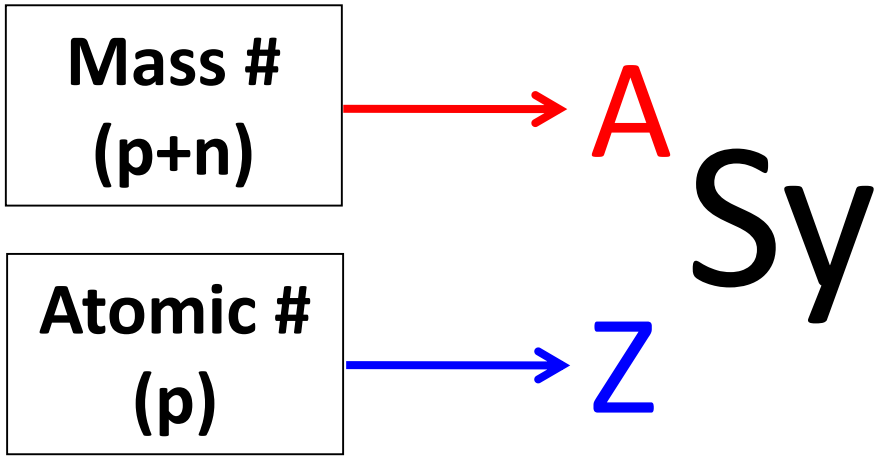
Writing “Balanced” Nuclear Equations

Writing Nuclear Equations

When looking at the reactants and products

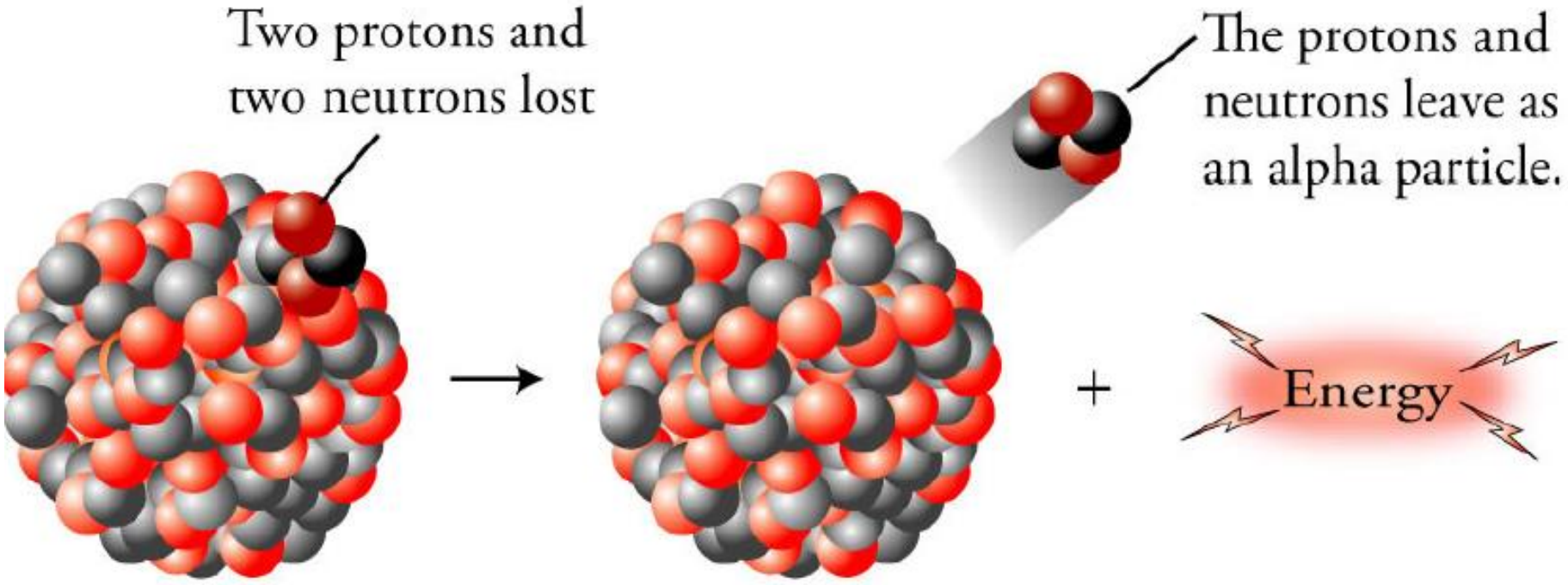
- **Atomic numbers must balance and**
- **Mass numbers must balance**



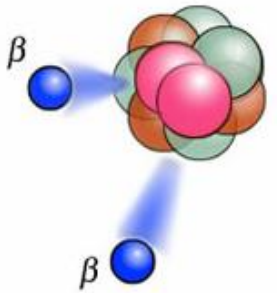
REMEMBER THE CONSERVATION OF MASS/MATTER LAW???

