CONCEPT: RATE OF RADIOACTIVE DECAY

- Recall under Chemical Kinetics, all radioactive processes (reactions) follow a _____ order rate law.
  - For these reactions we use the following equation:

Radioactive Integrated Rate Law

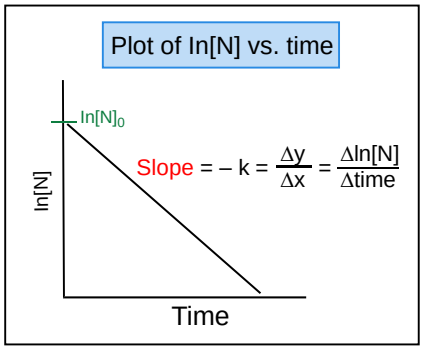
- $[N]_t$ = Final Reactant Concentration of Radioactive Nuclei
- $[N]_0$ = Initial Reactant Concentration of Radioactive Nuclei
- k = Decay Constant in _____
- t = time

$$\ln[N]_t = -kt + \ln[N]_0$$

Related to equation of a straight line:

$$y = mx + b$$

Slope = – k



EXAMPLE: The radioactive element of astatine-210 has a decay constant of 0.086 hr^{-1}. How many minutes would it take for its concentration to go from 9.3 $x10^5$ dps (disintegrations per second) to 2.7 x 10^4 dps?

PRACTICE: For the radioactive decay of lead-202 the decay constant is 1.32 x 10^{-5} yr^{-1}. How long will it take in hours to decrease to 53% of its initial amount?

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PRACTICE: During World War I radium-226 was used in the manufacturing of luminous paint. If it takes 2.12×10^4 days for its degradation to be 2.49% complete, what is its decay constant?

PRACTICE: If the decay constant for polonium-209 is 6.80×10^{-3} yrs^{-1}, what fraction of it remains after 1.1×10^4 years?