LIBERTY & SUCCESS LEARNING HUB
NUCLEAR PHYSICS / CHEMISTRY

DECAY SCHEME

MEANING OF DECAY SCHEME

A decay scheme is a diagram or written description that shows how a radioactive nucleus changes step by step as it emits radiation until it becomes stable.

It shows:

- The original radioactive nucleus
- The type of radiation emitted
- The new nucleus formed
- The final stable nucleus

RADIOACTIVE DECAY

Radioactive decay is the process by which an unstable nucleus loses energy by emitting radiation to become more stable.

Radioactive decay occurs spontaneously and cannot be controlled.

TYPES OF RADIOACTIVE DECAY IN A DECAY SCHEME

A decay scheme may involve one or more of the following:

(a) Alpha (α) Decay

- An alpha particle is emitted
- Atomic number decreases by 2
- Mass number decreases by 4

Example:
Uranium-238 changes to Thorium-234.

(b) Beta (β) Decay

- A beta particle (electron) is emitted
- Atomic number increases by 1
- Mass number remains the same

Example:
Thorium-234 changes to Protactinium-234.

(c) Gamma (γ) Emission

- No particle is lost
- Only energy is released
- Atomic number and mass number remain unchanged

Example:
An excited nucleus releases gamma rays to become more stable.

DECAY SCHEME EXPLAINED WITH AN EXAMPLE

Example: Uranium-238 Decay Scheme

Uranium-238 does not become stable immediately. It decays through several stages.

Step 1:
Uranium-238 emits an alpha particle and becomes Thorium-234.

Step 2:
Thorium-234 emits a beta particle and becomes Protactinium-234.

Step 3:
Protactinium-234 emits another beta particle and becomes Uranium-234.

This process continues until Lead-206, which is stable, is formed.

This entire process is called the decay scheme of Uranium-238.

IMPORTANCE OF DECAY SCHEME

Decay schemes help scientists to:

- Understand how radioactive elements change
- Identify types of radiation emitted
- Predict energy released
- Use radioactive materials safely

APPLICATIONS OF DECAY SCHEME

1. Medicine
   Used in cancer treatment and diagnosis
   Example: Cobalt-60 decay scheme used in radiotherapy
2. Archaeology
   Used to determine the age of fossils
   Example: Carbon-14 decay scheme
3. Nuclear Physics
   Helps in studying nuclear reactions and radiation