Alpha Decay

$$^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$$



Beta Emission:



$$^{1}_{0}\mathbf{n} \rightarrow {}^{0}_{-1}\beta + {}^{1}_{1}\mathbf{p}$$

A beta particle is just like an e-. When beta decay happens, the nucleus changes a neutron into a proton and an e-, and emits the e-

$$^{234}_{90}\mathrm{Th} \rightarrow {}^{0}_{-1}\beta + {}^{234}_{91}\mathrm{Pa}$$

Gamma Radiation:

No change in atomic or mass number

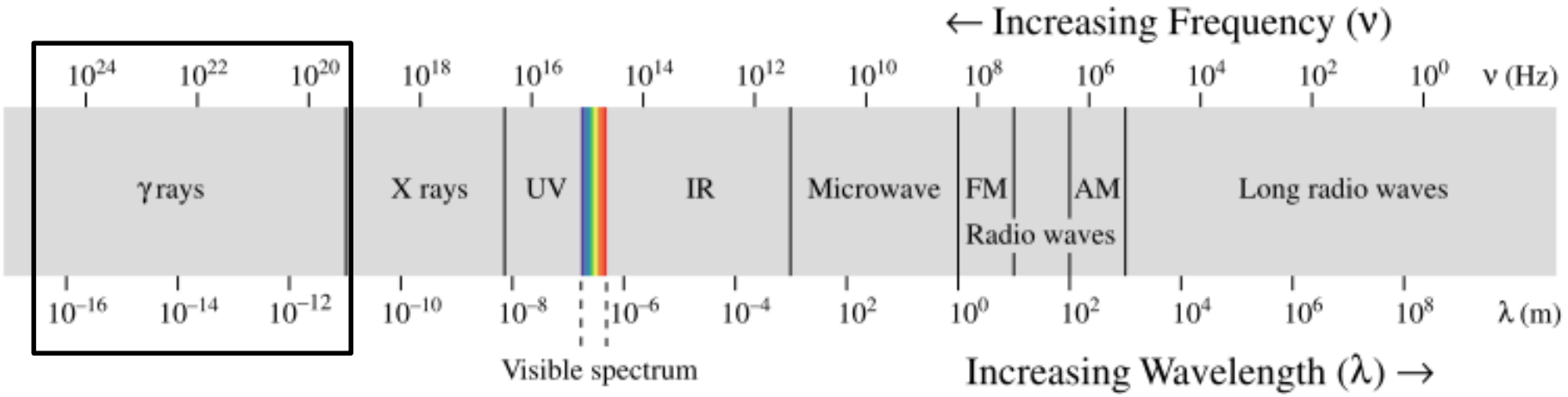
$$^{11}_{5}B^{*} \rightarrow {}^{11}_{5}B + {}^{0}_{0}\gamma$$

boron atom in a high-energy excited state

Gamma rays:

Dangerous EMR waves - usually emitted with other types of radiation. They penetrate very deeply.

$$^{0}_{0}\gamma$$



Balancing Nuclear Equations

238

238 = 234 + 4

$$^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$$

92

92 = 90 + 2

Remember that the # of PROTONS determines which ELEMENT it is!!!

Find the missing part

239 – 4 = 235

$$^{239}_{94}\mathbf{Pu} \rightarrow {}^{4}_{2}\alpha + \boxed{?}$$

94 – 2 = 92

235

Sy

92

Practice Problems

$$^{40}_{19}\mathrm{K} \rightarrow {}^{40}_{20}\mathrm{Ca} + ?$$

$$^{241}_{95}\mathrm{Am} \rightarrow {}^{237}_{93}\mathrm{Np} + ?$$

They can get weird!

