Al-Mustaqbal University College
Radiological Techniques Department

Radiation Protection

Half – life determination

Third Stage

Second Lecture

Practical

By
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Half – life determination

The radioactive half-life is as the amount of time required for the activity to decrease to one -half of its original value

Objective

Curve building and half – life determination for the unknown isotope

Apparatus

- Source
- Geiger tube
- Pulse inverter
- Timer counter
- Power supply

Theory

Approach to describing reaction rates is based on the time required for the concentration of reaction to decrease to one half its initial value

The period of time is called the half life of the reaction written as $t_{1/2}$

Radioactivity or radioactive decay is the emission of particle or a photon that result from the spontaneous decomposition of the unstable nucleus of an atom

In one half life the amount of original material reduce by half from 100% to 50%

During the second the amount of original material reduces by the half from 50% to 25%

The half life varies from isotope to isotope some have values in order of second others such thousands of millions of years

When the radioactive material decay apply radioactivity law

$$\mathbf{N = N_{\circ} e^{-\lambda t}}$$

N= Number nuclei when the time (t)

$N_{\circ}$= Number nuclei when the time zero ($t_{\circ}$)

λ= constant decay

When the count rate with time the equation become

$$\boldsymbol{R = R_{\circ} e^{-\lambda t}}$$

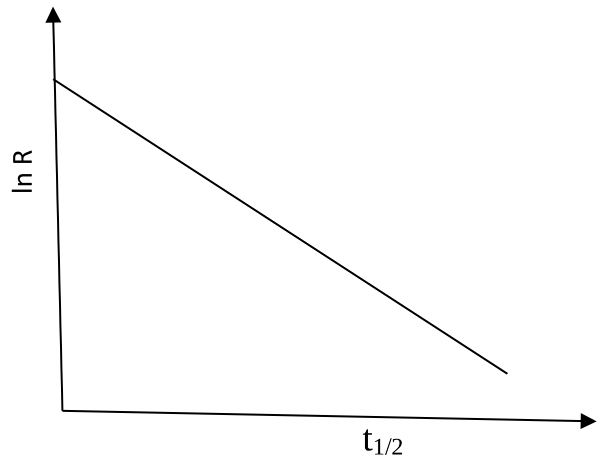
R= count rate when the time (t)

$R_{\circ}$= count rate when the start decay

Result

Time Sec	Count – rate R	Ln R

1- Plot graph between the (ln R)on the y axis and (t) on the on the y axis and (t) on the x axis and what the represent the slope
2- Determine the $t_{1/2}$ from the graph



Isotope	Halflife	Radiation
$^{3}_{1}H$	**12.3 year**	β
$^{14}_{6}C$	**5730 year**	β
$^{60}_{27}Co$	**30 year**	β, γ
$^{131}_{35}I$	**8.07 day**	β, γ
$^{212}_{82}Pb$	**10.6 hours**	β
$^{194}_{84}Po$	**0.7 second**	α
$^{210}_{84}Po$	**138 day**	α, γ

Question

for a substance with a half life of 2 hours 1/8 of the original atoms will remain after 6 hours calculate constant decay?