CONCEPT: INTRO TO RADIOACTIVITY

- **Radioactivity:** process of spontaneous _____ by an unstable nucleus.
  - □ Instability is due to excess _____ or _____ in the nucleus.
    - Produces a new _____ and emits radiation.
- Recall Isotope and Subatomic Particle Notations

Isotope and Subatomic Particle Notations

Mass # A
Atomic # Z
X — Element Symbol

N (neutron #) = __ - __

Proton particle	Neutron particle	Electron particle	Positron particle
_____	_____	_____	_____

- Differences between Chemical and Nuclear Reactions
  - □ **Chemical Reactions**: number and type of elements on reactant and product side are _____.
  - □ **Nuclear Reactions**: identity of the elements changes.
    - However, _____ and _____ is conserved between reactants and products.

EXAMPLE: Label each reaction as chemical or nuclear.

i) $^{15}_{8}O \longrightarrow {}^{15}_{9}F + {}^{0}_{+1}e$

ii) $2\,Mg + O_2 \longrightarrow 2\,MgO$

Understanding Nuclear Reactions

- Nuclear reactions consist of a *parent nuclide*, a *daughter nuclide,* and an *energetic particle.*
  - □ **Nuclide:** radioactive _____ that has an unstable nucleus and emits radiation as it decays.
    - **Parent nuclide**: an unstable radioisotope, appears on the _____ side.
    - **Daughter nuclide**: more stable radioisotope, appears on the _____ side.

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z}Y + {}^{0}_{+1}e$$

energetic _____

_____ nuclide _____ nuclide

  - □ **Energetic particle:** subatomic particle appears as a reactant or product.

EXAMPLE: Identify the energetic particle in the following nuclear reaction.

$$^{231}_{90}Th \longrightarrow {}^{231}_{91}Pa + {}^{0}_{-1}e$$

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Types of Radioactivity

- There are ___ types of radioactivity:
  - □ (1) _____ decay, (2) _____ decay, (3) _____ emission, (4) _____ emission
    - Decay (emission) occurs when energetic particle is _____ from an unstable nucleus and is a _____.
  - □ (5) Electron _____: energetic particle is _____ and is a _____.

EXAMPLE: Identify radioactivity as decay or capture.

i) $^{11}_{6}C \longrightarrow {}^{11}_{5}B + {}^{0}_{+1}e$

ii) $^{72}_{34}Se + {}^{0}_{-1}e \longrightarrow {}^{72}_{33}As$

iii) $^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

iv) $^{189}_{77}Ir + {}^{0}_{-1}e \longrightarrow {}^{189}_{76}Os$