C11 - 2.3 - Radioactive Decay/Fission/Fusion Notes

Alpha Particle: α

- Alpha particle = Helium nucleus

⁴₂ He

- Charge of +2

- Mass of 7000 electrons.

- No electrons

- Slow moving

- Can barely penetrate skin/paper

 $_{2}^{4}$ He = $_{2}^{4}\alpha$

Examples:

$$^{28}_{14}\text{Si} \rightarrow ^{24}_{12}\text{Mg} + ^{4}_{2}\text{He} \qquad ^{28 \rightarrow 24 + 4}_{14 \rightarrow 12 + 2}$$

$$^{208}_{83}$$
Bi $\rightarrow ^{204}_{81}$ TI $+ ^{4}_{2}$ He $^{208 \rightarrow 204 + 4}_{83 \rightarrow 81 + 2}$

Top = Top + TopBottom = Bottom + Bottom

Beta Particle

- Electron

- Charge of -1 - Mass of 0*

- Can only penetrate a few sheets of aluminum

Example:

$$^{14}_{6}$$
 C \rightarrow $^{7}_{7}$ N

$$14 \to 14 + 0 \\ 6 \to 7 + (-1)$$

- Neutron sends its electron away
- Increases charge of neutron by 1, turns into proton
- No change in mass
- Change in atomic #.

Gamma Particle: γ

- Energetic "light"

- No charge

- No mass

- Can penetrate a few centimetres of lead

Example:

$${}^{12}_{6}C^* \rightarrow {}^{12}_{6}C + {}^{0}_{0}\gamma \qquad {}^{12 \rightarrow 12 + 0}_{6 \rightarrow 6 + 0}$$

$$12 \rightarrow 12 + 0$$
$$6 \rightarrow 6 + 0$$

Fission: Splitting a nucleus in two.

- Creating an unstable isotope.
- Less powerful
- Used in nuclear power plants
- Atomic bombs (Hiroshima)

Example:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + 2^{1}_{0}n$$
 $\begin{vmatrix} 235+1 \rightarrow 140+94+2\\ 92+0 \rightarrow 54+38+0 \end{vmatrix}$

$$235 + 1 \rightarrow 140 + 94 + 2$$

 $92 + 0 \rightarrow 54 + 38 + 0$

Fusion:

Joining two nuclei into one.

- More powerful than fission
- Takes place in the sun
- Hydrogen bombs

Examples:

$${}^{1}_{1}H + {}^{1}_{1}H \rightarrow {}^{2}_{2}He$$

$${}^{2}_{2}He \rightarrow {}^{2}_{1}He + {}^{0}_{+1}e + a neutrino$$