

Purpose

To simulate radioisotope decay, using dice.

Materials

100 x dice

Method

1. Your teacher will explain how the simulation works.
2. Record your results in the table below as the experiment proceeds.

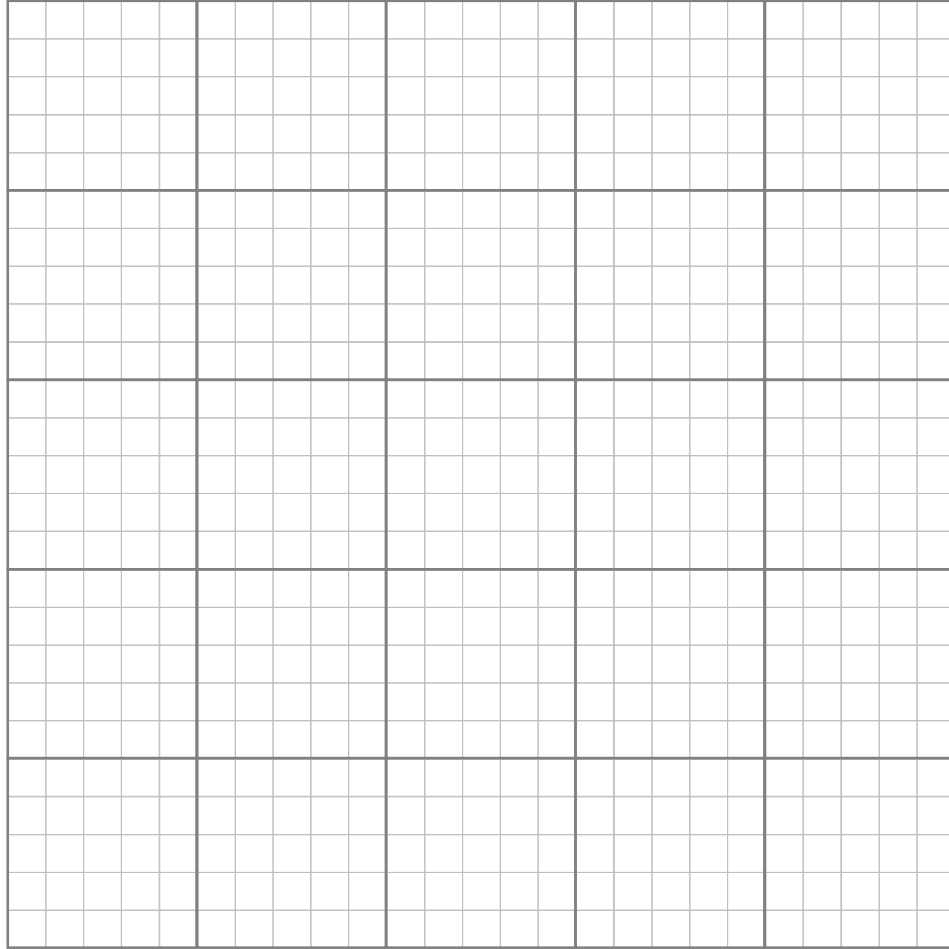
Results

Time interval	Number of undecayed nuclei	Total number of decayed nuclei
0	100	0
1		
2		
3		
4		
5		
6		
7		
8		

Analysis

In this simulation, a time interval is represented by each time the dice are thrown onto the desk. Plot a graph of the number of nuclei remaining against 'time-units'.

number
of nuclei



time

Questions and discussion

1. What is the chance (percentage likelihood) of a die producing a six when it is thrown?

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2. Estimate the half-life, in time-units, of the 'nuclei' used in this activity.

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3. Refer to the table of half-lives at the end of this worksheet. If a time-unit corresponds to a day, which element has a similar half-life to the simulated isotope?

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4. Radioactive decay is thought to be an entirely random process. What is the meaning of 'random process'?

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5. Is the rate of 'decay' (the number of decays per throw) in this experiment constant, increasing or decreasing? Justify your answer.

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6. If you had started with thousands of dice instead of one hundred, would the half-life be any different? Explain.

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7. Comment on any similarity between the actual radioactive decay of a radioisotope and the simulation activity you have just conducted.

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8. Simulations or models are often used by research scientists to replicate actual processes. List some advantages of using simulations and models in research.

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Table of half-lives

ISOTOPE	HALF-LIFE
bismuth-210	5.0 days
bismuth-214	19.9 min
iodine-125	60.1 days
iodine-131	8.04 days
iridium-192	73.8 days
lead-210	22.2 years
lead-214	26.8 min
molybdenum-99	2.75 days
polonium-210	138 days
polonium-214	0.0001 s
polonium-218	3.1 min
radon-220	3.83 days
rhenium-186	3.78 days
samarium-153	1.95 days
strontium-89	50.5 days
xenon-133	5.25 days
yttrium-90	2.67 days
erbium-169	9.40 days
lutetium-177	6.71 days
holmium-166	1.12 days
technetium-99m	0.25 days