Random decay: a dice model

Teacher / technician

YEAR 11 / LESSON 92 / PHYSICS + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Continue actual counts to round 10 on a separate table. This is a chance model, not a radioactive-source experiment.

Coverage and delivery

Shared Physics / Double Award: 7.4–7.5. Random nuclear decay and alpha, beta-minus and gamma radiation.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, five groups of six

Item	Per pair / setup	Class total
Dice	60 per group	300
Shallow trays	1 per group	5
Booklets, continuation and graph sheets	1 each per learner	30 of each

Immediate safety

Roll dice gently inside trays. Keep small pieces out of mouths and off the floor; retrieve dropped dice promptly. No radioactive source is used.

Preparation and delivery

Read alongside the student method

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1. Count five sets of 60 dice and prepare a round 0–10 recording sheet. Provide large-print or digital counts where handling many small pieces is unsuitable.

2. Explain model limits before linking to nuclei. Keep real dice counts separate from any expected mathematical curve.

Close of lesson

• Count all dice back to 60 per group, clear trays and retain graphs.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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- No; the outcome of a fair roll is random.
- 1/6 for each remaining fair die.
- No; the probability stays the same.
- Random sampling variation.
- A nucleus with two protons and two neutrons.
- Beta-minus is an electron from nuclear decay; gamma is electromagnetic radiation.

References and provenance

Pearson Physics specification

IOP: teaching radioactivity

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.