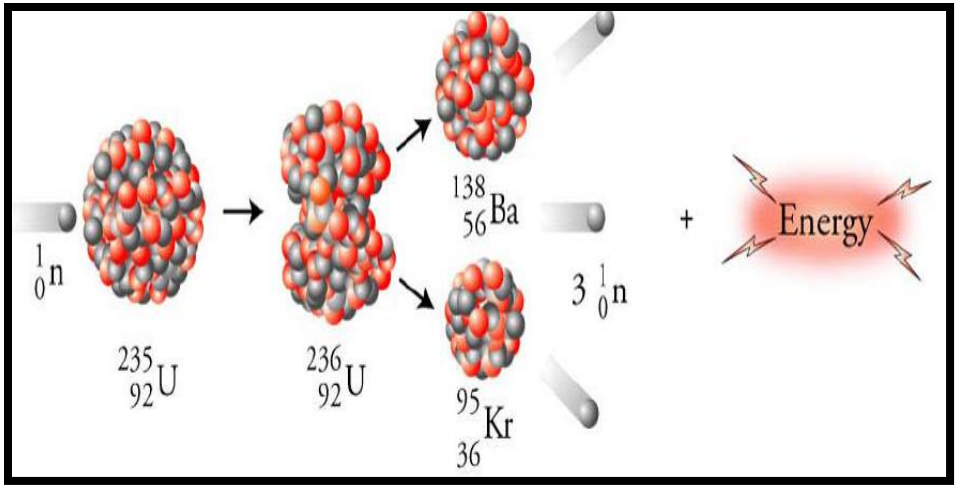
$$^{85}_{37}Rb + {}^{1}_{0}n \rightarrow ?$$

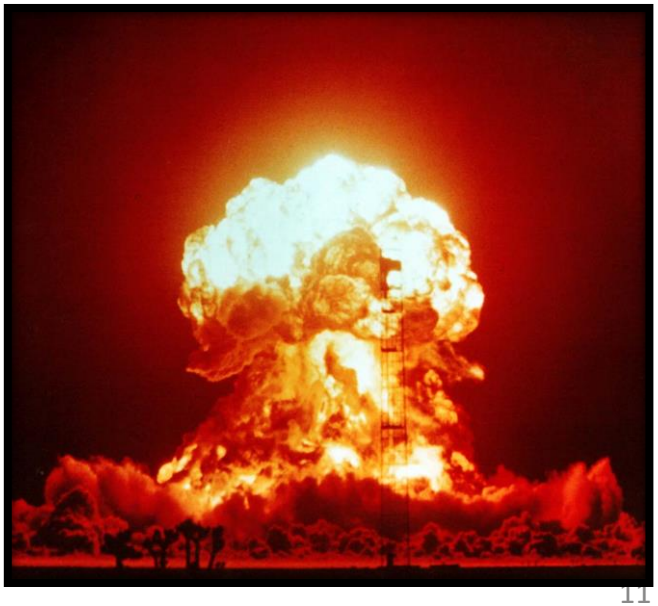
$$^{238}_{93}Np + 2\,^{0}_{-1}e^{-} \rightarrow ? + {}^{4}_{2}He$$

Still just adding and subtracting!

