UCSD Physics 130b   *Quantum Mechanics*   Quiz

You are allowed to use one 8.5" x 11" sheet of notes, front and back, which **must** be handwritten. Please write your answers in your blue books & put your name and PID number on each blue book. *Lots of partial credit will be given but **you must write neatly** to receive maximum credit!*

Problem 1

What is the wavelength of the so-called "Balmer transition" which involves an electron which transitions from an $n = 5$ level to an $n = 2$ for hydrogen?

Problem 2

The energy of the hydrogen atom in its ground state is 13.6 eV. What is the ionization energy of the atom in the $n = 4$ state?

Problem 3

A muon is a subatomic particle that behaves like electron except that it's mass is 207 times higher than that of the electron. If a muon were bound to a proton to make "muonium" how are the energy levels in the Bohr model related to those for Hydrogen?

Problem 4

Write down the wave functions for hydrogen including all three primary quantum numbers n, ℓ, m and explain the physical meaning of each of these three quantum numbers.

Problem 5

A hydrogen atom in its $n = 1$ state absorbs a 12.09 eV photon. To what level is the electron promoted?

Problem 6

Lithium has atomic number 3. What is the energy needed to change a Li^{++} doubly-ionized ion in its ground state to a triply ionized lithium atom: Li^{+++}?

Problem 7

If the principal quantum number for hydrogen is 5, which one of the following is not a permitted orbital angular quantum number? Explain your answer briefly.
a) $\ell = 2$ b) $\ell = 5$ c) $\ell = 3$ d) $\ell = 4$

Problem 8

What is the highest value of the orbital quantum number (ℓ) for an electron in krypton's (atomic number 36) outer shell when in its ground state? Hint: a filled shell has $2n^2$) unique (non-degenerate) quantum states.