Chemistry 448/548 Name: _____
Test 1
Fall 2014

Very Short Answer Questions: (3 points each)

1. What is the electron configuration of Ir^{+}? _____

2. Which of the following is not isoelectronic to the others? Al^{-}, Cl^{3+}, As^{+}, S^{2+}, Si^{0} (circle your choice)

3. The German word *gerade* means "even." What does it mean when applied to an orbital?

4. The outermost electrons on an atom are called the _____ electrons.

5. Atoms with no unpaired electrons are called _____.

6. The first electron affinity of open subshell atoms is _____.

7. The probability of finding an electron at a given point equals _____.

8. The presence of which symmetry element requires that a molecule be non-polar? _____

9. Give a point group to which a chiral molecule may belong. _____

10. _____ is the one element from Groups I-IIIA that is physically hard.

Discussion Questions: (You must show work to receive credit!)

1. What is the difference between a kinetically controlled reaction and a thermodynamically controlled reaction? (5 points)

2. Give preparations of 3 of the following 4: Al_2O_3, $(BN)_x$, $Mg(OH)_2$, or Na_2O_2? (9 points)

3. Discuss atomic size and ionization energy and the forces that affect them. (10 points)

4. When solving the Schrödinger equation for the particle-in-a-box three "interesting things" were found in the results. What were they? (10 points)

5. The wave functions for a 2*s* orbital are: $R = K_{2s}(2 - Zr/a_o)e^{-Zr/ao}$ and $\Theta\Phi = [(1/4\pi)]^{1/2}$. Describe how these functions correspond to a physically real picture of this orbital. Be as specific as you can. (10 points)

6. Give point groups for each of the following (no work required): (16 points)

PH_3: $OSCl_2$: *trans*-$Co(NH_3)_4Cl_2$: BeF_2:

7. The molecule benzene has numerous resonance forms. One of the most common shows it with 3 localized double bonds. This form has D_{3h} symmetry. Given the character table below: How many double bond absorptions would you expect to see in the IR if this localized structure were real? In the Raman? Give the irreducible representations of each. (10 points)

	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$
A_1'	1	1	1	1	1	1
A_2'	1	1	-1	1	1	-1
E’	2	-1	0	2	-1	0
A_1''	1	1	1	-1	-1	-1
A_2''	1	1	-1	-1	-1	1
E″	2	-1	0	-2	1	0
Γ_{red}	—	—	—	—	—	—