

Name: _____

Chemistry 121
Fall 2008
Test 3, Form A

Instructions: You have 75 minutes to complete this 100-point exam. You may use a scientific calculator.

I. Multiple Choice (10 pts, 2 points each) Carefully and clearly circle the best answer. If you circle two answers, *one of which is correct*, you will receive 1 point.

- Which of the following atoms has the smallest electronegativity?
a. S b. P c. N d. O e. F
- Which of the following terms is not used to describe light?
a. wavelength
b. frequency
c. delocalized
d. intensity
e. None of the above.
- The equation, $E = h\nu$, can be used to calculate the energy of _____.
a. An atom
b. A cation
c. An anion
d. A photon
e. None of the above
- Which of the following energy level diagrams correctly depicts the 3d electrons in Cr?
a. $\uparrow\downarrow \uparrow \uparrow \uparrow \uparrow$
b. $\uparrow \uparrow \uparrow \uparrow \uparrow$
c. $\uparrow \uparrow\downarrow \uparrow \uparrow \uparrow$
d. $\uparrow\downarrow \uparrow\downarrow \uparrow _ _$
e. None of the above
- Which of the following elements has the largest atomic radii?
a. Al b. F c. P d. O e. Si

II. Short Answer and Calculations: Clearly indicate your answer in the space provided and show all work. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

- (10 pts) Write all sets of possible quantum numbers for $n = 5$.

2. (15 pts) Write the **full or Noble gas** electron configuration (as indicated) for the following atoms and ions, indicate the number of valence electrons (VE) and determine if they are paramagnetic (P) or diamagnetic (D).

			<u>VE</u>	<u>Circle</u>
a.	Full	Ga	_____	P or D
b.	Full	Se ²⁻	_____	P or D
c.	Noble	Sn	_____	P or D
d.	Full	Zr ²⁺	_____	P or D
e.	Noble	Cs	_____	P or D

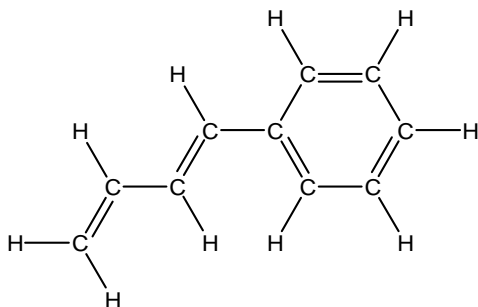
3. (10 pts) When I give talks on my environmental research at conferences, I typically use a green laser pointer that has a wavelength of 532 nm.
- Calculate the frequency (in MHz) of the laser pointer. (1 MHz = 10⁶ Hz)

- Calculate the energy of a mole of photons of this light.

4. (5 pts) Fill-in the blank:

- If F, Ge and Al were ranked from **smallest** to **largest** ionization energy, the atoms would be written in the following order: _____ < _____ < _____.

- The molecule below has _____ sigma bonds and _____ pi bonds



5. (40 pts) For each of the following molecules or ions: draw the correct Lewis Dot Structure, determine the molecular geometry, give the hybridization of the central atom and determine if the molecule is polar or nonpolar. **Include all resonance structures.**



Molecular Geometry: _____
Hybridization: _____
Polarity: _____



Molecular Geometry: _____
Hybridization: _____
Polarity: _____



Molecular Geometry: _____
Hybridization: _____
Polarity: _____



Molecular Geometry: _____
Hybridization: _____
Polarity: _____

6. (10 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. 3p	Y or N	_____
b. $n = 3, l=1, m_l = 2, m_s = -\frac{1}{2}$	Y or N	_____
c. $n = 2, l=1, m_l = 0, m_s = \frac{1}{2}$	Y or N	_____
d. 9s	Y or N	_____
e. 3f	Y or N	_____

III. Essay: (10 pts) In 4 – 6 grammatically correct sentences, answer **ONE** of the following:

- Explain/discuss the necessity of hybrid orbitals and how hybrid orbitals are formed from atomic orbitals.
- Explain the trend of ionization energy in relation to the periodic table and describe how the trend is caused by effective nuclear charge.