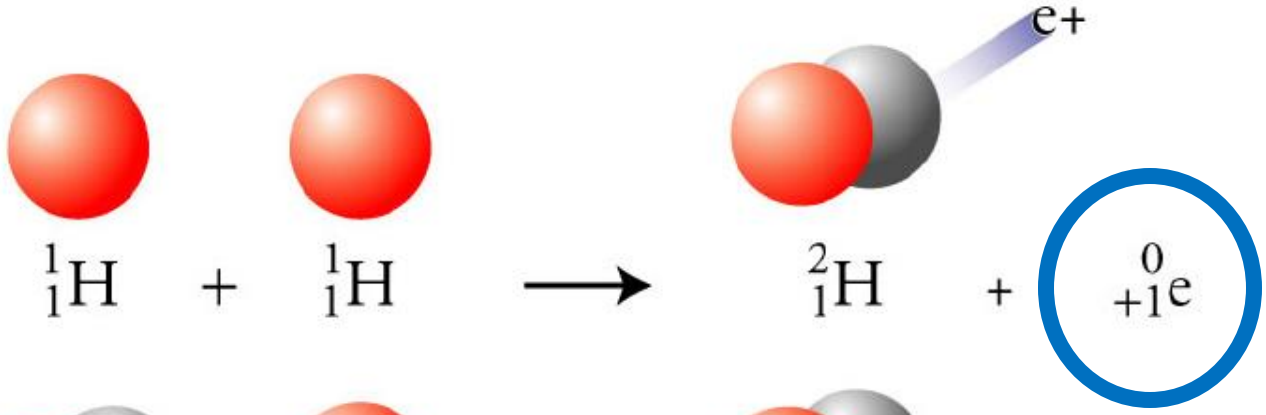
Nuclear Fission

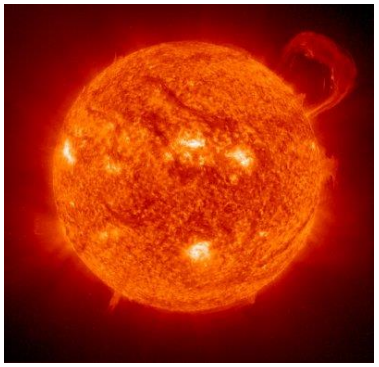
When atoms split into more/smaller pieces

