Gen. Phys. II **Exam 5 - Chs. 30,31 - Atomic & Nuclear Physics** **May. 12, 2020**

Rec. Time **Name**

This shows **some** of the possible questions you encountered on the online test. Point values here are arbitrary.

For full credit, make your work clear. Show formulas used, essential steps, and results with correct units and significant figures. Points shown in parenthesis. For TF and MC, choose the *best* answer. Bonus points possible by correctly using prefixes like 2.0 mV, 7.8 MW, 1.6 kΩ, 3.4 μCi, etc., in lieu of scientific notation like 3.4×10^{-6} Ci.

OpenStax Ch. 30 - Atomic Physics.

1. (5) A hydrogen atom initially in its n=3 state absorbs a photon of wavelength 256 nm, which is enough to ionize it. How much kinetic energy in eV does the ejected electron have?

2. (5) A singly-charged helium ion (He+) is initially in its n=2 (hydrogenic) Bohr state. What is the energy of a photon in eV that will ionize (or remove) the final electron and leave it with 5.00 eV of kinetic energy?

3. (5) Lithium has atomic number Z=3. A Li^{2+} ion, which has only one electron, is in a state with principal quantum number n=4. Using Bohr's model, calculate the radius of its electron orbit, in pm (picometers).

4. (5) Some atoms have energy levels at $E_1 = -5.00$ eV, $E_2 = -2.00$ eV, and $E_3 = -0.50$ eV. Suppose that there initially are some atoms in each of these three stationary states, and when the energy reaches $E = 0$ eV, the atom is ionized.

a) What is the longest wavelength of light that the atoms can absorb without being ionized?

b) What is the shortest wavelength of light that the atoms can absorb without being ionized?

c) What is the longest wavelength of light that will ionize some of the atoms?

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5. (5) An atomic electron is in a state with n=3. What is the largest value that the z-component of its orbital angular momentum can have (along some chosen z-axis)?

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6. (5) An electron experiences space quantization because its orbital angular momentum vector L can be thought to point only at specific angles to a z-axis. How many different angles can L make with the z-axis, if the orbital quantum number is $\ell = 3$?