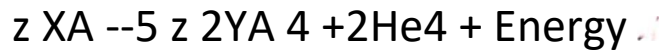


## Soddy Fajan Laws (Group-Displacement Laws)

- When a nuclide emits one  $\alpha$ -particle ( $\text{He}^4$ ), its mass number (A) decreases by 4 units and atomic number (Z) decreases by 2 units.



- When a nuclide emits a  $\beta$ -particle, its mass number remains unchanged but atomic number increases by one unit.  ${}_Z X_A \rightarrow {}_{Z+1} Y_A + \text{Energy}$

where antineutrino.

- In the nucleus, due to conversion of neutron into proton, antineutrino is produced. It has no charge or mass, but has momentum. When a proton is converted to a neutron, a neutron and a +ve  $\beta$ -particle is produced, which is called as positron.  $\beta^-$  rays are electrons and  $\beta^+$  are the antielectrons or positrons.  $n \rightarrow p + e^- + \bar{\nu}$  (antineutrino)



- Antineutrino and neutrino share the energy of electrons and positrons. That is the reason why the energy of  $\beta^-$  is continuous and  $\beta^+$  rays has a energy maximum.

When a  $\gamma$  particle is produced, both atomic and mass number remain constant.

## ACTIVITY OF A RADIOACTIVE ISOTOPE

- The activity of a radioactive substance (or radioisotope) means the rate of decay per second or the number of nuclei disintegrating per second. It is generally denoted by A.

$\frac{dN}{dt}$

- If at time  $t = 0$ , the activity of a radioactive substance be A and after time  $t$  — — t s, activity be  $A_t$  then

## E ▶ ENTRI

$$A_0 = \left[ \frac{dN}{dt} \right]_{t=0} = -\lambda N_0$$

$$A_t = \left[ \frac{dN}{dt} \right]_{t=t} = -\lambda N_t$$

$$A_t = A_0 e^{-\lambda t}$$

### Unit of Activity

- The activity is measured in terms of Curie (Ci). 1 curie is the activity of 1 g of a freshly prepared sample of radium  $\text{Ra}^{226}$

(T<sub>1/2</sub> = 1602 years.)

1 curie = 1 Ci =  $3.7 \times 10^{10}$  dps (disintegration per second) 1 dps is also known as 1 Bq (becquerel).

$$1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$$