Mass Defect

mass defect: the difference between the mass of the nucleons (protons + neutrons) and the actual mass of the nucleus. It is the mass that has been converted into energy when the nucleus was formed (the E was released).

e.g. mass of 1 proton = 1.00812 u
mass of 1 neutron = 1.00893 u

therefore the mass of He nucleus (2 protons + 2 neutrons) should be:

$2(1.00812\ u) + 2(1.00893\ u) = 4.0341\ u$

BUT the mass of a He nucleus is actually 4.0039 u

... difference of $4.0341 - 4.0039 = 0.0302$ u

This mass was converted into nuclear E, and released. This mass is the mass defect.

Exam Alerts

1. The greater the mass defect, the more energy that was released during the formation of the nucleus.

2. The more E released during the formation of the nucleus, the greater the mass defect. (opposite of #1)

3. The greater the mass defect, the more stable the resulting atom. This is because more E would be needed to break apart the atom (the same amount that was released when the atom was formed).

   $P + n \leftrightarrow atom + E$

4. The more unstable the atom, the smaller the mass defect. (Opposite of # 3) (an unstable atom needs little E to break it apart).

5. The more nucleons (neutrons + protons) in a nucleus, the more unstable the nucleus. (This is because there are many neutrons and the protons are far apart and the nuclear forces are not strong enough to hold the nucleus together well)

6. The more unstable the nuclei, the greater the number of nucleons in the nucleus. (opposite of #5)

7. The more stable the nuclei, the smaller the number of nucleons in the nucleus.