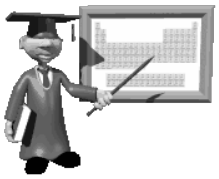
Nuclear Chemistry



Nuclear vs. Chemical

- Occurs when bonds are _____ and _____
- Atoms remain _____, but they may be rearranged
- Involve only _____
- Have _____ energy changes
- Reaction rates are influenced by _____, _____, _____, and _____

- Occurs when nuclei emit _____ and/or _____
- Atoms of one element are _____ into another element
- May involve _____, _____, or _____
- Have _____ energy changes
- Reaction rates are _____

Types of Radiation

- Unstable nuclei emit radiation to attain more stable atomic configurations in a process called _____ .

Types of Radiation

- The three most common types of radiation are _____ (α), _____ (β), and _____ (γ).

Properties of Alpha, Beta, and Gamma Radiation

Property	Alpha (α)	Beta (β)	Gamma (γ)
Composition	Alpha particles	Beta particles	High-energy electromagnetic radiation
Description of radiation	Helium nuclei $^{4}_{2}He$	Electrons $^{0}_{-1}\beta$	photons $^{0}_{0}\gamma$
Charge	2+	1–	0
Mass	6.64×10^{-24} kg	9.11×10^{-28} kg	0
Approximate energy*	5 MeV	0.05 to 1 MeV	1 MeV
Relative penetrating power	Blocked by paper	Blocked by metal foil	Not completely blocked by lead or concrete.

*(1 MeV = 1.60×10^{-13} J)

Alpha

- An _____ (α) has the same composition as a _____ nucleus—two protons and two neutrons—and is therefore given the symbol _____ .
- The charge of an alpha particle is _____ due to the presence of the two protons.

Alpha

- Because of their mass and charge, alpha particles are relatively slow-moving compared with other types of radiation.
- Thus, alpha particles are not very penetrating
- _____ stops alpha particles.

Beta

- A _____ (β) is a very-fast moving _____ that has been emitted from a neutron of an unstable nucleus.
- Beta particles are represented by the symbol _____
- The –1 subscript denotes the negative charge of the particle.
- Beta radiation consists of a stream of _____

Beta

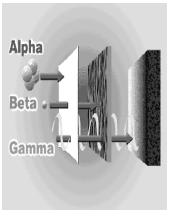
- Because beta particles are both lightweight and fast moving, they have greater penetrating power than alpha particles.
- A _____ is required to stop beta particles.

Gamma

- _____(γ) are high-energy (short wavelength) electromagnetic radiation. They are denoted by the symbol _____
- The emission of gamma rays does not change the atomic number or mass number of a nucleus.
- Gamma rays almost always accompany _____ radiation.

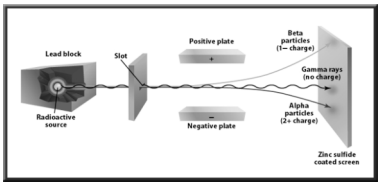
Gamma

- Gamma rays are high energy radiation
- They can only be blocked by _____



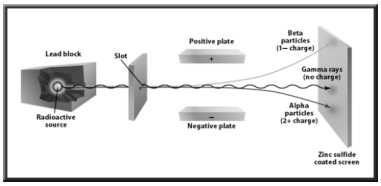
Deflection

- The effect of an electric field on three types of radiation is shown.
- Positively charged alpha particles are deflected toward the _____ charged plate.



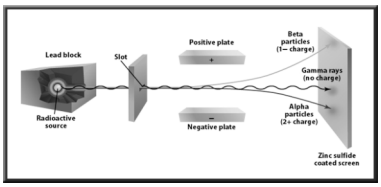
Deflection

- Negatively charged beta particles are deflected toward the _____ charged plate.



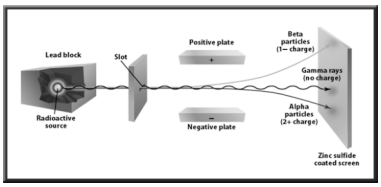
Deflection

- Beta particles undergo greater deflection because they have considerably _____ than alpha particles.



Deflection

- Gamma rays, which have no electrical charge, are _____ .



Writing Nuclear Reactions

- When writing nuclear reactions, you must remember the _____
- What you start with has to equal what you end with
- You also have to remember how to write formulas for isotopes

Nuclear Reactions

- Write the reaction for radium 226 converting into radon 222

Nuclear Reactions

- Write the reaction of carbon-14 decaying into nitrogen – 14

Nuclear Reactions

- Write the reaction of uranim-238 undergoing alpha and gamma decay

Half Life

- _____ - time required for ½ of a radioisotope to decay
- For example…
- You have 100 g of an isotope. How much is left after 1 half life?

- How much will be left after 2 half lives?

Fission and Fusion

- _____– splitting the nucleus into fragments
- Releases large amounts of _____
- Nuclear power plants use fission to generate power

Fission and Fusion

- _____– combining of atomic nuclei
- Release large amounts of energy
- Require extremely _____
- The lowest temperature possible is 40,000,000 K
- Know to occur on the sun