Name: KEY

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

D

2. Which of the following elements has the largest atomic radii?
   a. Al
   b. P
   c. Sr
   d. Ga
   e. Rb

E

3. Which of the following ions will not likely be formed?
   a. Li^+
   b. P^{3-}
   c. F^{2-}
   d. Mg^{2+}
   e. Na^+

C

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

E

5. When n = 1, which of the following is a possible value for *l*?
   a. -1
   b. 0
   c. 2
   d. -2
   e. 3

B

6. Which of the following elements is paramagnetic?
   a. P
   b. Mg
   c. Zn
   d. Ar
   e. Ba

A

7. Which of the following elements has the largest first ionization energy?

B

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?

D

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?

B

a. Cu
b. Cl
c. Zn
d. Na
e. La

10. Which is the most polar bond?

E

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	$[Ar]\,4s^1\,3d^5$	Para
b. Cl^-	$[Ne]\,3s^2\,3p^6$	Dia

2. Write a complete set of quantum numbers for n=2.

n	l	m_l	m_s
2	0	0	$\pm 1/2$
	1	$\pm 1, 0$	$\pm 1/2$

3. Please indicate whether or not the following orbitals can exist. (Y or N)

a. 3p — Y
b. 1f — N
c. 3f — N
d. 5d — Y
e. 9s — Y

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 $2.50 \times 10^{10}\ s^{-1}$, how much energy does a mole of photons of radar radiation generate? ($h = 6.626 \times 10^{-34}$ J s). Full credit will be given for the correct setup. No final calculation is required.

$E_{photon} = h\nu \qquad E_{mol} = h\nu \cdot N_A$

$$E_{mol} = (6.626\times10^{-34} J\cdot s)(2.50\times10^{10} s^{-1})\left(\frac{6.02\times10^{23}\ photons}{mol}\right)$$

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

a. Definition: atoms gain or lose, or share electrons to have 8 valence electrons

b. Two exceptions:

i. H

ii. He

iii. B

iv. Elements in the 3rd period or higher

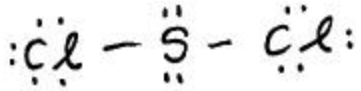
6. In Chapter 6, we discussed how radiation interacts with the Earth's atmosphere. In 3-4 **grammatically correct** sentences, describe the function of the ozone layer and the appropriate chemistry associated with it. The ozone layer is at the top of the stratosphere. molecular oxygen absorbs ultraviolet radiation and breaks into two oxygen atoms. ($O_2 + h\nu \rightarrow O + O$). Unstable, the oxygen atoms combine with molecular oxygen to form ozone and release heat ($O + O_2 \rightarrow O_3 + heat$) Ozone strongly absorbs uv light, protecting the earth from harmful radiation that could damage biological systems.

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. SCl_2

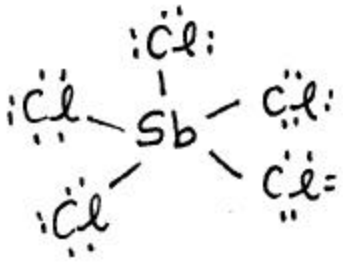
$6 + 14 = 20$



AXE: AX_2E_2
Molecular Geometry: bent
Orbital Geometry: tetrahedral
Hybridization: sp^3
Polar or Nonpolar: polar

2. $SbCl_5$

$5 + 5(7) = 40$



AXE: AX_5
Molecular Geometry: trigonal bipyramidal
Orbital Geometry: trigonal bipyramidal
Hybridization: sp^3d
Polar or Nonpolar: nonpolar

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

μ, mu