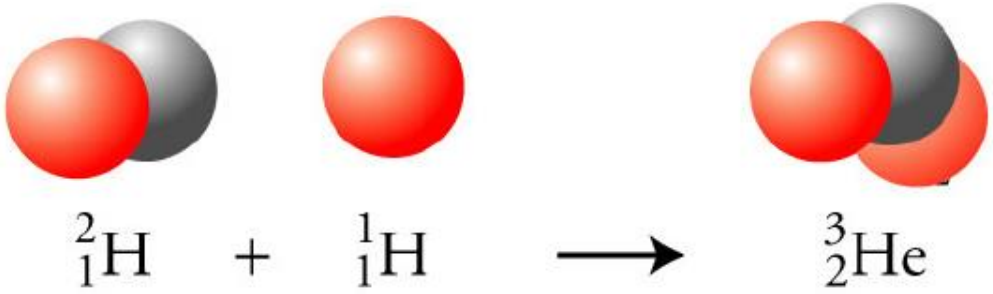




Nuclear Fusion - Powers the Sun

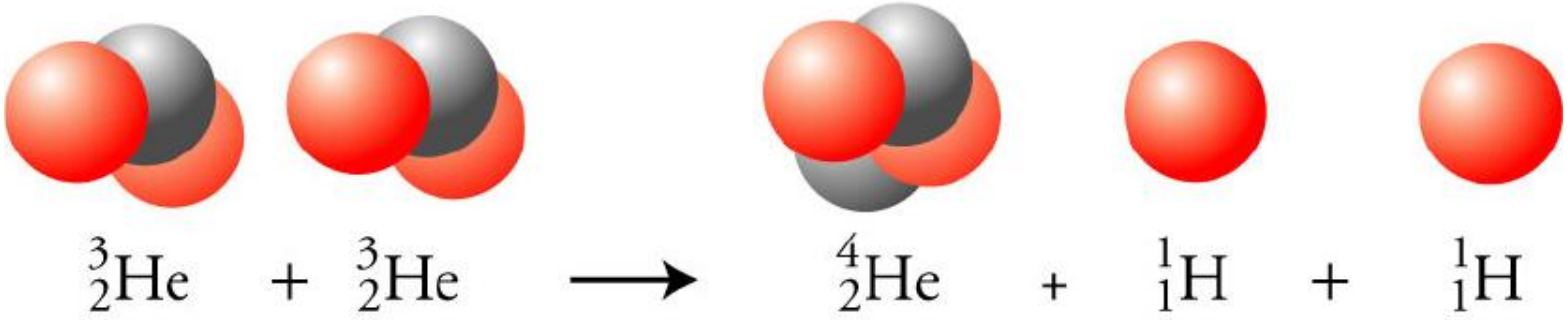






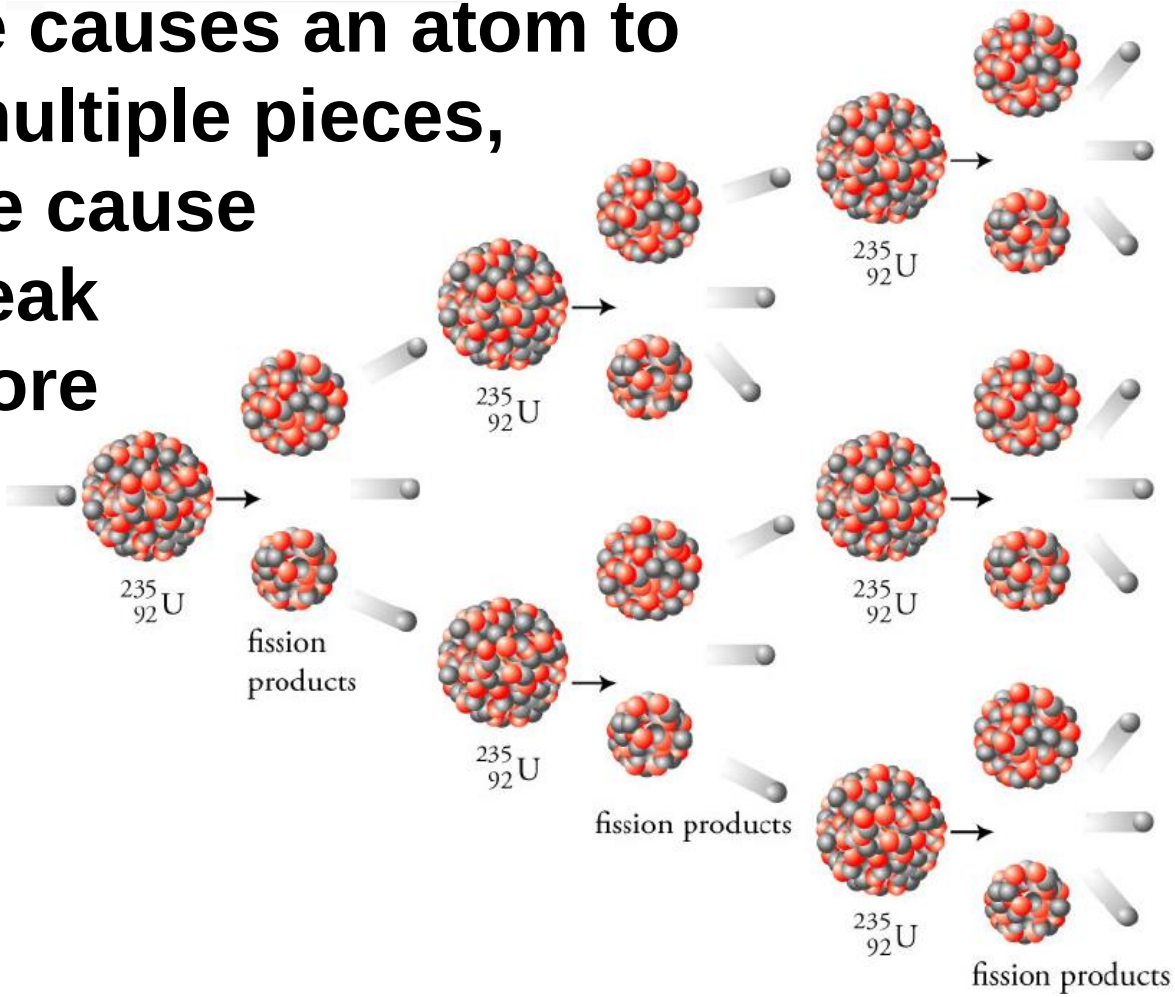
POSITRON

Like a beta particle, but positive. From breaking a <u>proton</u> into pieces



Chain Reaction

When one particle causes an atom to break apart into multiple pieces, then each of those cause more atoms to break apart into even more pieces, over and over

