

HALF-LIVES

Purpose

To show how the numbers of atoms change as a radioactive element decays.

In this simulation each dice represents one atom and each throw represents a unit of time. It is assumed that each "atom" has a 1 in 6 chance of decaying during each half life and that if it lands with the 6 face up then it has decayed and it is removed from the group.

Instructions

- 1. First make up a table like the one below with about 35 lines for readings on paper or on a spreadsheet.*

<i>throw number</i>	<i>number N of dice left</i>	<i>number of sixes</i>	<i>running total of sixes</i>
<i>0</i>	<i>100</i>	<i>0</i>	<i>0</i>
<i>1</i>			

- 2. Place the dice in the cup and shake them and then empty them into the tray.*
- 3. Remove all the sixes and place them neatly on the grid sheet.*
- 4. Fill in the table for that throw.*
- 5. Place the dice remaining in the tray in the shaker and repeat the process. Record each throw even if there are no sixes.*
- 6. When there are no dice left in the tray plot a graph of your data with the number of throws along the x axis and the number parent atoms on the y axis. Draw a best fit curve through the points.*

7. *Using the graph, work out the half-life assuming each throw represents 1000 years. Work out the length of the 2nd and 3rd half-lives and see if they are similar.*

Question

If 93.75% of the atoms have decayed to become the daughter atoms how many half lives have elapsed? Calculate this by imagining you are starting with 64 atoms.

Teacher's Section

Requirements

Sets of 100 dice

Tray about 40cm by 30cm size with 5cm high sides

Beaker large enough to contain all the dice

10 by 10 grid with each square the size of a dice

Making Dice (30 minutes)

Buy a piece of hard wood with a square section. Paint one side. Use a circular saw to cut it into cubes. The painted side is equivalent to "6" in the instructions above.

Results

The answer to the question is 4 half lives.

Notes

Dice have an uncanny knack of disappearing. If, at the end, students put the dice on the grid you can check that all are present. The last column in activity 1 is not strictly necessary but it helps check students' arithmetic because at the end it should be 100.

The exercise can be further enhanced by students entering their data into a spreadsheet or specialised graph drawing application so that the final decay curve is based on a larger sample.

Reference

Kennet P and Ross C A 1983 Geochronology Longman York

Time

30 minutes

Cost

Dice can be bought from wholesalers in packets of 1000 £28.80 plus VAT or £4.24 plus VAT per 100.