Chapter 7 *Quantum Atom*
Pretest Practice

1. Which of the following sets of quantum numbers are not allowed? For those that are incorrect, state what is wrong.
   Ex. n=5, ℓ=2, m_ℓ =-3 (If ℓ=2 then m_ℓ =-2-+2 not -3)

2. What is the maximum number of <u>electrons</u> in an atom that can have these quantum numbers?
   Ex. n=5, ℓ=3, m_ℓ=1 (describes a 5*f* orbital with <u>2</u> maximum electrons)
   Ex. n=4, ℓ=2 (describes the 4*d* orbitals, max. <u>10</u> e-s)

3. Use the noble gases configuration to write the electron configurations for the ground state atoms of Cu and Pb. For each, indicate the total number of unpaired electrons and number of valence electrons.

   Cu : _____ unpaired electrons: __1___ Valence: __1___

   Pb : _____ unpaired electrons: __2___ Valence: __4___

4. Write the quantum numbers for the last electron in: As: ___4, 1, +1, +1/2 _____

5. Using the graph of Ionization Energy

   The first ionization energy for O is lower than N. Why?

   As atomic number increases within a family there is a gradual decrease in first ionization energies. Explain.

   How does the size of the atom relate to ionization energy across a period?

6. Use the information listed below to calculate ΔH for the following processes:

   $Mg^{+2}_{(g)} + 2Br^- \longrightarrow Mg_{(g)} + 2Br_{(g)}$

   Shows the reverse of Mg I_1 and I_2 = -2180 kJ
   Shows the reverse of Br electron affinity (x2 Br's) = +649 kJ
   ΔH = -1531 kJ

From Previous AP Exams (+5 Test Points)
Due before Exam

Questions 1-3 refer to atoms of the following elements.

(A) Lithium
(B) Carbon
(C) Nitrogen
(D) Oxygen
(E) Fluorine

1. In the ground state, have only 1 electron in each of the three *p* orbitals
2. Have the smallest atomic radius
3. Have the smallest value for first ionization energy

Answer EITHER Question 2 below OR Question 3 printed on the next page. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 20 percent.

2. Answer the following questions regarding light and its interactions with molecules, atoms, and ions.

(a) The longest wavelength of light with enough energy to break the Cl–Cl bond in $Cl_2(g)$ is 495 nm.

(i) Calculate the frequency, in s^{-1}, of the light.

(ii) Calculate the energy, in J, of a photon of the light.

(iii) Calculate the minimum energy, in kJ mol^{-1}, of the Cl–Cl bond.

(b) A certain line in the spectrum of atomic hydrogen is associated with the electronic transition in the H atom from the sixth energy level ($n = 6$) to the second energy level ($n = 2$).

(i) Indicate whether the H atom emits energy or whether it absorbs energy during the transition. Justify your answer.

(ii) Calculate the wavelength, in nm, of the radiation associated with the spectral line.

(iii) Account for the observation that the amount of energy associated with the same electronic transition ($n = 6$ to $n = 2$) in the He^+ ion is greater than that associated with the corresponding transition in the H atom.