

PHY 251 Fall 2009: homework problem set 4, due in the PHY 251 drop box in room A-129 by noon on Friday, Oct. 9.

1. Do Serway problem 4.2 on p. 146. This problem illustrates how electrochemistry experiments already gave some idea about the discrete charge of the electron, once you believe in discrete atoms and know Avogadro's number!
2. Do Serway problem 4.3.
3. Do Serway problem 4.4.
4. Rutherford scattering involves  $\alpha$  particles being electrostatically repelled by the nucleus, so that the scattering obeys the  $(\sin \phi/2)^{-4}$  trend. However, when particles get closer than a certain distance from the nucleus, they can be affected by nuclear forces instead. It is found that when  $\alpha$  particles scatter off of a tungsten foil that they depart from the Rutherford scattering angle at energies above 42 MeV. Use this information to estimate the size of the tungsten nucleus.
5. Construct an energy level diagram for the ground state and the first two excited states of the  $\text{Li}^{2+}$  ion (lithium with two electrons removed). Calculate the photon wavelengths associated with all possible transitions between these states (for those of you who know about selection rules, ignore them for this problem).
6. Serway 4.23
7. Serway 4.28
8. Serway 4.43
9. Serway 4.44