

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

**Chemistry 121**  
**Spring 2003**  
**Exam III**  
**50 minutes/100 pts**  
**NO CALCULATORS**

**I. MULTIPLE CHOICE:** (30 pts, 3 points each) Carefully and clearly circle the best answer.

1. What element has the electron configuration:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$ ?
  - a. Cr
  - b. Mn
  - c. Co
  - d. Fe
  - e. Ni
  
2. Which of the following elements has the largest atomic radii?
  - a. Al
  - b. P
  - c. Sr
  - d. Ga
  - e. Rb
  
3. Which of the following ions will not likely be formed?
  - a.  $\text{Li}^+$
  - b.  $\text{P}^{3-}$
  - c.  $\text{F}^{2-}$
  - d.  $\text{Mg}^{2+}$
  - e.  $\text{Na}^+$
  
4. As an atom absorbs a photon of light, an electron is promoted to a higher energy level. The atom is now in the \_\_\_\_\_.
  - a. Wave function
  - b. Node
  - c. Ground state
  - d. Orbital
  - e. Excited state
  
5. When  $n = 1$ , which of the following is a possible value for  $l$ ?
  - a. -1
  - b. 0
  - c. 2
  - d. -2
  - e. 3
  
6. Which of the following elements is paramagnetic?
  - a. P
  - b. Mg
  - c. Zn
  - d. Ar
  - e. Ba

7. Which of the following elements has the largest first ionization energy?
  - a. Al
  - b. P
  - c. Sr
  - d. Ga
  - e. Rb
  
8. In order to form a set of  $sp^2$  hybrid orbitals, how many pure atomic orbitals of each type must be mixed?
  - a. one s and one p
  - b. two s and two p
  - c. two s and one p
  - d. one s and two p
  - e. two s and three p
  
9. Which of the following elements is a p-block element?
  - a. Cu
  - b. Cl
  - c. Zn
  - d. Na
  - e. La
  
10. Which is the most polar bond?
  - a. F – F
  - b. S – F
  - c. P – F
  - d. Si – F
  - e. Al – F

**II. Short Answer** (80 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. Write the noble gas electron configurations for the following atoms or ions and determine whether they are diamagnetic or paramagnetic. Dia or Para?
  - a. Cr \_\_\_\_\_
  - b. Cl \_\_\_\_\_
  
2. Write a complete set of quantum numbers for  $n=2$ .
  
3. Please indicate whether or not the following orbitals can exist. (Y or N)
  - a. 3p \_\_\_\_\_
  - b. 1f \_\_\_\_\_
  - c. 3f \_\_\_\_\_
  - d. 5d \_\_\_\_\_
  - e. 9s \_\_\_\_\_

4. Bart Simpson is in trouble again. He and Millhouse have borrowed Homer's car for a joy ride. Bart is wary of police radar detectors and is attempting not to speed. If a police radar detector operates at  $2.50 \times 10^{10} \text{ s}^{-1}$ , how much energy does a mole of photons of radar radiation generate? ( $h = 6.626 \times 10^{-34} \text{ J s}$ ). Full credit will be given for the correct setup. No final calculation is required.

5. Define the octet rule and list two exceptions to the rule

a. Definition:

b. Two exceptions:

i. \_\_\_\_\_

ii. \_\_\_\_\_

6. In Chapter 6, we discussed how radiation interacts with the Earth's atmosphere. In 3-4 **grammatically correct** sentences, describe the function of the ozone layer and the appropriate chemistry associated with it.

7. For each of the following molecules,

- (a) Draw the Lewis Dot Structure.
- (b) Give the AXE notation.
- (c) Determine the molecular geometry.
- (d) Determine the orbital geometry.
- (e) Give the hybridization of the central atom.
- (f) Determine if it is polar or nonpolar.

1.  $\text{SCl}_2$

AXE: \_\_\_\_\_  
Molecular Geometry: \_\_\_\_\_  
Orbital Geometry: \_\_\_\_\_  
Hybridization: \_\_\_\_\_  
Polar or Nonpolar: \_\_\_\_\_

2.  $\text{SbCl}_5$

AXE: \_\_\_\_\_  
Molecular Geometry: \_\_\_\_\_  
Orbital Geometry: \_\_\_\_\_  
Hybridization: \_\_\_\_\_  
Polar or Nonpolar: \_\_\_\_\_

**Extra Credit (5 pts):** What is the symbol for dipole moment?