**Nuclear Binding Energy Calculations**

1. Calculate the binding energy per nucleon of a Be-9 atom with a mass of 1.4960 × 10‑26 kg. Give your answer in MeV.
2. When an alpha particle bombards nitrogen-14, oxygen-17 is formed. Calculate the binding energy per nucleon, firstly in MeV and then in joules, of one oxygen-17 nucleus.  
   *m*p = 1.00728 u  
   *m*n = 1.00867 u  
   *m*O-17 = 16.999131 u
3. Fe-56 is one of the most tightly bound nuclei. What is its binding energy per nucleon in MeV? The mass of an Fe-56 atom is 55.934938 u.
4. The oxygen atom O has an isotope, O. Find the binding energy of each nucleus and thus determine which is more stable. (*m*O-16 = 15.994915 u)
5. Write a nuclear equation for the alpha decay of U-238 and calculate the energy released from one such decay.  
   *m*U-238 = 238.05078826 u  
   *m*Th-234 = 234.04360 u  
   *m*α = 4.001506 u
6. There are about 6.023 × 1023 atoms in 235 g of pure uranium-235.
   1. Calculate the energy released by one atom of U-235 when it is struck by a neutron and splits into barium-139, krypton-94, and three neutrons. Give your answer in joules and MeV. (You may wish to write a nuclear equation first.)  
      *m*U-235 = 235.0439299 u; *m*Ba-139­ = 138.908841 u; *m*Kr-94 = 93.93436 u
   2. Little Boy, the bomb that was dropped on Hiroshima, contained 64 kg of uranium. However, it is estimated that only 80% of that uranium was U-235, and only 1 kg of that U-235 underwent nuclear fission. Calculate the energy released by this amount of U-235, assuming that all of it underwent fission as described in part a.
   3. TNT has an energy density of 4.6 million J kg-1. How much TNT would be required to match the energy output of Little Boy?
7. H-3 (*m* = 3.016049 u) and H-2 (*m* = 2.014102 u) can fuse to form He-4 (*m* = 4.002603 u) and one neutron.
   1. Calculate the mass difference.
   2. How much energy will one fusion reaction release? Give your answer in joules and MeV.
   3. How does this compare with the energy released by the fission reaction described in question 6a?