Making new elements

- Particle Accelerators ("atom smashers") used to accelerate sub-atomic particles and cause transmutation rxns

bombarded particle

$$^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$$

- Accelerators enormous, circular tracks w/ miles long radii

Decay rates and half life

- The rate of decay depends on the amount of N present (first order)
- After 1 half-life, half of N remains

flashback from the beginning of the semester

$$-\frac{\Delta[N]}{\Delta t} = k[N] \qquad 1^{st} \text{ order rxn}$$

$$\ln\frac{N_t}{N_0} = -kt \qquad t_{1/2} = \text{time when } \frac{N_t}{N_0} = \frac{1}{2}$$

$$\ln\frac{1}{2} = -kt_{1/2} \Rightarrow \boxed{t_{1/2} = \frac{0.693}{k}} = \ln\frac{2}{k} = \frac{-\ln(\frac{1}{2})}{k}$$

Half-life

$$\frac{0.693}{k} = t_{1/2}$$

- Half-life is the time required for $\frac{1}{2}$ of a radionuclide sample to decay

Measuring Radioactivity

- Geiger meter - probe w/ Ar(g), positive and negative electrodes
- when radiation reaches Ar(g), creates charged particles, registered as pulse
- measure decays/min
- Units
  - Becquerel (Bq) = one decay event/second
  - Curie (Ci) = 3.70×10^{10} Bq