Decay Process

Adetoun Adeyemi with Daria Khon

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1 Introduction

Nuclear decay refers to the process in which the nucleus of unstable atom will spontaneously change into a different nuclear configuration be the emission of radioactive particles.

This simulation lab is designed to observe relation between half life of the decay and initial input of the product.

2 Methods

Simulation was run through Java application designed by Dr. Shultz.

3 Hypothesis

From decay equation

$$A = A_0 \times e^{-\lambda t}$$

Therefore with the equation of half life, relationship between half-life period and decay constant can be derived

$$\frac{A}{A_0} = \frac{1}{2} = e^{-\frac{T}{2}}$$

$$ln\frac{1}{2} = -\lambda \times \frac{T}{2}$$

$$\frac{t}{2} = \frac{ln2}{\lambda}$$

Therefore no matter what input is going to placed, half life time would be defined only by decay fraction.

Experiment	λ	Initial input of atoms	T (theoretical)	T (experimental)
1	0.01	100,000	69.3	68-69
2	0.01	10,000	69.3	68-69
3	0.01	85,830	69.3	69-70
4	0.01	69,542	69.3	68-69
5	0.01	27,073	69.3	69-70

Table 1: Experimental data

4 Data

Sample calculation (for experiment 4)

$$\frac{T_{th}}{2} = \frac{ln2}{0.01} = 69.3$$

$$\frac{T_{exp}}{2} = \frac{69,542}{2} = 34,771$$

Thus it makes half life for this experiment lie between 68th and 69th steps.

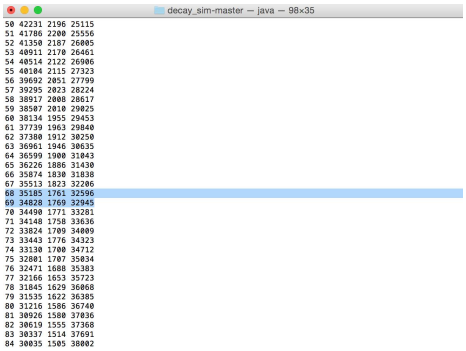

Figure 1: Decay for experiment 4

5 Conclusion

For exponential decay, its half life depends on decay rate in a reverse relation. The larger the decay rate the smaller is half life. Otherwise its value does not chane with regardless amount of initial input of atoms.