IGCSE PHYSICS • EXERCISE SHEET

5.2 Radioactivity

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

Objective

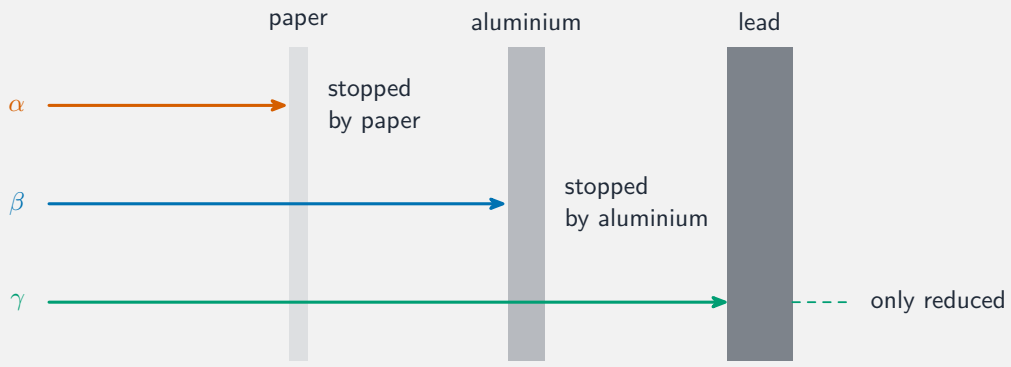
Build the skills to answer exam questions on **radioactivity** 放射性—the three types of radiation, **decay equations** 衰变方程, **half-life** 半衰期, and safety.

You must be able to:

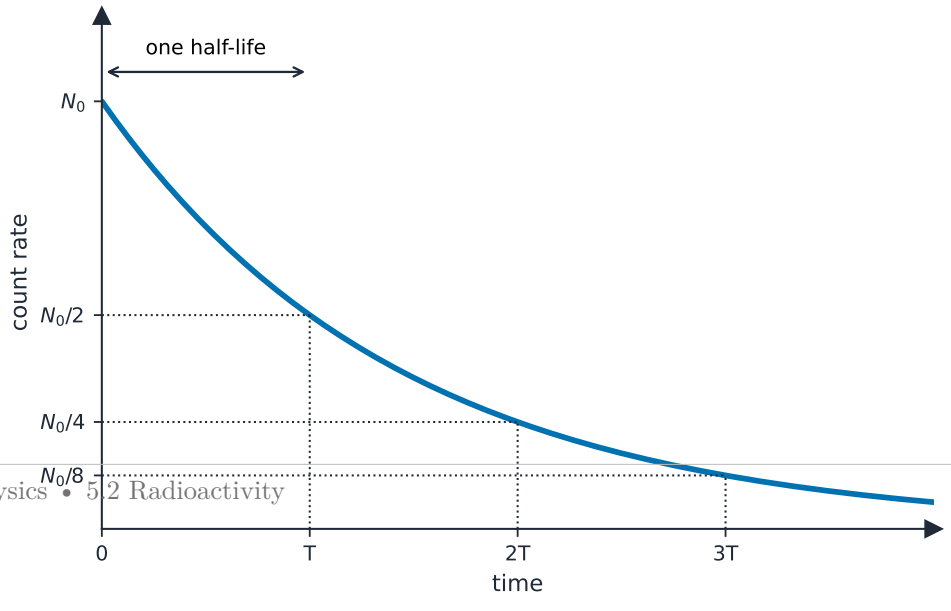
- compare alpha, beta and gamma (ionising, penetrating, stopped by)
- balance alpha and beta decay equations
- use half-life and correct for background radiation

1 Worked examples

Penetration & half-life



Alpha = most ionising, least penetrating; gamma = least ionising, most penetrating



Alpha decay: ${}^{226}_{88}\mathrm{Ra} \to {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\alpha$ $(A-4,\ Z-2)$.

2 Practice

2.1 State what material stops beta radiation. [1]

2.2 A detector reads 250 counts/min; the background is 30 counts/min. Find the corrected count rate. [2]

3 Exam-style questions

3.1 Which radiation is the most penetrating? [1]

- **A** alpha
- **B** beta
- **C** gamma
- **D** they are equal

3.2 A nucleus ${}^{24}_{11}\mathrm{Na}$ undergoes beta decay.

(a) Write the decay equation, giving the new nuclide. [3]

(b) State what happens inside the nucleus during beta decay. [1]

3.3 A source has a count rate of 800 counts/min and a half-life of 5 days.

(a) Find the count rate after 15 days. [3]

(b) Explain why the count rate never quite reaches zero. [1]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **5.2 Radioactivity** past-paper sheet in the Library, or try these in **Practice mode**:

- 0625/21 N25 —Q34 (types of radiation)
- 0625/21 N25 —Q35 (beta decay)
- 0625/21 N25 —Q36 (uses of radioactivity)

Solutions

2.1 a few millimetres of aluminium.

2.2 corrected $= 250 - 30 = 220$ counts/min.

3.1 C. Gamma radiation is the most penetrating.

3.2 (a) ${}^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\beta$.
(b) a neutron changes into a proton (and an electron, which leaves as the beta particle).

3.3 (a) $15 \div 5 = 3$ half-lives; $800 \rightarrow 400 \rightarrow 200 \rightarrow 100$; $= 100$ counts/min.
(b) decay is random; there is always a chance some nuclei have not yet decayed.