Nuclear Reactions

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Inside the nucleus there were two types of particles:

	electric charge	Mass
neutrons:	0	1.6749×10^{-27} kg
protons:	same charge as an electron except positive 1.603×10^{-19} C	1.6726×10^{-27} kg

Nuclear Reactions:

In stars. Hydrogen-1 and Hydrogen-2 make Helium-3

mass number → $^{1}_{1}H$ ← atomic number

A = mass number = # of p^+ + # of n

Z = atomic number = # of p^+

Nuclear Equations

Law of conservation of mass

$$^{1}_{1}H + ^{2}_{1}H \longrightarrow ^{3}_{2}He$$

Law of conservation of charge

Ex.

$$^{36}_{15}P + ^{12}_{6}C \longrightarrow ^{25}_{12}Mg + ^{6}_{3}Li + ^{14}_{6}C + 3\,^{1}_{0}n$$

Decays:

There are 3 natural/spontaneous

decays for unstable nuclei

$^{4}_{2}\alpha \rightarrow {}^{4}_{2}He$ nuclei shot out of a nucleus
- High energy, very little penetrating power

$^{0}_{-1}\beta$ - High energy electrons → a neutron decays into an electron and a proton

γ - High energy light. Extreme penetrating power

Alpha Decay

$$^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$$

Units

Nuclei are really small

The units we use are u = atomic mass units. and MeV = mega electron Volts

$$1u = 1.6605 \times 10^{-27} kg$$

MeV is a unit of energy.

mega $\times 10^6$ → MeV ← volts J/C

e = charge of an electron $1.6 \times 10^{-19} C$

$$1\ MeV = 1.6 \times 10^{-13} J$$

M V for Mass $E = mc^2$ kg → $m = \frac{E}{c^2}$ ← J

MeV for Mass $\Rightarrow E = mc^2$ $\quad$ kg $\Rightarrow m = \frac{E}{c^2}$ ← m/s

$$m = \frac{1.6\times10^{-13}\,J}{(3\times10^{8})^2} = \frac{1.6\times10^{-13}}{9\times10^{16}} = 1.8\times10^{-30}\,kg$$

(1 MeV)

$1\,MeV \approx 1.8\times10^{-30}\,kg$

$1u = 1.6605\times10^{-27}\,kg$

$1u = 931.49\,MeV$

$1\,MeV = 1.6\times10^{-13}\,J$

Avagadro's # $\quad 6.023\times10^{23}$ # of atoms in 1 mol