

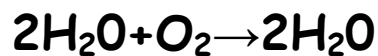
## Nuclear Chemistry

Nuclear Chemistry- radioactive (unstable nucleus) isotope.

Unstable Nuclei= 1.) The repulsion of the protons overcomes the strong force. Elements with atomic numbers greater than 83

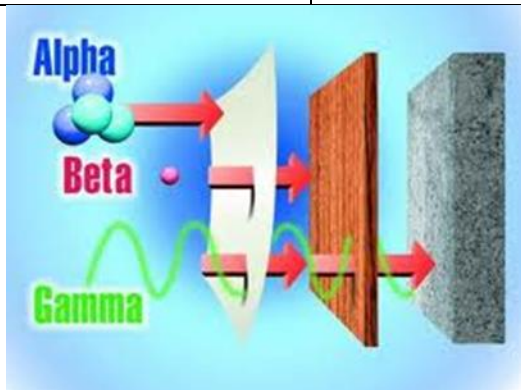
2) The Neutron: proton ratio exceeds 1:5:1

Reactants → products (RIGHT) If there is more than one reactant or product they are separated by a "+" = "and"



Natural Transmutation - spontaneously emitting (giving off) alpha particle, beta particle, positrons to reach nuclear stability.

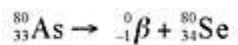
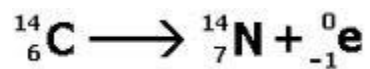
3 Natural Transmutations	Mass	Charge	Penetrating Power
Alpha Particle	4	+2	Weak
Beta Particle	0	-1	Moderate
Positron	0	+1	Moderate
Gamma Rays	0	0	Strong



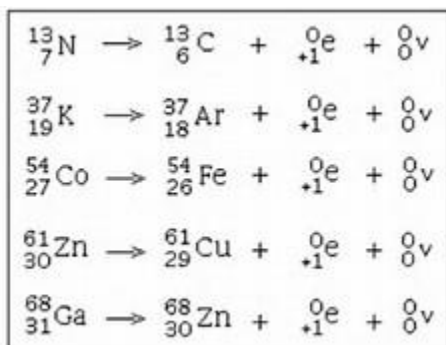
Law of Conservation- Energy mass and charge are conserved

Natural Transmutations \*Hint(1 Reactant)\*

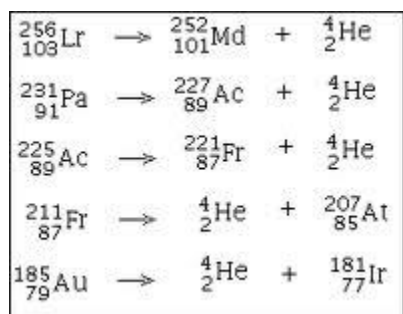
## Beta



## Positron Emission

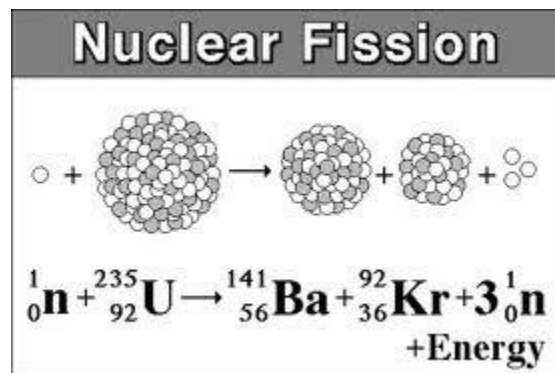
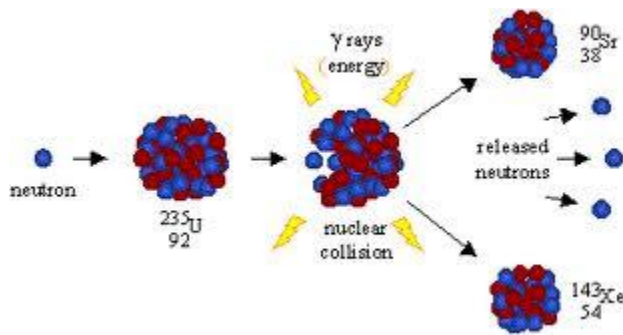


## Alpha



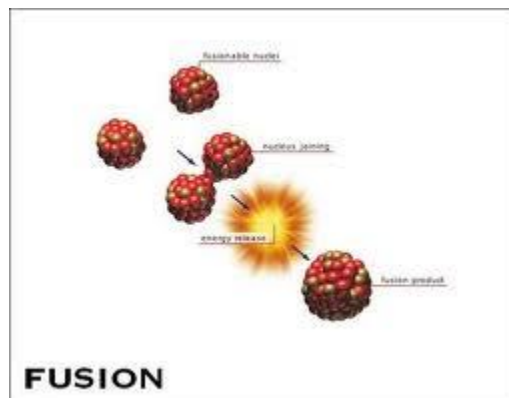
## Artificial Transmutations \*HINT (Two Reactants)\*

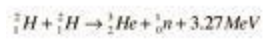
Fission- the splitting of a large nuclei by the bombardment of the nucleus with an accelerated neutron. Fissionable materials: U-235 (most common) and Pt-239



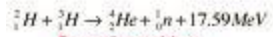
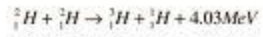
In some cases the mass of the reactants is greater than the mass of the products. When this occurs a portion of the mass is converted to energy.  $E = mc^2$

Fusion- the fusion of two small nuclei to produce a heavier nucleus.





Deuterium-deuterium  
Fusion



Deuterium-tritium  
Fusion



**\*\*\* \*mass converted to energy**

Fusion occurs naturally on the sun because the extremely high temperature overcomes the repulsion of the nuclei.



Half Life- amount of time it takes a radioisotope to decay to one half its original mass.

Half Life cannot be altered by changes in temperature or pressure.

### HINTS

- Any information concerning mass should be written on the side and "brackets" used with HLP
- Write the number 1 on the side when dealing with questions involving fractions/fraction remaining.

**HLP= tt/half life**

HLP= tt/half life      5= 62h/12.36h      1]  
2 ]  
4 ]  
8 ]  
16 ]  
32

## Uses of Radioisotopes

- 1.) C-14: C-12- used to date living things
  - 2.) U-238:Pb-206- used to date rocks and geological structures
  - 3.) \*\* I-131- Thyroid disorders/treatment
  - 4.) Tc-99 (brain) Cu-60, Cs-137- Cancer (tumor detection and treatment)
  - 5.) Co-60, Cs-137- Anthrax
  - 6.) P-31p Fertilizer
- Radioisotopes used in medicine should have relatively short half-lives so they can be quickly eliminated from the body.