

**Test 3, Chemistry 121**  
**Spring 2006**

**Name:** \_\_\_\_\_

Instructions: You have 75 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

**I. Electromagnetic Radiation**

- (10 pts) UV - C radiation is especially harmful to humans. Most of the UV-C radiation is filtered as sunlight passes through the ozone layer. What is the wavelength (in nm) of UV - C radiation having a frequency of  $1.13 \times 10^{15} \text{ s}^{-1}$ ?
  
  
  
  
  
  
  
  
  
  
- (10 pts) What is the energy of a mole of photons of the above UV-C radiation?

**II. Quantum Numbers and Electron Configurations**

- (10 pts) Write a complete set of quantum numbers for  $n = 5$ .
  
  
  
  
  
  
  
  
  
  
- (15 pts) Indicate whether the following orbitals/quantum numbers exist. If it deso not exist, explain why.

	<b>Y or N</b>	<b>If not, why?</b>
a. 8p	_____	_____
b. $n = 3, l = 3, m_l = 2, m_s = 1/2$	_____	_____
c. $n = 5, l = 3, m_l = -1, m_s = -1/2$	_____	_____
d. 2d	_____	_____
e. $n = 4, l = 3, m_l = -1, m_s = -1$	_____	_____

- (15 pts) Write the NOBLE GAS electron configuration for the following atoms and ions, indicate the number of valence electrons (VE) and determine if they are paramagnetic (P) or diamagnetic (D).

<b>Atom/ion</b>	<b>Configuration</b>	<b>#VE</b>	<b>P or D</b>
a. P	_____	_____	_____
b. $\text{Ga}^{1+}$	_____	_____	_____
c. Cu	_____	_____	_____
d. $\text{S}^{2-}$	_____	_____	_____
e. I	_____	_____	_____

**III. Molecular Geometry:** (30 pts) For each of the following molecules: (i) Draw the correct Lewis Dot Structure, (ii) Give the AXE notation, (iii) Determine the molecular geometry, (iv) Give hybridization of the central atom, and (v) Indicate if it is polar or nonpolar.



**IV. Trends, Bonding and Electron Configuration Rules**

1. (5 pts) Rank the following atoms in order of increasing ionization energy: Si, O, Cl, Ca and N.

2. (5 pts) In the following groups, circle the species with the largest radii.

a. P or Cl

b. F or  $\text{F}^{1-}$

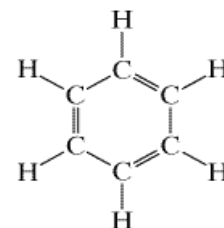
c. Ca or  $\text{Ca}^{2+}$

d. As or Si

e. Ge or Br

3. (10 pts) Fill in the blank

a. There are \_\_\_\_\_ sigma bonds and \_\_\_\_\_ pi bonds in the molecule at the right.



b. When placing electrons in orbitals around atoms, you must follow:

i. \_\_\_\_\_ Principle (Hint: two words)

ii. \_\_\_\_\_ Principle (Hint: one word)

iii. \_\_\_\_\_ Rule (Hint: one word)