?

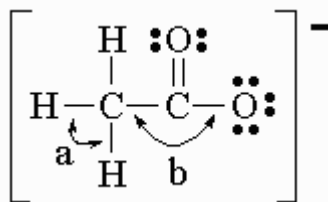
- N-N
- N = N
- N \equiv N
- They should all be the same length.

10. (6 pts) 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 AB₃E notation has 3 electron domains and will have trigonal planar geometry.
- T F Pi bonds are formed from unhybridized s orbitals.
- T F A triple bond contains 1 σ bond and 2 π bonds.
- T F Liquids with *higher* vapor pressures boil at *higher* temperatures compared with liquids with lower vapor pressures.

C 11. (4 pts) Which answer correctly states the approximate (\sim) values of the bond angles, a and b, in the ion illustrated below?

- a is $\sim 90^\circ$ and b is $\sim 180^\circ$
- a is $\sim 109.5^\circ$ and b is $\sim 109.5^\circ$
- a is $\sim 109^\circ$ and b is $\sim 120^\circ$**
- a is $\sim 120^\circ$ and b is $\sim 109.5^\circ$
- a is $\sim 109.5^\circ$ and b is $\sim 180^\circ$



12. (3 pts) Indicate the hybridization of a central atom with the following number of electron (e-) domains:

2 e- domains: sp 5 e- domains: sp³d 6 e- domains: sp³d²

13. (10 pts) Please draw all possible Lewis Dot Structures for IO₂⁻ 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: AB₂E₂ 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: sp³

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. (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

16. (2 pts) Which of the substances (from the question above) should have the **highest** boiling point? NaCl

17. (2 pts) Which of the substances (from the same list) should have the **highest** vapor pressure? CO_2

C 18. (4 pts) The measure of a liquid's resistance to flow is

- London forces
- Dipole-Dipole forces
- viscosity**
- vapor pressure
- surface tension

B 19. (4 pts) When a gas becomes a solid, the phase change is called _____.

- sublimation
- deposition**
- vaporization
- freezing
- 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 $^\circ\text{C}$) values on the axes. (You may use the back of the paper if you need more room – just tell me to look there!)

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