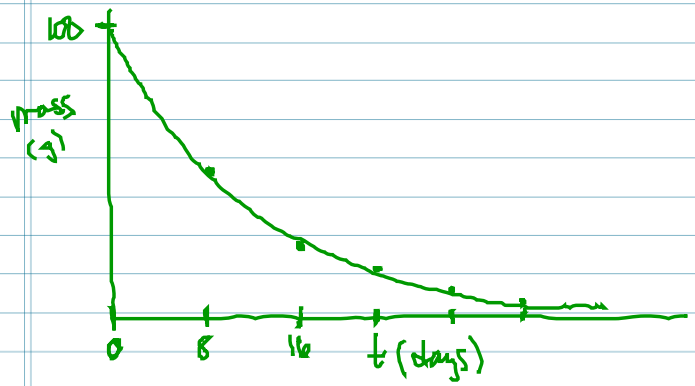
HALF LIFE → the amount of time it takes for ½ of a reactant sample to react

units: sec, min, hr, days, yrs 0.1m 0.1 M m ≠ M

the shorter the $t_{\frac{1}{2}}$, the faster the reaction

^{131}I $t_{\frac{1}{2}}$ = 8 days

100g —8d→ 50g —8d→ 25g —8d→ 12.5g —8d→ 6.25g remain, 93.75g reacted



one reactant first order reaction (Radioactive decay)

A → products rate = k [A]¹ $t_{\frac{1}{2}} = \frac{0.693}{k}$

one reactant, second order overall

A → products rate = k [A]² $t_{\frac{1}{2}} = \frac{1}{k[A]_0}$

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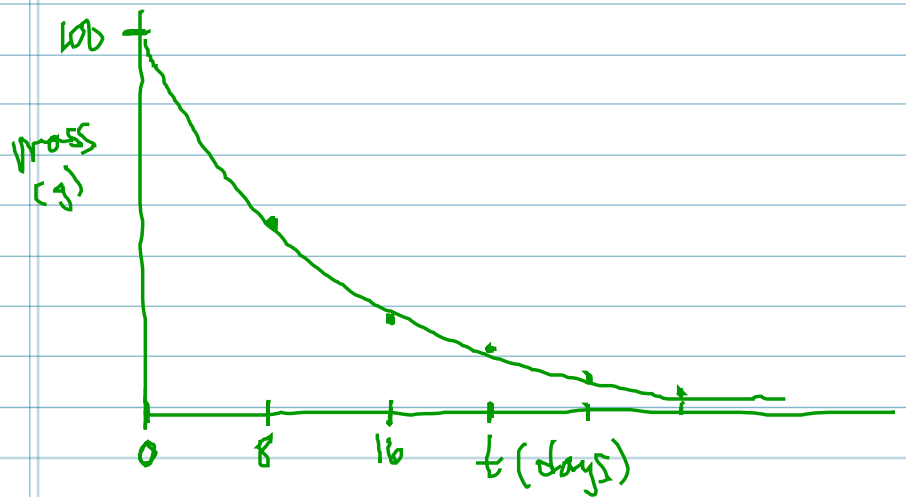

one reactant first order reaction (Radioactive decay)

$A \rightarrow$ products rate = $k[A]^1$ $t_{\frac{1}{2}} = \frac{0.693}{k}$

one reactant, second order overall

$A \rightarrow$ products rate = $k[A]^2$ $t_{\frac{1}{2}} = \frac{1}{k[A]_0}$

Sucrose $\xrightarrow{H_2O}$ 2 monosaccharides

$C_{12}H_{22}O_{11} \xrightarrow{H_2O} C_6H_{12}O_6 + C_6H_{12}O_6$

FIRST ORDER KINETICS k @25°C = $6.17 \times 10^{-4}\ s^{-1}$

What is $t_{\frac{1}{2}}$ in minutes? $t_{\frac{1}{2}} = \frac{0.693}{6.17 \times 10^{-4}\ s^{-1}} = 1123\ s \longrightarrow 18.7\ min$

$2\ HI \longrightarrow H_2 + I_2$ rate $= k[HI]^2$

What is the $t_{\frac{1}{2}}$ in minutes when the initial rate = 1.975×10^{-4} M/s and $k = 0.079\ M^{-1}s^{-1}$?

$t_{\frac{1}{2}} = \frac{1}{k[HI]_0}$

$[HI]^2 = \frac{rate}{k}$

$t_{\frac{1}{2}} = \frac{1}{(0.079\ M^{-1}s^{-1})(0.050\ M)}$

$[HI] = \sqrt{\frac{rate}{k}} = \sqrt{\frac{1.975 \times 10^{-4} M/s}{0.079\ M^{-1}s^{-1}}}$

$[HI] = 0.050\ M$

$t_{\frac{1}{2}} = 253.16\ sec$

$t_{\frac{1}{2}} = 4.22$ minutes

RADIOACTIVE DECAY $\Rightarrow$ NUCLEAR REACTION

↳ Change in the nucleus

*FIRST ORDER KINETICS

$^{137}_{55}Cs \longrightarrow {}^{0}_{-1}\beta + {}^{137}_{56}Ba + {}^{0}_{0}\bar{\nu}$

${}^{1}_{0}n \longrightarrow {}^{1}_{1}p^{+} + {}^{0}_{-1}e$ (E)

${}^{0}_{-1}\beta$

$\Downarrow$

Nuclear radiation

→ the release of particles and energy from the nucleus

${}^{4}_{2}\alpha$, ${}^{0}_{-1}\beta$ ${}^{0}_{-1}e$