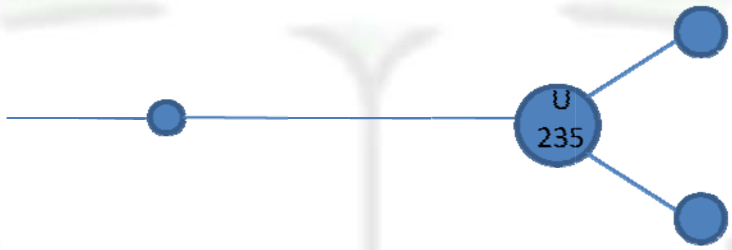
Nuclear Fission: The breaking of a nuclide of an atom having large atomic number into atoms of lower atomic number is known as Nuclear Fission.

For an example when an atom of Uranium (235) is bombarded with a high speed neutron the Uranium atom breaks to form Molybdenum and Xenon. The total mass of the product of atoms is less than the mass of parent which is broken and the difference in mass is converted into energy which is released during fission. Thus we can obtain tremendous amount of energy through nuclear fission.

$$^{235}_{92}\mathrm{U} + {}^{1}_{0}n \rightarrow \underset{\text{Stable}}{^{98}_{42}\mathrm{Mo}} + \underset{\text{Stable}}{^{136}_{54}\mathrm{Xe}} + 2\,{}^{1}_{0}n + 207\,\mathrm{MeV}$$



On the L.H.S of the equation : M(235,92) =235.044u

M_n = 1.009u

M(98,42) = 97.905 u

M(136,54)=135.917 u

Total mass =236.053 u

Total mass of R.H.S =235.840 u

Mass difference =0.213 u

Energy released =0.213x 934 MeV=207 MeV

It can be shown that if 1gm of Uranium can be subjected to fission completely it would release 5.1 x 10^{29} MeV energy which is equivalent to burning 7000 tons of nuclear fission.

Nuclear Fusion: Two or more lighter nuclides are fused together to form a single nuclide. The mass of that single nuclide is less than the total mass of the component nuclides and the difference in mass is converted into energy which is released.

For example the nuclides of two hydrogen atoms are to be fused. The nuclides which are to be fused are always positively charged particles and hence will suffer electrostatic repulsion. In order to bring the nuclides close together in spite of the repulsive force the nuclides should be given sufficient initial K.E. So that they can overcome the repulsion. The K.E given to the nuclides in the form of heat energy. It is found that to provide the required amount of K.E the temperature to be maintained is of the order of few million degree centigrade (nearly equal to the temperature of sun). Since the fusion reaction requires such a high temperature they are known as thermo nuclear reaction.

Let us consider the following fusion reaction:

$$^{1}_{1}\mathrm{H} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{2}_{1}\mathrm{D}_1 + {}^{0}_{\mathrm{H}}\mathrm{e}\,(\beta^+) + \upsilon\,(\text{neutrino})$$
$$^{2}_{1}\mathrm{D}_1 + {}^{1}_{1}\mathrm{H} \rightarrow {}^{3}_{2}\mathrm{He}_1\ (\text{unstable})$$
$$^{3}_{2}\mathrm{He}_1 + {}^{1}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He}_1 + {}^{0}_{\mathrm{H}}\mathrm{e}\,(\beta^+) + \upsilon\,(\text{neutrino})$$

$$4\,^{1}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He}_1 + 2\,{}^{0}_{\mathrm{H}}\mathrm{e}\,(\beta^+) + 2\,\upsilon + 27\mathrm{MeV}$$

Since nuclear fusion reactions require very high temperature hence they are very difficult to conduct.

We know that sun continuously emits energy which is obtained from nuclear fusion. The Chromospheres surrounding the photosphere (hot central core) contains different elements gases vapours in the atomic form. The lighter nuclides present in the chromospheres fused together at that very high temperature which is suitable for nuclear fusion and this energy is continuously being released.