

Radioactive decay · supported focus

International Baccalaureate · IB Diploma · Physics · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

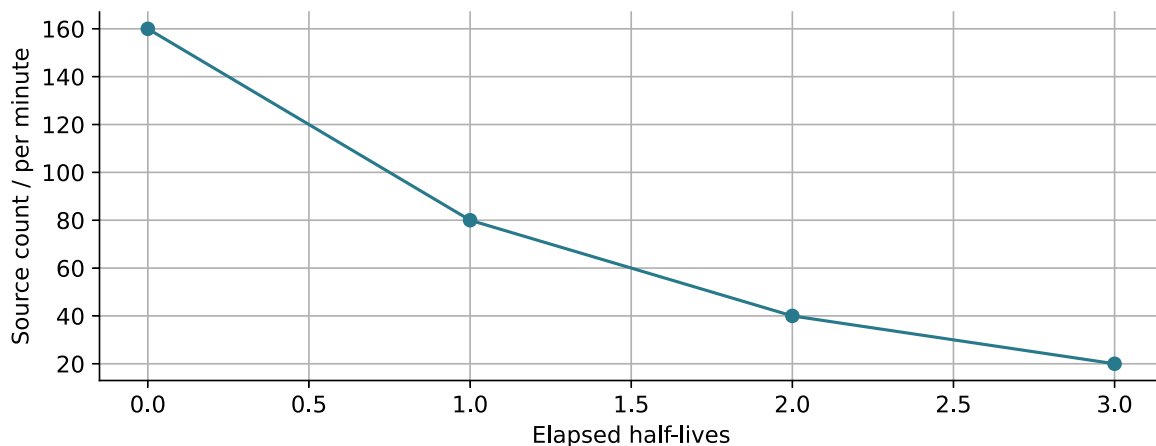
Nuclear changes and radiation evidence

■ What would explain this observation?

- A detector records counts even when the classroom source is removed. Background must be considered before attributing every count to the source.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- Radioactive decay is spontaneous and random for an individual nucleus. **Half-life** describes the time for half the undecayed nuclei in a large population to decay, or for background-corrected activity to halve.
- half-life: Time for activity or undecayed population to halve; **background radiation** : Radiation measured apart from the investigated source.



■ Choose evidence that can test it

- Subtract background counts measured over the same time interval. Distinguish irradiation from contamination. Shielding, distance and reduced exposure time can reduce risk under a school-controlled procedure.
 - Use teacher-managed sources and the school radiation rules. Record count duration and repeat background measurements. Do not extrapolate a half-life from one nucleus or from uncorrected readings.
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■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: measured count rate falls from 100 to 55 counts per minute; background is 10. Source rates are 90 and 45, so one half-life has elapsed. Without subtraction, 55/100 would obscure the exact half in this example.

Example:

An initial source count is 160 per minute. Find it after three half-lives. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- An irradiated object is not automatically radioactive. A half-life does not predict the exact decay time of one nucleus.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Half-life predicts the exact decay time of an individual nucleus. This claim is false: An irradiated object is not automatically radioactive. A half-life does not predict the exact decay time of one nucleus.

Key:

Nuclear changes and radiation evidence: Subtract background counts measured over the same time interval. Distinguish irradiation from contamination. Shielding, distance and reduced exposure time can reduce risk under a school-controlled procedure.