

## Radioactive Decay

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## Radioactive Decay

- ▶ **Radioactive decay** is the spontaneous disintegration of a nucleus into a slightly lighter nucleus, accompanied by emission of particles, electromagnetic radiation, or both.
- ▶ Nuclear Radiation is the name of the particles or electromagnetic radiation emitted from the nucleus during radioactive decay.
- ▶ Uranium-238 is an example of a radioactive nuclide, which is an unstable nucleus that undergoes radioactive decay.



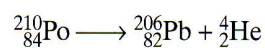
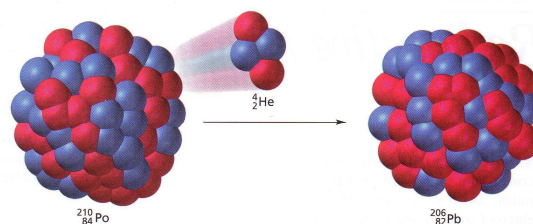
2.6 : 1 N:P ratio

## Types of Decay

- ▶ **Alpha Emission**
- ▶ An alpha particle ( $\alpha$ ) is two protons and two neutrons bound together and is emitted from the nucleus during some kinds of radioactive decay.
- ▶ Alpha Particles are Helium Nuclei and have a charge of 2+.



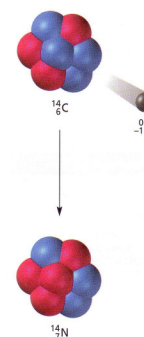
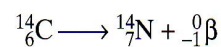
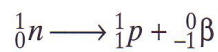
## Alpha Decay



## Beta Emission

- ▶ Elements above the band of stability are unstable because they have too many neutrons. **To decrease the number of neutrons, a neutron can be converted into proton and an electron.**
- ▶ A **beta particle** ( $\beta$ ) is an electron emitted from the nucleus during some type of radioactive decay.

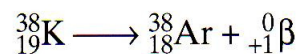
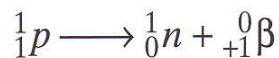
## Beta Emission



## Positron Emission

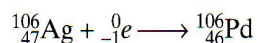
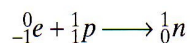
- ▶ Elements below the band of stability have too many protons to be stable. **A proton can be converted to a neutron by emitting a positron.**
- ▶ A positron is a charged particle that has the same mass as an electron, but has a positive charge and is emitted from the nucleus during some kinds of radioactive decay.

## Positron Emission



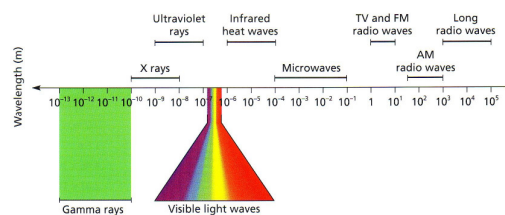
## Electron Capture

- ▶ Another type of radioactive decay for nuclides with too many protons is **electron capture**.
- ▶ In electron capture, an inner orbital electron is captured by the nucleus of its own atom. This inner-orbital electron combines with a proton and a neutron is formed.



## Gamma Emission

- ▶ **Gamma rays ( $\gamma$ )** are high-energy electromagnetic waves emitted from a nucleus as it changes from an excited state to a ground state.
- ▶ Part of the electromagnetic spectrum.



## Radioactive Decay Summary

**TABLE 22-1** Radioactive Nuclide Emissions

Type	Symbol	Charge
Alpha particle	${}^4_2\text{He}$	2+
Beta particle	${}^0_{-1}\beta$	1-
Positron	${}^0_{+1}\beta$	1+
Gamma ray	$\gamma$	0