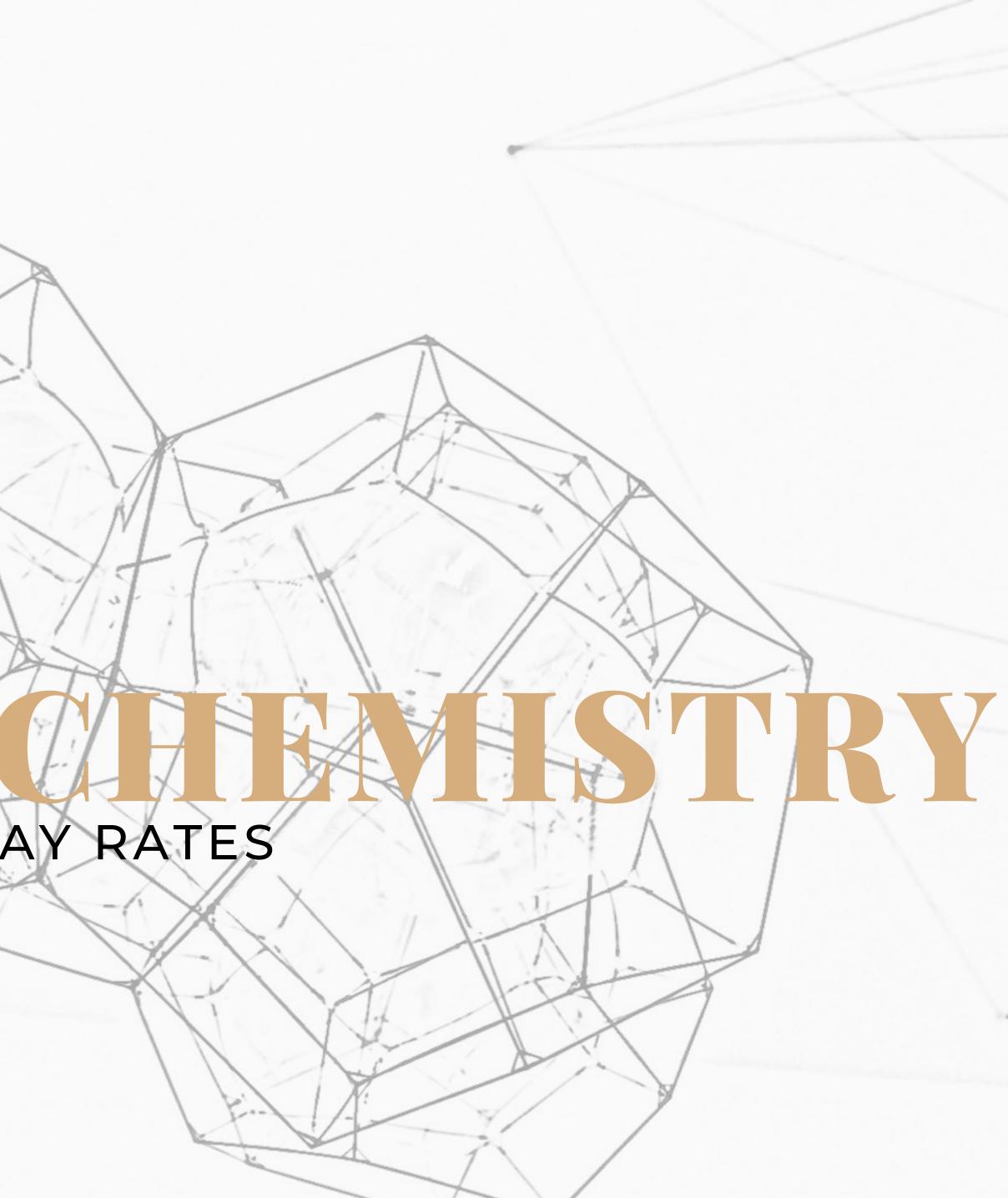
KINETICS: RADIOACTIVE DECAY RATES

DR. MIOY T. HUYNH | YALE UNIVERSITY CHEMISTRY 165B | SPRING 2019 WWW.MIOY.ORG/CHEM165



⁶⁰Co decays with a half-life of 5.27 years to produce ⁶⁰Ni. Calculate the fraction of original sample of ⁶⁰Co that will remain after the second second

years has passed.

- answer -

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Because radioactive decay obeys first-order kinetics, we can apply the integrated rate law to find the fraction:

 $\frac{N_t}{N_0}$

$$\frac{t}{t} = 0.5^{\frac{t}{t_{1/2}}}$$

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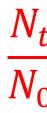
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 $\frac{N_{t}}{N_{t}}$



$$\frac{t}{t} = 0.5^{\frac{t}{t_{1/2}}}$$

$$= 0.5^{\frac{15 \text{ yr}}{5.27 \text{ yr}}}$$

$$\frac{t}{t} = 0.139$$

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²³⁹Pu decays with a half-life of $t_{1/2} = 2.41 \times 10^4$ years. Calculate the time it would take for a sample of ²³⁹Pu to decay to 2.5% of its original population.

- answer -



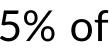
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Because radioactive decay obeys first-order kinetics, we can apply the integrated rate law to find the time:

 $t = -\frac{t_{1/2}}{\ln 2} \ln \frac{N_t}{N_0}$

$$\frac{\frac{1}{2}}{2}\ln\frac{N_t}{N_0}$$



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- answer -

Because radioactive decay obeys first-order kinetics, we can apply the integrated rate law to find the time:

 $t = -\frac{t_1}{\ln t}$ $= -\frac{2}{2}$

t = 1.28

$$\frac{\frac{N_{t}}{N_{0}}}{\frac{1}{2} \ln \frac{N_{t}}{N_{0}}}$$

$$\frac{41 \times 10^{4} \text{ yr}}{\ln 2} \ln \frac{2.5}{100}$$

$$\frac{100}{100}$$

