Unit 2.8

Remember:

– average $\pm \sigma_{sd}$ tells me the probable range the value of one more measurement would fall in.

– average $\pm$ SDM tells me the probable range the average of one more experiment would fall in.

– The SDM is used as the uncertainty of my average.
Unit 2.9

Last time I told you that the variations about the average of your individual measurements were random, and that the variations in your data will follow a Gaussian distribution.

And you all believed me!

– How do we know that the variations in your timing measurements were random?

– How do we know that random variations in measurements produce a Gaussian distribution?

Today, we will look at:

– Rolling Dice: a known random phenomena. Do the variations in results produce a Gaussian distribution?

– Radioactivity: allows us to do thousands of measurements. Is radioactive decay really a random process?
Activity 2.9.1 a.

- The person is limited to going left or right (or standing still).
- Each step, left or right, is completely at random – the person has no intention as to where they are going.
Activity 2.9.2 a.

- Everyone will roll their die 20 times to find their final position, measured from 0 m.
- Everyone will then start from 0 m again and will roll the die 20 times a second time to find their 2\textsuperscript{nd} final position, measured from 0 m.
- Enter your 2 final positions next to your name in the class spreadsheet.

Activity 2.9.2 b.

- Use dots for the histogram instead of rectangles.
Activity 2.10.
alpha decay

$^{240}_{94} \text{Pu} \rightarrow ^{236}_{92} \text{U} + \alpha$-particle $= ^{4}_{2} \text{He}$

Plutonium                  Uranium
Radium $^{228}_{88}$Ra

beta minus decay

neutrino$^-$

$^{228}_{89}$Ac

$\beta^-$ particle = $^0_1e$

Radium

Actinium

$^0_1e$
Protactinium (Pa) undergoes beta plus decay, emitting a neutrino (ν^+) and a positive electron (β^+) to form Thorium (Th). The reaction is represented as:

\[ ^{231}_{91}\text{Pa} \rightarrow ^{230}_{90}\text{Th} + \nu^+ + \beta^+ = ^0_{+1}e \]
gamma decay

$^{240}_{94}\text{Pu}^*$ $\rightarrow$ $^{240}_{94}\text{Pu}$

$\gamma$-radiation: high-energy electromagnetic waves

Plutonium* $\rightarrow$ Plutonium
Firefox

Safari