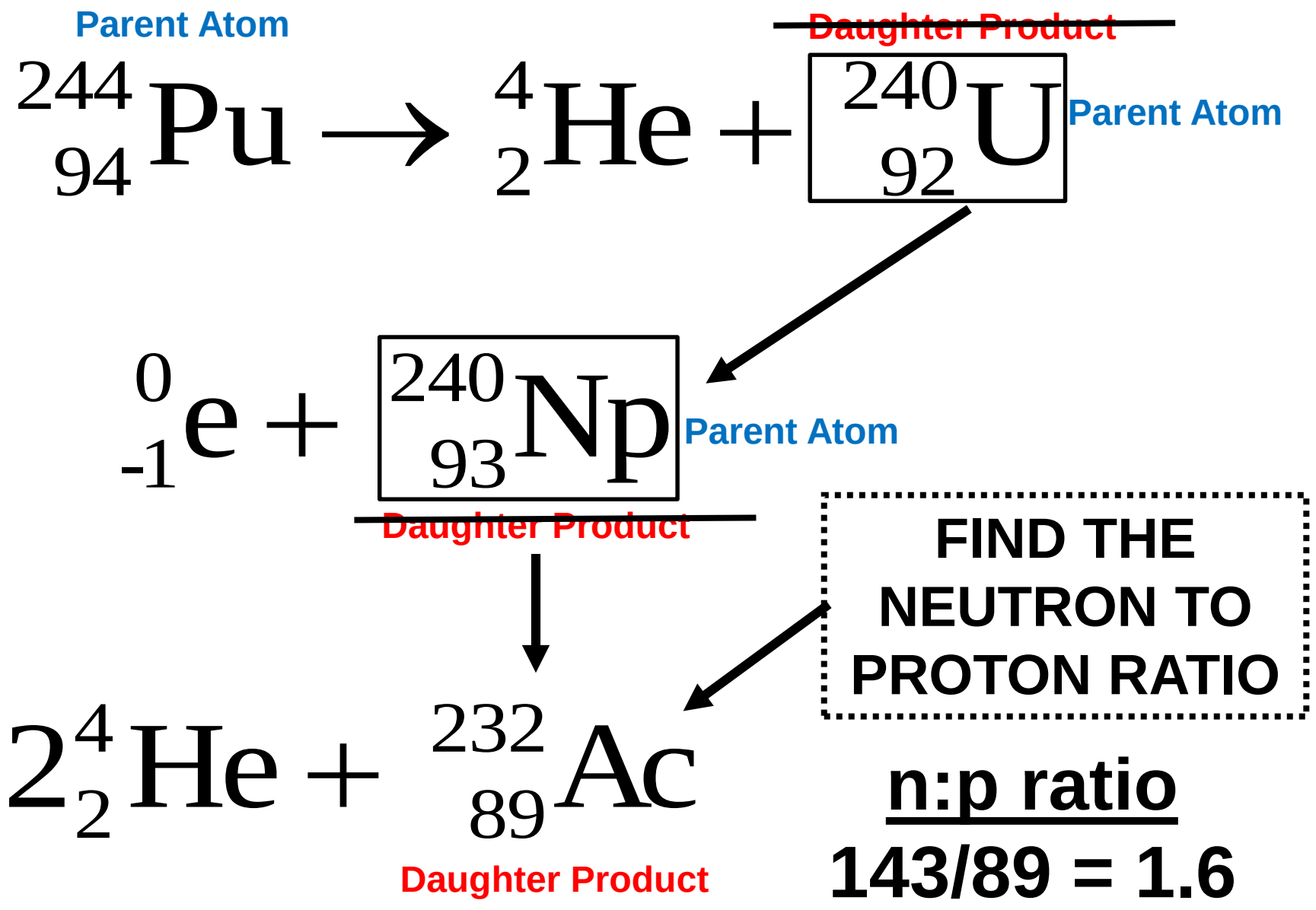


Parent and Daughter Vocab

- **Parent Atom**
  - What you start with
- **Daughter Product (Decay Product)**
  - The new atom that is made

Decay Series

- **The daughter product of one reaction is still unstable. It will decay into a new daughter product.**
  - The daughter product becomes a parent atom for a new reaction!


Parent Atom
Daughter Product
$^{244}_{94}Pu \rightarrow {}^{4}_{2}He + {}^{240}_{92}U$
Parent Atom
$^{0}_{-1}e + {}^{240}_{93}Np$
Parent Atom
Daughter Product
$2{}^{4}_{2}He + {}^{232}_{89}Ac$
Daughter Product
FIND THE NEUTRON TO PROTON RATIO
n:p ratio
143/89 = 1.6