Modelling radioactive decay

The aim of this activity is to illustrate the idea of exponential decay and half-life.

What you need

* Counters (red on one side, white on the other)
* Plastic cup

What to do

1. Count the total number of counters that you have, record this number and place them in the plastic cup.
2. Shake the cup and tip all the counters onto the desk.
3. The counters that land red side up have decayed. Move them to a ‘discard’ pile.
4. Count the remaining ‘nuclei’, record this number and place the remaining nuclei back into the cup.
5. Shake the cup, tip them out again, move decayed nuclei to the discard pile and count those remaining.
6. Continue until you have three or fewer nuclei.
7. Repeat the whole process three more times.

**Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of throws | Number of a undecayed atoms | | | |
| Trial 1 | Trial 2 | Trial 3 | Trial 4 |
| 0 |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

Draw a set of axes with the number of throws on the horizontal axis and the number of atoms remaining on the vertical axis. Plot points, and draw a line of best fit through the points for each of the trials. Include a key for each set of data.

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Discussion

1 The atomic nuclei were represented by counters. What represented the half-life of the decay process?

2 Are the shapes of the three curves similar or different?

3 Do you think the overall shape of the curves would be different if you started with more atomic nuclei? Explain your answer.

4 In this activity, could you predict when each individual nucleus would decay? Why is this similar to the behaviour of real radioactive atoms?

5 In this experiment, you would eventually end up with no ‘undecayed’ counters. Would this be the case with a real radioisotope? Explain your answer.