General Chemistry I NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chem 111 Exam #4 - Vining December 11, 2015

**1. *4 pts***

What is the driving force causing the formation of a covalent bond between two atoms?

*Choose one.*

 a. the ability to fill valence shells, usually with an octet of 8 electrons

 b. the ability for electrons on one atom to be near the nucleus of another atom

 c. the ability of electrons to “pair up” with other electrons from other atoms

 d. the ability of two nuclei to be closer to each other, increasing the strong nuclear force

**2. *3 pts*** How many valence electrons does each of the following have:

 a) N \_\_\_\_ b) Mg \_\_\_\_ c) S2- \_\_\_\_

**3. *12 pts***

Draw Lewis Dot structures for the following: If resonance forms exist, only draw one.

SO2 CHCl3 (all atoms bonded to C)

BrCl5

**4. *4 pts***

For *each pair*, which bond is longer?

 a. C-C or C-O

 b. C-C or C=C

**5. *4 pts***

For *each pair*, which bond is stronger?

 a. C-C or Si-Si

 b. C-C or C=C

**6. *6 pts***

For *each pair*, which bond is more polar?

 a. F-F or H-Cl

 b. C-O or Si-O

Why is a C-O bond polar?

**7. *6 pts***

What is ΔH for the following reaction? N2(g) + 3 F2(g) → 2 NF3(g)

Bond energies:

N≡N = 391 kJ/mol

F-F = 155 kJ/mol

N-F = 283 kJ/mol

**8. *15 pts***



For each of the following molecules, give the Lewis structure, the electron-pair geometry, the molecular geometry, the bond angles, and determine the molecular polarity. Space is given to show your work.

HCN IF4-

electron-pair geometry: electron-pair geometry:

molecular geometry: molecular geometry:

bond angles: bond angles:

polar or nonpolar? polar or nonpolar?

SF2

electron-pair geometry:

molecular geometry:

bond angles:

polar or nonpolar?

**9.** ***6 pts***

Draw all resonance structures for SO2.

What is the average bond order for each sulfur-oxygen bond? \_\_\_\_\_\_\_



 **10.** ***6 pts***

What hybrid orbitals are used by each indicated atom?

**11. *6 pts***

How many sigma and pi bonds are in

the structure?

sigma: \_\_\_\_\_ pi: \_\_\_\_\_

**12.** ***6 pts***

Describe what orbitals are used to form each

of the following bonds in CH3CH2Cl. Your answer

should use language like “an sp2 orbital on N overlaps

with an sp3 orbital on O”.

First C-C bond:

Second C-C bond:

C-H bond:

**13.** ***8 pts***

Determine the formal charges on all atoms in these resonance structures of the OCN- ion.

Draw a box around the most stable resonance structure.

Draw an arrow pointing to the least stable resonance structure.



**14.** ***6 pts***

Are these two shapes: conformations or isomers



How do you know?

These two structures are a class of compounds called cycloalkanes.

Are these two shapes: conformations or isomers



Explain why.

**15.** ***6 pts***

Fill electrons into the following MO diagram for the C2 molecule. Notice that 1s orbitals are not included in this diagram.



What is the carbon-carbon bond order? \_\_\_\_\_

Is C2: diamagnetic or paramagnetic

**16.** ***2 pts***

What is an antibond?

