Homework 1 Solutions

Nuclear Engineering 162

Due 5 February 2008

I.1 Turner 2.5 (Page 48) Estimate the number of atoms/cm^2 in an aluminum foil that is 1 mm thick.

I.2 Turner 2.8 (Page 48) What is the minimum distance to which the 7.69MeV alpha particles could approach the center of the gold nuclei in Rutherford's experiments?

I.3 Turner 2.9 (Page 48) How much energy would an alpha particle need in order to "just touch" the nuclear surface in a gold foil?

I.4 Turner 2.15 (Page 49) Calculate the radius of the $n = 2$ electron orbit in the Bohr hydrogen atom.

I.5 Turner 2.25 (Page 50) How much energy is needed to remove an electron from the $n = 5$ state of He^+?

I.6 Turner 2.29 (Page 50) The negative muon is an elementary particle with a charge equal to that of the electron and a mass 207 times as large. A proton can capture a negative muon to form a hydrogen-like "mesic" atom. (The muon was formerly call the mu meson.) For such a system, calculate
(a) the radius of the first Bohr orbit
(b) the ionization potential.

I.7 What is the energy in eV of a photon with frequency of 2 GHz? (b) What is the energy of a proton that has the same momentum as a 1-MeV photon?

I.8 Turner 3.4 (Page 80) Calculate the energy released when a thermal neutron is absorbed by deuterium.

I.9 Turner 3.5 (Page 80) Calculate the total binding energy of the alpha particle.

I.10 Turner 3.9 (Page 80) The atomic weight of ^{32}P is 31.973910. What is the value of Δ in MeV?