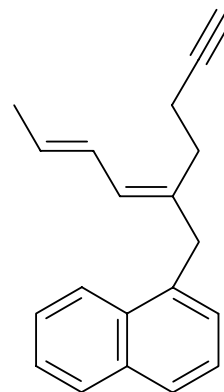


Chemistry 121  
Fall 2005  
Test 3 **FORM A**

**Instructions:** You have 50 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

**I. Multiple Choice** (10 pts) Carefully and clearly circle the best answer.

- How many unpaired electrons are there in the ground state of sulfur?
  - 6
  - 4
  - 2
  - 0
- Which set of atoms below is arranged in order of decreasing ionization energy?
  - F, P, Se, Ge
  - Ge, Se, P, F
  - F, Se, P, Ge
  - Ge, P, Se, F
- What molecule below is isoelectronic with carbonate,  $\text{CO}_3^{2-}$ ?
  - $\text{NO}_3^{1-}$
  - $\text{OCl}_3^{1-}$
  - $\text{SO}_3^{2-}$
  - $\text{SO}_2$
- How many pi-bonds are in the molecule on the right?
  - 6
  - 7
  - 8
  - 9
- Which of the following is not a valid set of quantum numbers?
  - $n = 5, l = 3, m_l = -2, m_s = \frac{1}{2}$
  - $n = 4, l = 3, m_l = -4, m_s = \frac{1}{2}$
  - $n = 7, l = 2, m_l = -2, m_s = \frac{1}{2}$
  - $n = 8, l = 3, m_l = -2, m_s = \frac{1}{2}$



**II. Calculations and Molecules:** Show all work. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

- (15 pts) The yellow light emitted from a firefly (lightning bug) is the result of a reaction between luciferin, ATP and oxygen. It has a wavelength of 510. nm.
  - What is the frequency of this light?
  - What is the energy of a mole of photons of this light?
- (5 pts) If  $n = 4$ , list all valid sets of quantum numbers.

8. (15 pts) Indicate whether or not the following quantum numbers or orbitals can exist using Y for yes and N for no. For those that cannot exist, explain why.

	<u>Circle</u>	<u>If no, then explain why.</u>
a. 9d	Y or N	_____
b. $n = 3, l=2, m_l = 3, m_s = \frac{1}{2}$	Y or N	_____
c. $n = 2, l=2, m_l = 0, m_s = \frac{1}{2}$	Y or N	_____
d. 3f	Y or N	_____
e. $n = 7, l=5, m_l = 0, m_s = -1$	Y or N	_____

9. (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).

	<u>Noble Gas Electron Configuration</u>	<u>VE</u>	<u>Circle</u>
a. $\text{Se}^{2-}$	_____	___	P or D
b. Ti	_____	___	P or D
c. Pd	_____	___	P or D
d. Cl	_____	___	P or D
e. Cu	_____	___	P or D

10. (40 pts) For each of the following molecules or ions: **(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.



**III. (10pts) Essay Question:** Explain the trend of atomic size in relation to the periodic table and describe how the trend is caused by effective nuclear charge.