



TRINITY COLLEGE FOR WOMEN NAMAKKAL

Department of Chemistry

Application of Radioisotopes

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AP/Chemistry

Inorganic chemistry

Application of Radioisotopes:-

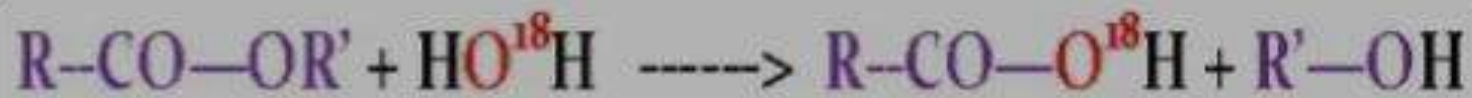
A) As Tracers:-

1. In studying reaction mechanism:

(i) When water enriched in **O18** isotope is used in photosynthesis, it is found that the oxygen evolved in the process comes entirely from water while oxygen of **CO2** is retained in organic compound.



(ii) In ester hydrolysis by using water enriched in O18 isotope, it is found that the acid only contains excess O18 as,



This indicates that,

-OR' bond is broken. And the -O18H from H2O18 takes the place of —OR' forming acid while H combine with —OR' producing alcohol.

2. In medicine:-

- (i) Gama emitted by ^{60}Ni , ^{60}Co , ^{60}Co , radium are useful to prevent the growth of cancer.
- (ii) ^{131}I isotope is used to detect and cure the cancers of thyroid glands.
- (iii) ^{32}P isotope are used to detect cancers (i.e. for treatment of Leukemia.)
- (iv) Radioisotope of iodine is used to detect brain tumor.
- (v) ^{24}Na used to determine the efficiency of blood circulation and function of heart.
- (vi) ^{198}Au isotope is used for curing some types of cancers.
- (vii) Gama radiations are also used to sterilize the surgical instruments.

3. In agriculture: -

(i) Food grains exposed to gama-radiations, last longer.

(ii) Superior plant varieties can be obtained by inducing mutation by gama-rays.

(iii) Potatoes and milk are preserved by-gama rays.

(iv) Pests and insects on crops can be killed by Gama rays.

(v) Radioactive phosphorus is used to study the efficiency of fertilizers.

(vi) ^{14}C isotope is used for the study of photosynthesis and biosynthesis.

(vii) ^{35}S isotope is helpful to study the advantages and disadvantages of fungicides.

4. In industry:-

- (i) To measure level of liquids in closed tanks.**
- (ii) To trace movement of oil in the pipes of a refinery.**
- (iii) α and beta rays are used to measure thickness of metallic and plastic sheets.**
- (iv) To study wear and tear of machinery parts.**
- (v) To study self diffusion of metals, mechanism of friction and effectiveness of lubricants.**
- (vi) gamma -rays are used to detect the flaws and leaks in moulds, welding and gas systems.**

B. As radiotherapy:-

- (i) gamma-rays emits by ^{60}Co are used for testing deeply separated cancer growths.**
- (ii) Radioisotope of phosphorus is used for treatment of Leukemia.**
- (iii) Radioisotope iodine for treatment of hyperthyroidism.**
- (iv) ^{24}Na is used to check the blood circulation and to study the functioning of heart.**

(C) In mutation of crops:-

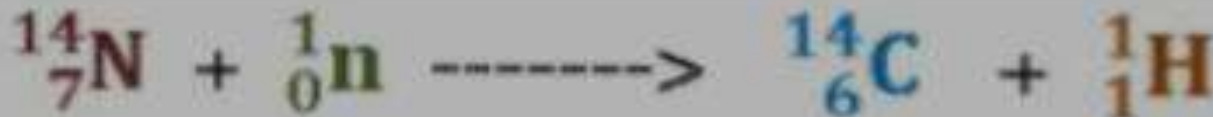
Radioisotopes are used in mutation of crops. Mutations are induced in plants to get crops with higher yield, resistant to disease and better adaptability to the environments.

(D) Carbon dating: -

(W. F. Libby (1960) first developed this technique.)

1. The process of determining the age of historic and archaeological organic samples by comparing the ratio of ^{14}C to ^{12}C is called ^{14}C dating or carbon dating.

2. The isotope ^{14}C is radioactive. It is produced in upper atmosphere as,



3. The atmospheric CO_2 a mixture of $^{14}\text{CO}_2$ and $^{12}\text{CO}_2$ present in a fixed ratio. Plants absorb this CO_2 and prepare cellulose (wood) by photosynthesis.

4. The ratio ^{14}C to ^{12}C atoms in the living tree is the same as in the atmosphere.

5. When the tree is cut, this cycle stops and the ratio ^{14}C to ^{12}C begins to decrease because the ^{14}C atoms are constantly disintegrating.

6. The concentration of ^{14}C can be measured by counting its radioactivity.

Consider,

N_0 = concentration of ^{14}C in living tree.

N_t = concentration of ^{14}C at particular time t (after cutting).

The age of the wood (or old geological specimen) (i.e. time, t), can be determined as,

$$\lambda = \frac{2.303}{t} \log \frac{N_0}{N_t} \quad \text{where, } \lambda = 0.693 / t_{1/2}$$

Here, $t_{1/2}$ Half life period of radioactive carbon (^{14}C).

THANK YOU

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