

Nuclear Equation

Representing Radioactive Decay

- ▶ Nuclear equations are the way of showing radioactive decay by element symbol
- ▶ Equation written as:

Atom before decay \rightarrow atom after decay + radiation particle

Changing the Nucleus

- ▶ Through emitting radiation, we can change the nucleus of an atom. There are two ways in which the nucleus of an atom can be changed:
 1. **Charge.** We can increase or decrease the charge of an atom through nuclear radiation.
 2. **Mass.** We can decrease the mass of an atom through nuclear radiation.
- ▶ Golden rule to remember is that total mass and atomic number is same on both side. Which is called balanced equation.

Emission of radiation

- ▶ There are 3 types of radiation which is emitted in reaction and write it in chemical nuclear equation
 1. Alpha radiation / Alpha decay
 2. Beta radiation / beta decay
 3. Gamma radiation / Gamma decay

1- Alpha decay:

- **A helium nucleus has been emitted.** a **helium** nucleus has been emitted, this is alpha decay. The helium nucleus is made up of 2 protons and 2 neutrons, and it is the **alpha particle**.

- **Mass and atomic numbers have changed.** From the equation, we can see that both the mass number and the atomic numbers have changed. The mass number has decreased by 4, and new atom's mass no is **234**. While the atomic number has decreased by 2 and new atom's atomic number is **90**
- **Balanced Equation:** But if we add the mass number of new element which is **Thorium** and alpha **particle(He)** mass number it is equal to Uranium mass number. Same as atomic number
- In Nuclear Equation alpha particle is written as



Alpha Decay

An **alpha particle** is composed of **2 protons** and **2 neutrons**.
It is essentially a helium atom which has been stripped of its electrons

Alpha Particle
 ${}^4_2\text{He}$

Parent
 ${}^{238}_{92}\text{U}$
(Alpha decay of ${}^{238}\text{U}$)

→

Daughter
 ${}^{234}_{90}\text{Th}$

α^+
Alpha Particle

$${}^{238}_{92}\text{U} \rightarrow {}^4_2\text{He} + {}^{234}_{90}\text{Th}$$

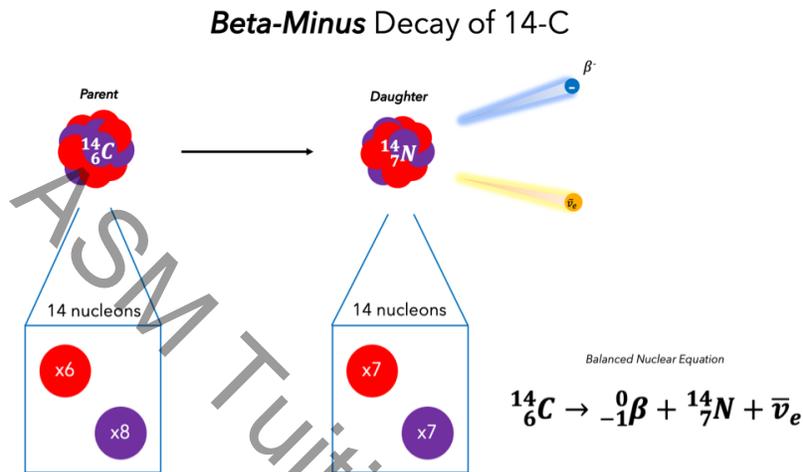
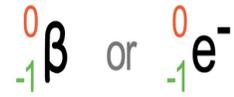
Balanced mass numbers

Balanced atomic numbers

2- Beta Decay

- **An Electron has been emitted.** Since an electron has been emitted, we know that this is beta decay. The electron is the beta particle.
- **Only the atomic number has changed.** From the equation, we can see that only the atomic number has changed. The mass number does not change, since the electron has a negligible mass.
- **Balanced Equation:** But if we add the mass number of new element which is **Nitrogen** and Beta particle (e) mass number it is equal to **Carbon** mass number. Same as atomic number.

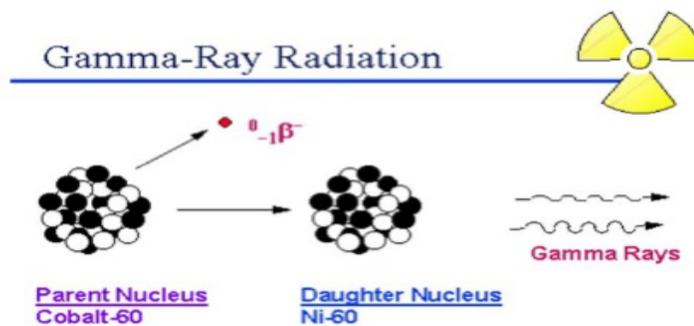
- In Nuclear equation beta particle is written as



3- Gamma Decay

- Gamma rays are a way of getting rid of excess energy from the nucleus
- Unlike beta and alpha decay, gamma rays do not cause a change in mass or charge.
- This means that neither the atomic number or the mass number changes when gamma rays are emitted.
- it's is written as in Nuclear Equation γ

Gamma Radiation



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