CH301H – Principles of Chemistry I: Honors
Fall 2015, Unique 49310
Homework, Week 8

1. Determine whether each of the following sets of quantum numbers are allowed. Explain your answers.

a) $n = 2$, $l = 2$, $m = 1$, $m_s = 1/2$
b) $n = 3$, $l = 1$, $m = 1$, $m_s = -1/2$
c) $n = 1$, $l = 2$, $m = 0$, $m_s = 1/2$
d) $n = 4$, $l = -1$, $m = 0$, $m_s = -1/2$
e) $n = 3$, $l = 2$, $m = 0$, $m_s = -1/2$
f) $n = 3$, $l = -3$, $m = 1/2$, $m_s = -1/2$

2. Name the orbitals described by each of the following sets of quantum numbers.

a) $n = 2$, $l = 0$
b) $n = 4$, $l = 2$
c) $n = 6$, $l = 3$
d) $n = 3$, $l = 1$

3. For each of the allowed solutions in problems 1 and 2, determine the number of radial nodes, angular nodes, and total nodes.

4. a) Write out the full wavefunction for a $2p_z$ orbital.
b) Prove that the probability of finding an electron in that orbital anywhere in the *xy* plane is 0.

5. Give the ground state electron configuration of the following atoms:

a) Si
b) Rb
c) Cl
d) O

6. Electrons act like little magnets. Atoms with unpaired electrons are attracted into a magnetic field and are said to be "paramagnetic." Determine which period 2 atoms are paramagnetic.

7. To make an anion, an electron is added to the next available atomic orbital. Conversely, cations are formed when an electron is removed from the highest energy orbital. Determine the ground state electron configuration of the following ions and indicate which are paramagnetic.

a) Be^{+}
b) C^{-}
c) Ne^{2+}
d) Mg^{+}

e) P^{2+}
f) Cl^{-}
g) As^{+}
h) I^{-}

8. Write out the ground state electron configuration of N. Based on what you know about the Pauli exclusion principle and Hund's rule, attempt to explain (in words) data on IE and EA of N from Chapter 3.